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Journal of The Egyptian Society of Cardio-Thoracic Surgery

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THORACIC

Guidelines For Authors

Journal of Egyptian Society of Cardio-Thoracic Surgery
(J. Egypt. Soc. Cardiothorac. Surg.)

Editorial Office

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The Journal of the Egyptian Society of Cardiothoracic Surgery [ISSN 1110-578 X] is the official publication of the Egyptian Society of Cardio-thoracic Surgery. The journal is published every three months .

General Instructions

Every submission must include:

Cover letter, indicating the category of article, the ***Complete manuscript***, including title page, abstract, text, tables, acknowledgments, references, illustrations.

Required disclosures;

A. **Conditions for Publication Form** which includes disclosures regarding freedom of investigation and conflicts of interest, signed by ***all*** authors. In single Author publication an additional Senior Consultant Signature is required.

B. **Written permission from the *publisher*** (copyright holder) is required to reproduce any previously published table(s), illustration(s) or photograph(s) in *both print and electronic media*.

C. **Written permission** from unmasked patients appearing in photographs is also required.

Revised_Manuscripts:

Revised manuscripts must be submitted in three parts as Microsoft word-processing files : (1) cover letter with responses to reviewers' comments (2) revised, marked manuscript showing additions and deletions; (3) revised, unmarked manuscript.

General Information

Three copies of the Manuscripts should be sent preferably prepared in Microsoft Word , typed *double-spaced* throughout (including title page, abstract, text, references, tables and legends) with one (1) inch (2.5 cm) margins all around. Place Author name and page number in the upper right corner of each page.

Manuscripts written in ***12*** point ***Arial*** or ***Times New Roman*** fonts are preferred (Note: Do not submit your manuscript in PDF format it causes problems in processing your submission.)

Arrange manuscript as follows: (1) title page, (2) abstract, (3) text, (4) acknowledgments, (5) disclosures if required, (6) references, (7) tables and (8) legends. Number pages consecutively, beginning with the title page as page 1 and ending with the legend page.

If your manuscript contains illustrations, in addition to submitting them online, you must send two sets of original illustrations to the editorial office labeled with manuscript number, first author, and figure number on back.

Tables and figures should be provided separate from the text while there position in the text should be marked on the manuscript.

Word Limits by Category of Manuscript

Original articles should not exceed 4500 words including title page, abstract of 150-200 words, text, figure legends *and references*. The combined total of illustrations and tables should not exceed 10 and the number of references should not exceed 40.

New Technology articles are limited to 2500 words including title page, abstract, text, figure legends and *references*. The number of tables should not exceed three; the number of illustrations should not exceed six if tables are included; eight if there are no tables. The number of references should not exceed 10.

Case reports and **"how to do it"** articles are limited to a total of 1500 words including title page, abstract, text, references and figure legends. For each illustration subtract 100 words and for each table subtract 300 words from the word limit. References are limited to eight. A "how to do it" article should be a description of a useful surgical technique and contain descriptive, illustrative material.

Images in cardiothoracic surgery are limited to 350 words including title and text and to two, possibly three figures. The entire contribution must fit on one printed page .

Review articles are limited to 6500 words including title page, abstract, text, figure legends and *all references*. The total number of references should not exceed 80. Subtract 100 words for each illustration and 300 words for each table.

Our surgical heritage articles are limited to 2500 words including title page, abstract, text, figure legends and references. Subtract 100 words for each illustration and 300 words for each table.

Correspondence (Letters to the Editor) and **commentaries** are limited to 500 words. Subtract 100 words for each illustration and 300 words for each table.

Editorials are limited to 2500 words including references. Subtract 100 words for each illustration and 300 words for each table.

Manuscript Preparation

Title Page (first page)

The title is limited to 100 characters and spaces for original manuscripts and to 80 characters and spaces for all other categories of manuscripts. The title may not contain acronyms or abbreviations. All submissions, including correspondence, must have a title.

Running Head. Supply a short title of 40 characters and spaces.

Authors. List all authors by first name, all initials, family name and highest academic degree using "MD, PhD" for holders of both degrees (if more then 7 Authors justifie).

Institution and Affiliations. List the name and full address of all institutions where the work was done. List departmental affiliations of each author affiliated with that institution after each institutional address.

Meeting Presentation. If the paper has been or is to be presented at the annual meeting of The Society, provide the name, location and dates of the meeting.

Keywords. Provide up to 5 keywords selected from the appended list to describe the manuscript. Do not use any keywords that are not on the list..

Word Count. Provide the electronic total word count of the entire manuscript including title page, abstract,text,figure legends and entire reference list.

Corresponding Author. Provide the name, exact postal address with *postal code, telephone number, fax number and e-mail address* of the author to whom communications, proofs and requests for reprints should be sent.

Abstract Page (Second page)

- Original articles

Provide a structured Abstract, *no longer than 250 words*, divided into four sections: **Background, Methods, Results, Conclusions**. Avoid abbreviations and acronyms. Indicate the abstract word count below the abstract.

*- **New Technology***

Provide a structured abstract, *no longer than 175 words*, divided into four sections:

Purpose, Description, Evaluation and Conclusions. Avoid abbreviations and acronyms. Indicate the abstract word count below the abstract. [Disclosure stating the source of all funds to the study, plus "freedom of investigation" which is defined as freedom from outside interests in controlling the study and having freedom to fully disclose all results;these statements are mandatory for all new technology articles only]

- ***Case reports, "how to do it"** articles, **review articles** and **our surgical heritage** articles*. Provide an unstructured abstract of 100 words.

- ***Images, correspondence, commentaries, editorials and updates***. No abstract is required.

Text *(thirdpagecontinueuptoacknowledgments)*

Text should be organized as follows: **Introduction**, **Material** (**or Patients**) **and Methods**, **Results**, and **Comment**.**Cite references, illustrations and tables** in numeric order by order of mention in the text.

Avoid abbreviations. Consult the *American Medical Association Manual of Style,* 9th edition, for recommended abbreviations. Define abbreviations at first appearance in the text. *If 8 or more abbreviations or acronyms are used, provide a separate table of abbreviations and acronyms*.

Measurements and weights should be given in standard metric units. **Statistical nomenclature and data analysis**. Follow the "Guidelines for Data Reporting and Nomenclature" published in *The Annals of Thoracic Surgery* (1988;46:260-1). **Footnotes**. Type footnotes at the bottom of the manuscript page on which they are cited. **Suppliers**. Credit suppliers of drugs, equipment and other brand-name material mentioned in the article within parentheses in text, giving company name, city and country.

Acknowledgments

Grants, financial support and technical or other assistance must be acknowledged at the end of the text before the references.

References

Identify references in the text using Arabic numerals in brackets on the line.. **Type references** *double-spaced* after text or acknowledgments beginning on a separate sheet. Number consecutively in the order in which they appear in the text. **Journal references** should provide *inclusive* page numbers; **book references** should cite *specific* page numbers. **Journal abbreviations** should conform to those used in *Index Medicus*. follow the formats outlined below:

Journal Article

8. Jones DR, Stiles BM, Denlinger CE, Antie P. Pulmonary segmentectomy: results and complications. Ann Thorac Surg 2000;76:343-9. (List *all* authors if 6 or fewer; otherwise list first 3 and add "et al.")

Chapter in Book

12. Vinten-Johansen J, Zhao Z-Q, Guyton RA. Cardiac surgical physiology. In: Cohn LH, Edmunds LH Jr, eds. Cardiac Surgery in the Adult. 2nd ed. New York, NY: McGraw-Hill; 2003:53-84.

Internet Address

3. 1996 NRC Guide for the Care and Use of Laboratory Animals. Available at: http://www.nap.edu/readingroom/books/labrats/contents.html. Accessed October 20, 2003.

Tables;

Tables should be typewritten *double-spaced* on separate sheets (one to each page). Do not use vertical lines. Each table should be numbered (Arabic) and have a title above. Legends and explanatory notes should be placed below the table. Abbreviations used in the table follow the legend in alphabetic order. Lower case letter superscripts beginning with "[a]" and following in alphabetic order are used for notations of within-group and between-group statistical probabilities.

Figure Legends

Figure Legends should be numbered (Arabic) and typed *double-spaced* in order of appearance beginning on a separate sheet. Identify (in alphabetical order) all abbreviations appearing in the illustrations at the end of each legend. Give the type of stain and magnification power for all photomicrographs. **Cite the source** of previously published material in the legend and indicate permission has been obtained. Proof of permission must be surface mailed or faxed to the editor.

Illustrations

You must send two sets of original illustrations to the editorial office labeled with manuscript number, first author, and figure number on back.

Images or figures are submitted online as one or more separate files that may contain one or more images. Within each file containing images, use the figure number (eg, Figure 1A) as the image filename. The system accepts image files formatted in TIFF and EPS. Powerpoint (.ppt) files are also accepted, but for line drawings only and you must use a separate Powerpoint image file for each Powerpoint figure.

Most illustrations will be reproduced at a width of one column (8.25 cm; 3 1/4 inches). **Black, white and widely crosshatched bars** are preferable; do not use stippling, gray fill or thin lines.

Instructions:

Identify print proofs of figures on the back with figure number and name of the first author; when necessary, indicate the top with an up arrow

Please include hardware and software information, in addition to the file names, with figures submitted electronically or on disk

For figures submitted in electronic format, all images should be at least 5 inches wide. Graphics software such as Photoshop and Illustrator, should be used to create art.

Color images need to be CMYK, at least 300 dpi.

Gray scale images should be at least 300 dpi .

Line art (black and white or color) and combinations of gray scale and line art should be at least 1200 DPI .

Cover letter:

Include with the manuscript a cover letter that provides 1) the category of manuscript (e.g., original research, Brief Communication, Letter to the Editor); 2) statement that the material has not been previously published or submitted elsewhere for publication; 3) information about any personal conflicts of interest of any of the authors; and 4) names of sources of outside support for research, including funding, equipment, and drugs .You may also submit the name of one reviewer of your choice. You should include that individual's mailing address, telephone number, fax number, and e-mail address.

Editorial Policies

Scientific Responsibility Statement

Before publication of an accepted manuscript, each author is required to certify by signing the Conditions for Publication Form that he or she has participated sufficiently in the work and approved the final version of the manuscript to be published.

In addition, each author must indicate whether or not he has had full "freedom of investigation" which is defined as freedom from outside interests in controlling the design of the study, acquisition, analysis, and interpretation of data and having freedom to fully disclose all results.

Exclusive Publication Statement

Each author must certify that none of the material in this manuscript has been published previously in either print or electronic form, and that none of this material is currently under consideration for publication elsewhere. This includes symposia and preliminary publications of any kind except an abstract of 400 words or fewer.

Conflict of Interest

The J. Egypt. Soc. Cardiothorac. Surg. requires authors to disclose any conflict of interests. Authors who have a financial relationship with one or more companies whose products are featured in an article will ***disclose the existence of this relationship in a box at the bottom of the first page of the published article.***

Consultant statistician and statistical methods:

All manuscripts with statistical analysis are required to undergo biostatistical review .The most appropriate way is to involve a biostatistician consultant or coauthor from the investigators' home institution . Manuscripts may undergo further biostatistical review by the Journal after submission. Additional information on statistical methods can be found in "Uniform Requirements for Manuscripts Submitted to Biomedical Journals"(www.acponline.org/journals/resource/unifreqr.htm).

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Authors of articles submitted to *The J. Egypt. Soc. Cardiothorac. Surg.* must transfer copyright to The Egyptian Society of Cardio-Thoracic Surgery by signing the "Conditions for Publication Form." This transfer becomes binding upon acceptance of the article for publication. No part of the published material may be reproduced elsewhere without written permission.

Date of Receipt: The "received for publication" date is the date when the editorial office receives the manuscript, the cover letter, and the Copyright Transfer and Author Declaration Statement, signed by all authors. The revised manuscript on disk and all camera-ready figures.

Date of acceptance : letter is provided from the editor.

Checklist:

A] Cover letter

- *Letter to the Editor*
- *Manuscript category designation .*
- *Single-journal submission affirmation .*
- *Conflict of interest statement (if appropriate).*
- *Sources of outside funding.*
- *Signed Statistical Collaboration .*

B] Complete manuscript

- *Title page .*
- *Title of article*
- *Full name(s), academic degrees, and affiliation(s) of authors.*
- *Corresponding author .*
- *Telephones, fax, and e-mail address*
- *Abstract (250 words; double-spaced) .*
- *Ultramini-abstract (50 words; double-spaced) .*
- *Text (double-spaced).*
- *References (double-spaced; separate pages).*
- *Tables (double-spaced; separate pages).*
- *Figures (separate files; on hardcopy; properly identified),*
- *Figure legends (double-spaced; separate pages) .*
- *Word count.*

C] Required disclosures

- **Conditions for Publication Form** which includes disclosures regarding freedom of investigation and conflicts of interest, signed by ***all*** authors. Which ***transfer copyright*** to The Egyptian Society of Cardio-Thoracic Surgery
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- **Written permission** from unmasked patients appearing in photographs.

Conditions For Publication Form

This form MUST be completed, signed by ALL authors, and returned to the Editorial Office before your manuscript can be accepted for publication.

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The author(s) warrant(s) that if a prior version of this work (normally a preprint) has been posted to an electronic server, such version was accessible to only a small group of individuals and the author(s) will cause its prompt removal from such server.

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Each author must indicate below that either (a) no financial conflict of interest exists with any commercial entity whose products are described, reviewed, evaluated or compared in the manuscript, except for that disclosed under "Acknowledgements" or (b) a potential conflict of interest exists with one or more commercial entities whose products are described, reviewed, evaluated or compared in the manuscript through the existence of one or more of the following relationships: the author is a full or part-time employee of a company; has an existing or optional equity interest in a company; owns or partly owns patents licensed to a company; has an ongoing retainer relationship (consultantship, speaker, etc.) with a company for which he/she receives financial remuneration; or has received financial compensation for this publication. If Yes is checked, a box on the first page of the published article will read: ?Dr. X discloses that he/she has a financial relationship with company Y.?

Electronic Publishing

Tips for preparing Word documents

1 Learn how to use the Word features under the Tools/ Autocorrect submenu. Some people turn off all autocorrection features because they are disconcerted by Word's default behaviour of adjusting capitalisation and reformatting type on the fly, but these features save a lot of time once you tune them in to match your expectations. In particular, if you have a long word like 'hypergammaglobulinaemia' that you need to type repeatedly, turn on `Replace text as you type' and add it to the replacement list.

2 Keep formatting to a minimum. editors, much prefer manuscripts in a simple one-column layout. Only use fonts that everybody has on their computers: for example, Times New Roman for your main text font and Arial as your font for headings. Turn off type justification, automatic hyphenation, and automatic paragraph numbering. On the other hand, the use of bold, italic, superscript, and subscript text as appropriate is good.

3 Use styles and style tagging rather than formatting the article paragraph by paragraph. This makes it much easier to format an article as you write and easier again if you are asked to change the formatting later. For your level I headings, therefore, define a Heading l style, with the combination of font, spacing, and alignment that you want to use, and then apply this to each heading as you create it. To change all your level I headings later, simply redefine the style and all will be changed without having to select and manipulate each heading.

4 Format text as one continuous flow. Use a page break (Ctrl + Enter) to start a new page (e.g. after your title page) not a stream of hard returns. put only one hard return between each paragraph,. Do not break the article up with Word's section breaks.

5 Keep table formatting simple and consistent. A common error is to place a column of separate items into a single table cell, with each item separated by a hard return: instead each data item should have a table cell of its own. Sometimes tables are formatted with tabs instead of cells: in this case, the key is to set the tab stops for the whole table so that one tab equals one column.

6 Image files should be sent as separate files. The same goes for Excel spreadsheets or charts. If you are embedding images in the file, it is probably best to do it at the end, after the text and references.

7 Be prepared to send the data used to generate graphs. Some publishers will use the data to regenerate the graphs according to their own style rules. In such a case, it helps if you send only the data that are actually shown in the graphs – not the spreadsheet with all of the data generated in the study.

What about PDF?

Send your Manuscript in a Word file. Don't send it as

PDF or any other word processor format.

PDF files are not editable in the same way as word processor files. Some publishers will ask for, or even create, a pdf file of your manuscript for use during the peer review process, but a Word file will also be required for editing and production.

Tips for preparing images

Do not make electronic images too small . No effective way exists to increase the resolution of an image beyond its original size, and if an image is reduced in size and saved, picture data is permanently lost. Image files therefore have to be created and saved at high resolution. For a colour image that is to be printed as 4 X 4 in., the required size is (4 X 300) X (4 X 300) = 1200 X 1200 = 1440 000 dots. In many image formats (e.g. tagged image file format, or tiff), each dot will take eight bits (one byte) to store, so the image file will be 1.44 megabytes

Compression techniques can reduce the size of the image file. Zip compression is safe, because it uses an algorithm that packs the data tighter without throwing any of it away; In Compression during which files are saved in jpeg format, select the option for large file size (maximum picture quality).

Guidelines for Reviewers

Purpose of Peer Review

The purpose of peer review for The *Journal of the Egyptian Society of Cardio-Thoracic Surgery* (*J*ESCTS) is twofold. One is to evaluate objectively the science of the submitted paper and the other is to provide a constructive critique indicating how the paper could be or could have been improved by the authors. Reviewers should respect the authors' efforts and avoid disparaging or unpleasant comments. Reviewers are not asked to copyedit papers, but should comment if language editing is needed.

Acceptance of a Manuscript for Review

Reviewers should accept assignments to review manuscripts that are within their sphere of expertise, which they plan to review within the 21 day deadline. Reviewers should decline assignments for which a conflict exists between the reviewer and authors or between the reviewer and commercial products that are integral to the content of the article.

Category of the Manuscript

The broad categories of papers for which peer review is undertaken are (1) original scientific articles; (2) new technology papers; (3) case reports, how to do it articles and images; and (4) review articles. The editor and/or associate editors review correspondence, invited commentaries, editorials, surgical heritage submissions and ethical and statistical papers.

General Requirements for Publication

The paper should conform to the format and restrictions for the category to which it belongs and be written in good, readable English. The paper should address an important or interesting subject and provide new and original information. Illustrative material should be well chosen and of good quality.

Original Scientific Article

Original scientific articles should provide new, reliable information that is relevant to the science and practice of cardiac and general thoracic surgery. The reviewer should assess the articles' interest to readers; strengths and weaknesses; originality; clarity of text, tables, illustrations and figure legends; presentation; analysis of results; credibility of results; importance of the findings; depth of scholarship; relationship of the results to the existing literature; and presence of marginally relevant or unnecessary archival material. Ethical issues, such as prior publication of all or part of the data; plagiarism; transgression of human or animal rights; or dishonesty should be noted, if detected.

Original scientific articles are usually one of three types: prospective, retrospective, or observational studies. For prospective studies the protocol of the study is planned before data are collected. The most common form is the 'Prospective, randomized controlled trial', which is well suited for many experimental animal studies and some human trials. Retrospective studies use data recorded before the study protocol was designed.. Most original scientific articles in clinical disciplines, particularly surgery, are retrospective, but modern statistical models are now available to analyze objectively retrospective data using a variety of statistical methods. Observational studies record observations of one or more groups of patients. These studies may record changes in various laboratory or biochemical tests in response to procedures or other therapy or determine the indications, efficacy and safety of a new procedure or laboratory or diagnostic test.

The following topics are offered to help guide the reviewer's assessment of an original scientific article. Not all topics are relevant to every article.

- 'Title' should reflect the content of the article and be concise and clear 'Abstract' should indicate the purpose of the study, subjects and methods used, most important results and the main conclusions supported by results.
- 'Introduction' should indicate the rationale and focus of the study and state the purpose or hypothesis.
- 'Methods' should present the design of the study, fully describe the number and subjects and exclusion and inclusion criteria; whether subjects were enrolled consecutively; methods used to gather data, including follow-up data; methods by which control and experimental groups were assembled; the primary outcome variable; secondary outcome variables; how outcome measurements were made and validated; the statistical design of the study; and the statistical methods used to analyze the study.
- 'Results' should concisely present the most important findings in text and relegate to tables data of lesser importance. Data should be reported as means or medians with appropriate indicators of variance and exact p values in tables and text. Figures should be well selected to highlight important findings and should not be used to present data of lesser significance. Survival and event curves should indicate specified confidence limits or subjects at risk. Regression diagrams should include the regression equations, regression coefficient and exact p value in the figure legend. Figure legends should adequately and clearly describe the important information illustrated.
- 'Comment' should not repeat results, but should point out the significance and conclusions of the new data, integrate the authors' new data with that in the prior literature, draw inferences and conclusions regarding the question or purpose addressed by the study and point out the limitations of the study. The 'Comment' section should not be a review of the literature.
- References should be properly cited, reasonably current, accurate, in proper format and selected. Important omissions should be noted.

New Technology

Articles describing new technology are necessarily descriptive and do not pose or test a hypothesis. These articles evaluate new devices, systems, machines, equipment, instruments, monitors, implantable material and similar technology designed for improving patient care and outcomes. The reviewer is asked to evaluate the efficacy, safety and indications of the new technology and the rigor, completeness and objectivity of the evaluation study.

Topics which the reviewer should consider include:

- Probable importance or usefulness of the technology.
- Problem or task that the technology addresses.
- Newness and innovation of the technology.
- How well the technology is described and illustrated.
- Protocol used for evaluation.
- Methods used to test the technology; and the results obtained.
- Reasons for selecting the methods of testing and evaluation.
- All studies used in the evaluation.
- Ease and difficulties in application including successes and failures.
- Advantages, complications and late adverse events of the new technology.
- Whether are included or should be included in the evaluation.

The conclusion section should summarize the indications, deficiencies and drawbacks. The article should have an objective, dispassionate tone and avoid the enthusiasm of an advertisement or endorsement.

The reviewer needs to inspect the 'Disclosure statement' after the text, before References. This statement should disclose the source of funds used for the evaluation study and whether or not the product was purchased, borrowed or donated by the manufacturer or inventor. Conflicts of interest statements for authors are managed by the editorial staff.

Case Reports, How to Do It, Images

Case reports describe interesting presentations of disease and innovative management of the patient's or patients' problem. ***How to Do It*** articles emphasize innovations in the operative management of technical challenges and new ways of doing things. ***Images***, which must fit on one printed page, are graphics of interesting presentations of disease within the chest.

Reviewers should evaluate the clarity and completeness of the case or procedure descriptions and the selection and quality of the illustrative material. Reviewers should also note whether or not the paper adheres to the format restrictions enumerated in "Information for Authors". The reference list should be selective rather than inclusive.

Review Article

Reviewers should assess the importance of the subject matter, need for the review and probable interest to readers. Reviews of very rare and unusual diseases are discouraged; subject matter should be sufficiently broad to have instructional and practical value for readers. Reviewers should note if authors have respected the format and restrictions of this category as stated in "Information for Authors".

The 'Introduction' should provide the rationale for reviewing the subject matter and provide the outlines of what is included and not included in the review. In the 'Methods' section reviewers should assess the methods used to search for articles, including search words and databases probed. The body of the review should be well organized with well chosen topical headings arranged in logical order. Within each topical heading the material should be presented in an integrated, comprehensive, objective manner. Statements should be referenced accurately. Reviewers should look for a "summing up" of the topical content before the author proceeds to the next topic. Reviewers should reject topical presentations consisting of "one sentence précis of referenced articles" arranged serially.

The review should provide a general overview of the subject matter assessing progress, pointing out deficiencies in present management and indicating opportunities and directions of future work. The reviewer should also assess the selection of references and note important absences or trivial inclusions.

Footnote.

This editor carefully reads all reviews and respects the time and effort that each reviewer has expended on behalf of the author and all readers. The reviewer remains anonymous; there is no reward beyond listing on the annual thank you list. The reviewer should direct his or her critique to the authors in the style and format that suits them best. The recommendation to the editor is made separately with or without additional comments.

Events of Interest

The 17th Annual Conference of the Egyptian Society of Cardiothoracic Surgery Cairo, Egypt (National Heart Institute)

Timing : 30 Jan - 2 May 2012

Location : Cairo J.W Marriot

E-mail : jegyptscts@gmail.com

- **30 January – 1 February 2012**

  Fort lauderdale, flunited states 48th annual meeting of the society of thoracic surgeons Greater fort lauderdale broward county convention center

- **8-9 February 2012 Kolkata.west bengal India**

  58th annual meeting of indian association of cardiovascular and thoracic surgeanos-joint Workshop of EACTS and LACTS

- **12-15 February 2012 Freiburg germany**

  41th annual meeting of the german society for thoracic-cardiovascular surgery GSTCVS messe freiburg

- **13-14 February 2012 Paris france**

  FSTS school of thoracic surgery (practical course in the laboratory) Covidien european training center

- **18-21 February 2012**

  St. Petersburg, FL United states 12th annual international symposium on congenital heart disease

- **14-18 March 2012**

  Antalya Turkey

  ESTS school of thoracic surgery (theoretical course)

- **25-28 April 2012**

  Dubrovnik croatia (Hrvatska)

  The 61st international congress of the european society for cardiovascular and endovascular surgery

- **26-27 April 2012**

  New yourk, NY United states

  Aortic symposium 201

  Sheraton hotel and towers

- **28 April-2 May 2012**

  San Francisco, CA United states

  92nd annual meeting-American Association for thoracic surgery

Editorial

"THANK YOU MY TEACHERS"

Prof. Dr. Anwar Balbaa

Mr. Chairman, Dear Guests, Dear Colleagues and students

I Was approached to address this honorable audience, I elected to review briefly some major factors that influenced the formation of my career.

I believe, the ALMIGHY put in my way, many figures who shared in my orientation and career structure. To those figures, I say:

"THANK YOU MY TEACHERS"

My first teacher was my father who had full confidence in me that I would choose the right correct way to do things, not the easier way, not the most profitable. Over the years, I could see him smile in Heavens, whenever I make the correct choice.

Basic teaching

The excellent basic teaching I gave received before university was responsible to choosing biology and languages as my favorites subjects .in the other subjects (math, phusics … etc) I did not receive enough encouragement.

I believe I am still learning many scopes are still open to me.

However I feel have gone through many experiences.

Through the deep personal contact I always had with my teachers, I have accumulated enough knowledge and experience to help me formulate my own career as well as orient the present and future generation of cardiothoracic surgeons as regards teaching and career structure.

University day

On my first day at university I was greeted by my collegues having achieved the highest high school grades in the kingdom of Egypt the congratulated me on the honorary scholarship. I realized that the fees have been paid by my father.

I asked to see the dean prof . ali mostafa moshrafa to complain about it . he told me that "your parents can easily afford to pay the university fees, wouldn't it better to grant it to some student who could not afford it".

I am immediately agreed I never felt happier. That was an excellent lesson I had learned quite early .

Our physiology professor was prof. Anrep Student of Pavlov his lectures on the physiology of the heart and circulation were like music symphonies, I believe that this has shared in my inclination to choose the specialty…..

Thank you Professor Anerp

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Our professors Abdallah El Kateb, Kamel Hussien and Mostafa El-Sherbiny were gifted teachers

They insisted that at the end of every lecture or class the students will go home with a cretin message they will never forget like reaching a reasonable diagnosis through careful history taking especially at a time there was no advanced available investigations as a abdominal songraphy, endoscopy, ct and magnetic resonance … etc

Probably I was lucky to have *Prof Mohamed Kinawi* give six lectures in cardiothoracic surgery after his long visit to the U.S.A centers. He was fascinated by the new specialty and could transfer this to me.

After graduation

My first appointment as intern was in the cardiology department on my first day, I reached the unit just before 8.00 am. I was amazed that *Prof Mohamed Ibrahim* the founder of Egyptian cardiology, was there already. Noting the surprise on my face he kindly told the young doctor " I love to have a well disciplined department, I should set the example I learnet the lesson and remembered it throughtout my active life soon after I served with some colleagues as frontier doctors in the plastine war for almost one year we learnt a good deal of displine and had extensive training in all types of injuries.

Residency training

The general surgical training I received was well planned and organized. The training in causalities and acute emergencies was particulary superior.

I still believe that trauma management to all body organs is a most essential part of the training particularly for the future cardiothoracic surgeon.

As a last year resident *Prof. Hassan Ibrahim* admitted a boy with constrictive pericarditis who had huge ascites and edema and was totally incapacitated. Soon after the operation the miraculous improvement in his case encouraged *Prof. Ibrahim* to operate 7 subsequent cases all with excellent results.

In 1953, shortly after obtaining my much degree in general surgery , I attended in the operating room of the newly opened thoracic surgery unit *Prof. Mohamed Ibrahim* was encouraging *Prof Sallah El-Malah* which deforming the first closed mitral commissurotomy in Egypt by then I was sold the idea of choosing thoracic surgery as my future career.

Prof Abdallah El-Kateb, dean of Kasr El-Ainy Faculty of Medicine was very ken to establish syrgical specialties neuro surgery- cancer surgery and cardiothoracic surgery.

He recommended I start in London

Training abroad

At Brompton institute of chest diseases, I was advised to join the M.R.C.P course of chest medicine.

I had the chance of coming close to the GIANT teachers of U.K. They gave us lectures regulary and attended the Friday medico- surgical conference besides we were allowed to attend all rarities of operation on the lung mediastinum diaphragm and esophagus. Heart operations had a limited role of course . open heart surgery was then not available

The program included lectures in anatomy, physiology, pathology and medicine of chest diseases. Stangely enough, about cardiac and chest this surgery. Professor Norman Barret told me that his information we have should be made available to our colleges the physicians . they see the patient first and an orient him better. Besides how can upon operate on a patient without knowing his pathology and the course of his disease if he is not operated

The same meaning was implanted by *Prof Paul Wood* the master cardiologist during a round in the M.R.C.P course in cardiology that I attended, he blamed me harshly about being unable to answer one of his question. I apologized by mentioning that I was a surgeon. His voice tone was raised saying "this is more reason for you to know the answer".

Sir Russel Brock's outpatient clinic was always deserted by the postgraduate doctors being a highly strung perfectionist I insisted on attending after his permission and "how wrong I was" I was greatly impressed by his fatherly altitude. His listened carefully to his lady patient's history, he asked me to auscultate her, and he told the patient that she may need re-operation . I never forgot her answer (Dr If you tell me I need operation every year I would accept without hesitation) .

Professor Brock told me that this lady was his first mitral closed commisurotomy reported to the literature in 1948.

This operation became later my favorite operation with a total of much over a thousand of grateful patients restored to go back to their original hard jobs.

A good lesson I received during my attending a lecture by Sir Clement Price Thomas in the building of the royal college of surgeons.We all found great difficulty hearing the lecture because of continuous hammering by works in the floor above. He walked up to them to have them stop working until the lecture is finished. He came back to tell us that he had just

received a lesson. The foreman told him “Rebuiding England after the war is more important than the your lecture”

Let me tell you a very impressive story by this great teacher: A case was being presented to the conference detailing his clinical and investigation data until it was a time to talk about his surgery. Prof Thomas jumped to his feet shouting “I hope you have not commented the stupid mistake I made by operating on similar patient. The patient died on the table. That was also the fate of the new case WHAT MODESTY! Thank you Sir Clement . It needs a lot of wisdom to arrange our priorities.

Residency in Sheffield.

My real surgical training started by being appointed as a thoracic surgical registrar in the National Heart service hospital on Sheffield. Prof. Judson Chesterman was the chief of the department He was a gifted surgeon who was very fond of teaching in his daily rounds and outpatient clinic.

I was on duty 24 hours a day trying to learn as much as possible in as short time as could be. That made me deeply interested in intensive care. There was no ICU at that time..

Training in USA

I was extremely lucky to be granted a fellowship in Michigan University in Ann Arbor center .

Prof. Cameron Haight, who is known to have closed the tracheoesophageal fistula in neonates for the first time was the chief. He was like a father to me and used to pass by my boarding house early in the morning to take me with him to attended the medico-surgical 2 weekly conference in the chest. He encouraged me and planted in me self-confidence when he said that for the first time the vote of a visitor is counted in the confirm.

Back home.

Soon after coming home my status changed from lecturer of General Surgery to lecturer of Thoracic surgery under *Prof Salah EI Mallah* in a specialized unit. Within few months the 1956 war started and we were quite busy treating thoracic and thoracoabdominal injuries. This is a very important training for the thoracic surgeon .

The encouragement I obtained for my medical professors of chest diseases and cardiology was remarkable especially from *Prof AbelAziz Sami* and *Prof. Mohamed Ibrahim*. This made it my first concern to train the future generations of thoracic surgeon. I insisted on giving maximum help and orientation and training. This is a major responsibility and commitment. I believe we have not wasted time when I see the large number of well trained staff whose results are comparable the international figures.

I admit that there are some comers we badly need to upgrade.

In pursuit of the progress in thoracic and cardiac surgery in of the wars 1967 and then the war in 1973 we went through open heart surgery using hypothermia.

Only 1976 when funds were available, we started to establish a modern fully equipped heart surgery operating room with a modern leU with a hate using attached to it.

A fatherly advice

After more than fifty years in cardiothoracic surgery I fell I have gathered enough information that I would like to pass to my juniors colleagues. I owe a lot of it to my teachers.

Our profession is a very hard and difficult profession, sometimes beyond our capacity of endurance. However I feel that we are the most privileged among professions.

- Starting a new unit or a new project in your department. **Do not start with mediocre facilities.** It is better to wail unit you have completed the basic necessities. If done the other way the result will be absolutely discouraging. More important than the equipment is the training of the personnel doctors, nurses, technicians and administration staff. Make sure you have maintenance personal for yours precious equipment
- Every newly appointed resident should be attached to a senior staff member who acts as his Godfather or guardian to guide him in his training and career structure this will make a huge difference in his performance.
- As a senior person in charge, you have 2 options to discipline your department either by LAW only or by love. The second option is by far the better. Everybody will avoid any mistakes just to keep you happy.
- Never humiliate your juniors. Do your best to encourage them, to praise them when they do unexpectedly well. I gained a lot from the encouragement of my teachers.
- If one member spends more time in res each give him. More privileges with full transparency. I witnessed this clearly in Hopital Broussais in Paris between Professor Dubost and the young Alain Carpentier.
- Our sources of information are numerous. We learn from our teachers, from books, J ournals from the internet and from attending the international conferences.

I would like to draw attention to the fact we learn from skilled competent surgeons by trying to imitate them, And we equally learn from ill tempered excessively speedy and incompetent surgeons by avoiding their attitudes.

We sometimes learn from passing remark of an anesthesiologist or a resident.

In short we can learn from any person.

I will conclude by telling you the story of Am Mahmoud. During my student years he was the shoe shine man in front of our leture rooms he used to shine my shoes every Saturday . On one occasion I commented to him that his previous polish of my shoes was a poor job. He examined my shoes and immediately said.

This shoe shine is not my work. It does not conform with my dignity"

It turned out that he was right and I was wrong and from that day I learnt his slogan and I have it used a lot throughout my career.

Management Technique for Deep Sternal Surgical Wound Infection

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Background: **Deep sternal surgical wound infection DSSWI or mediastinitis is a life threatening complication after open heart surgery. The aim of the current retrospective work was to review the management strategy for DSSWI after cardiac surgery in the last ten years in the authors' hospitals.**

Patients and Method: **Four females (40%) and 6 males (60%) of age ranged between 32 and 63 years old mean 53.5 +/-9.5 years developed DSSWI after cardiac surgery. They underwent the current management technique for management of their DSSWI at Al-Azhar university hospitals. The technique consists of two stages. First stage controls the infection. Drainage, debridement, undue or opening the lower third of the wound down to the pericardial cavity with out opening the sternum. This was immediately concomitant by administration of three intra-venous (IV) antibiotics regimen until the results of the culture and sensitivity come back. The lower third of the wound would be covered by a colostomy appliances tailored to fit wounds' gap. Second Stage of reconstruction starts with signs of healing begins; it consists of debridement of the skin, subcutaneous tissues, muscles, bones and removing all the necrotic tissues around the heart. The pectoralis major muscles with the skin was undermined and advanced as a myocutaneous flap. Retained viable sternum was approximated by Dixon No. 2. Three stitches in the form of figure of 8 were taken. This was followed by approximation of the myocutaneous flap in the midline without over ridding by vertical simple stitches taking all layers from the skin down to the bone and the cartilage using proline or nylon No. 2.**

Results: **Wound infection discovered in the 2nd postoperative week and onwards (day 12-17 postoperatively) mean (14.4+/-2.3 days) in the first 5 patients. However, it was discovered in the first week and onwards (day 4-11 postoperatively) mean (5+/-2.8 days) in the last 5 patients. The current technique was performed in range of 3 to 10 days from the time of discovering the DSSWI mean (5.8+/-2.8) and was used in the last 5 cases from the first to second day of discovery of DSSWI. Culture and sensitivity revealed infection with Enterococci in 3 patients (30%), Stap. Aureus in 3 patients (30%), Klebsiella in 2 patients (20%), Pseudomonas in one patient (10%), Methicillin resistant staphylococcus aureus in one patient (10%). The 3 IV antibiotic regimens were effective to begin with and to continue in addition to the sensitivity antibiotics results. The time lapsed to get the patient from stage I to stage II was ranged from 8 to 15 days mean (9+/-1.5 days). Retro-sternal chest tube was removed in range of 2 to 5 days mean (3+/-0.95) and the tension suture was removed in range of 13 to 16 days postoperatively mean (12.5+/-1.6). The colostomy bag that replaced the retrosternal tube was removed in range of 5 to 15 days mean (6.5+/-2.9). The period of stay in the hospital from the time of discovery of the DSSWI to discharge home ranged from 21 to 46 days mean (25+/-5.1). In follow-up ranged of 6 months to 9 years there was one late death (10%). There was no mediastinal gap, recurrence of deep infection, stitch sinuses or skin dehiscence.**

Conclusion: **The current technique is an alternative to the other methods of managing deep sternal surgical site infection with less postoperative complications.**

Key words: **Deep sternal wound infection.**

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Surgical wound infection is the third most frequently hospital -acquired - infection among all hospitalized patients (1). This is remaining a substantial cause of morbidity and mortality among surgical patients (2). Deep sternal surgical wound infection DSSWI or mediastinitis is a life threatening complication after open heart surgery. The causes of DSSWI are multi-factorial and the range of incidence between cardiac centers in one nation is variable. Many methods have been tailored to fit the circumstances of those patients suffering from DSSWI. Early treatment protocol used was open packing of the debrided wound (3). This method treated the situation like an abscess. Sternal and mediastinal debridement followed by continuous or intermittent closed system irrigation has gained popularity for many years (4) with remained unsatisfactory decline in the rate of mortality. Using omental, muscle or myocutaneous flap in one or two sitting reconstruction after debridement recording advantages in some patients (5). Using vacuum-assisted closure in the treatment of DSSWI has shown in late nineteen's of the last century degrees of improvement of the out come in comparison to the other previous methods (6). The aim of the current retrospective work was to review the management strategy for (DSSWI) after cardiac surgery in the last ten years in the authors' hospitals.

Patients

Between Jan. 2002 to Dec. 2011 (ten years), 10 consecutive patients developed DSSWI out of 1560 patients (0.006%) who had cardiac surgery procedures at cardiothoracic department in Al-Azhar University Hospitals. They were four females (40%) and six males (60%) of age ranged between 32 and 63 years old (mean 53.5 +/-9.5 years). They underwent the current management technique for DSSWI. All patients who had sterile sternal instability or any wound infection above the sternum were excluded. The primary diagnosis for 7 patients (70%) was ischemic heart diseases (IHD) and they underwent coronary artery bypass grafting (CABG). Two patients (20%) diagnosed IHD with ischemic mitral valve incompetence and they underwent CABG and mitral valve repair (MVr). One patient (10%) was rheumatic heart disease (RHD) and she underwent mitral valve replacement (MVR).

The primary operation was performed electively in 9 patients (90%) and in the form of emergency in patient No. 5 (10%). All patients' information was gathered from the patients' filling system (table1).

Method

The management technique consists of two stages. Stage I: patients on suspicion with DSSWI were re-admitted to the hospital if they have not left the hospital yet (stage of infection).

An urgent plain postero-anterior, dead lateral chest X ray and Echocardiography were performed. Gram's stain film from the wound's discharge as well as swaps for culture and sensitivity were requested as urgent procedures too.

With settling of the diagnosis of DSSWI only the site of discharge or collection was lad opened at the most dependant area to drain the collection like an abscess. Removing all suture materials and necrotic looking tissues at that site were followed by undue or opening the lower third of the wound including the rectus muscles down to the pericardial cavity without opening the sternum. Obvious and reachable loculi or unviable tissues could be removed by low grade suction through the rectus gap.

This was immediately concomitant by administration of three intra-venous (IV) antibiotics regimen until the results of the swaps come back. The regimen consists of Augmentin 1.2 grams 12 hourly, Garamycin 80 milligrams 8 hourly 1M for 48 hours and Metronidazole 100 milligrams IV twice daily for 48 hours then replaced by oral 500 milligrams twice daily. Vancomycin 500 milligrams 12 hourly was replaced Augmentin in patient No. 5 to No. 10.

Separate wound dressing had to be changed as many as needed. The wound was regularly cleaned by 0.9% saline. The skin edges were soaked with glycerol during changing the dressing. The lower third of the wound would be covered by a colostomy appliances tailored to fit wounds' gap followed

Pt. No.	Sex	Age	Diagnosis	Priority of surgery	Operation performed
1	M	32	IHD	Elective	CABG x 1+3
2	M	58	IHD	Elective	CABG x 1+1+1
3	M	62	IHD+MVI	Elective	CABG x 1+MVr
4	M	53	IHD	Elective	CABG x 1+1
5	F	61	IHD	Emergency	CABG x 1+1
6	F	41	RHD	Elective	MVR
7	M	61	IHD+MVI	Elective	CABG x 2+MVr
8	F	54	IHD	Elective	CABG x 1+2
9	M	53	IHD	Elective	CABG x 1+2
10	F	52	IHD	Elective	CABG x 1+2

Table I. Sex, age, diagnosis, priority of surgery and operation performed

by attachment of the colostomy bag. The patient would be advised to lie in semi-sitting position and the bag evacuated as needed. All measures been taken to improve the patient's general hygiene.

The studied patients were considered in post-operative complications status from the nutritional point of view. In such circumstances they had given 40-45 Kcal/Kg as energy and 0.2 gram nitrogen/Kg for protein supplement.

Reassurance of the patient and elevation of his mode were taken in consideration as well to alleviate the effect of the psychological trauma of re-operation soon after the first procedures. Clinical judgment, full blood picture and ESR all monitored the patients' progress.

Stage II: with signs of infection regressed to minimal and obvious granulation tissues appear the patient consented for reconstructive surgery (reconstructive stage). This is consisting of debridement of the skin, subcutaneous tissues, muscles, bones and removing all the necrotic tissues around the heart with wash using warm saline until the purple color of the viable tissues would be seen. The pectoralis major muscles with the skin was undermined and advanced as a myocutaneous flap. The myocutaneous flap dissected off the costal cartilages in a length enough to cover the sternum without tension. Laying 3/8 inch's diameter drainage tube with multiple side holes was used under the sternum. This is for draining blood and serous discharge. Retained viable sternum was approximated by Dixon No. 2. Three stitches in the form of figure of 8 were taken. The first stitch was taken to adjust the supra-sternal notch and the other two to approximate the rest of intercostal spaces. No stainless steel wire was used in this technique. This was followed by approximation of the myocutaneous flap in the midline without over ridding by vertical simple stitches taking all layers from the skin down to the bone and the cartilage using proline or nylon No. 2. An additional vertical mattress sutures between the previous ones to adjust the skin edges using Proline No. 2/0 were used.

Twenty-four hours after the operation the wound was exposed and chest binder was applied for 2 months. With discharge less than 50 mills per day, the drainage tube is removed and replaced by colostomy bag. The appliances were fixed around the centre of the exit of the drainage tube to be removed when absolute no discharge and signs of granulation tissues have appeared. The site of the draining tube was covered by soaked glycerol gauze to be changed as required until the granulation tissues fill the pit.

Follow up: the studied patients were assessed by clinical examination for mediastinal dehiscence, recurrence of DSSWI, progress of wound healing, scars, keloid and sinuses. They followed as well by full blood picture, ESR, culture and sensitivity from the wound discharge if any, ECG, plane CXR and echocardiography.

Statistical analysis: Statistical analysis was performed using SPSS version 13.0. Values were given as mean with standard deviation (SD).

Results

Pre-operative assessment of risk factors of arteriosclerosis and wound infection showed that diabetes was present in 70%, hypertension in 60%, smoking in 60%, hyperlipidemia in 30% and family history of related disease in 20%. However, patient No. 5 was suffering from hypothyroidism and she was on replacement therapy (table 2).

The peri-operative assessment for the risk factors that predispose to DSSWI revealed that the first patient developed on table ventricular tachycardia after wound closure. This was required urgent re-opening and resuscitation for 5 minutes. The second patient was re-opened for missed swap before transfer to the intensive care unit. For the second time, after 24 hours from the first operation, routine postoperative plane CXR discovered a missed tip of the two stages venous cannula in the inferior

Pt. No.	DM	HTN	Family H.	Smoking	Hyper-lipidemia	Others	
1	Y	Y	Y	Y	Y	N	
2	N	N	N	Y	N	N	
3	Y	N	N	Y	N	N	
4	Y	Y	N	N	N	N	
5	Y	Y	N	N	N	Hypothyroid	
6	N	N	N	N	Y	Obesity	
7	Y	Y	Y	Y	Y	N	
8	Y	Y	N	Y	N	N	
9	Y	Y	N	Y	N	N	
10	N	N	N	N	N	N	

Table. 2. Pre-operative risk factors for DSSWI (DM: diabetes, HTN: hypertension, H: history).

vena cava. He was re-opened for the third time to retrieve the tip of the cannula. Patient No. 6 developed moderate pericardial effusion day 4 postoperatively and wound's discharge. Patient No. 8 reopened for bleeding 5 hours postoperatively. Patient No. 10 developed fever with weeping wound 3rd postoperative day (table 3).

Pt. No.	Events
1	VT after wiring needed resuscitation for 5 minutes.
2	Opened for missed swap in the first time. Opened for missed fractured tip of the 2 stages cannula.
6	Moderate pericardial effusion 4th postoperative day.
8	Re-opened for bleeding 5 hours postoperatively.
10	Developed fever with weeping wound 3rd postoperative day.

Table 3. Per-operative risk factors for DSSWI.

Deep sternal surgical wound discovered in the 2nd postoperative week and onwards (day 12-17 postoperatively) mean (14.4+/-2.3 days) in the first 5 patients. However, it was discovered in the first week and onwards (day 4-11 postoperatively) mean (5+/-2.8 days) in the last 5 patients.

The current technique (stage I) was performed in range of 3 to 10 days from the time of discovering the DSSWI mean (5.8+/-2.8). On the other hand this technique was used in the last 5 cases from the first to second day of discovery of DSSWI.

Culture and sensitivity revealed infection with Enterococci in 3 patients (30%), Stap. Aureus in 3 patients (30%), Klebsiella in 2 patients (20%), Pseudomonas in one patient (10%), and Methicillin resistant staphylococcus aureus in one patient (10%). The 3 IV antibiotic regimens were effective to begin with and to continue in addition to the sensitivity antibiotics results (Table 4).

The time lapsed to get the patient from stage I to stage II was ranged from 8 to 15 days mean (9+/-1.5 days).

Retro-sternal chest tube was removed in range of 2 to 5 days mean (3+/-0.95) and the tension suture was removed in range of 13 to 16 days postoperatively mean (12.5+/-1.6). The colostomy bag that replaced the retrosternal tube was removed in range of 5 to 15 days mean (6.5+/-2.9). The period of stay in the hospital from the time of discovery of the DSSWI to discharge home ranged from 21 to 46 days mean (25+/-5.1) (table 5).

In follow up ranged of 6 months to 9 years there was no early mortality. However; there was one patient (10%) died after 4 months from stage II (Figure 1). Up to the writing this work there was no mediastinal gap, recurrence of deep infection, stitch sinuses or mechanical skin dehiscence. There was residual chest wall pain related to the site of the harvested thoracic artery in 3 patients (30%).

Pt. No.	T. infecion days	T. Surgery days	Ant. before	Organism	Ant. after Cult.
1	12	5	3 IV	Stap. A	3 IV+S
2	15	7	3 IV	Pseu.	3 IV+S
3	17	10	3 IV	Entero	3 IV+S
4	12	4	3 IV	Stap.A	3 IV+S
5	16	3	3 IV	MRSA	3 IV+S
6	6	1	3 IV	Klebsiella	3 IV+S
7	5	1	3 IV	Stap. A	3 IV+S
8	11	2	3 IV	Entero	3 IV+S
9	5	1	3 IV	Entero	3 IV+S
10	4	2	3 IV	Klebsiella	3 IV+S

Table 4. Timing (T) of infection, surgery, type of organisms and the antibiotics been used, S according to the sensitivity.

Pt. No	T. tube removal	T. suture removal	T. bag removal	hospital Stay
1	3	14	15	25
2	5	16	7	30
3	4	13	13	27
4	2	11	6	14
5	3	14	10	46
6	4	11	5	22
7	3	13	7	21
8	3	12	6	23
9	2	11	5	26
10	4	12	5	25

Table 5. Time in days (T) of tube, suture, bag removal and staying in the Hospital.

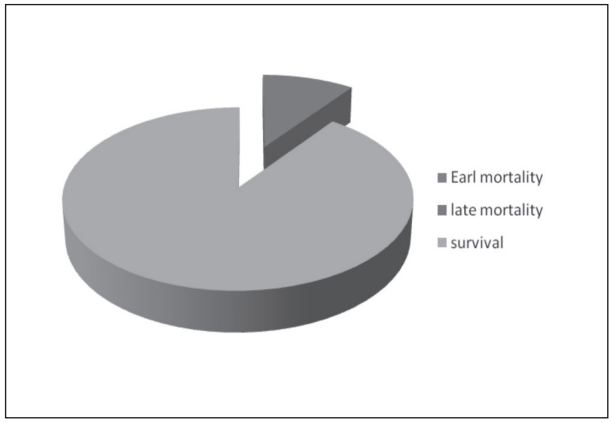

Fig. (1) Over all results.

Discussion

Currently, deep sternal surgical site infection is infrequent (0.15-5%) (2,6). However, this is remaining a substantial cause of morbidity and mortality among surgical patients. The decline of incidence relates to the introduction of the guidelines of prevention of cross infection and using prophylactic antibiotics for surgical wound infection (1). In the current work the incident of DSSWI was 0.006%. Others highlighted the importance of measuring the impact on the DSSWI of specific procedures and patient's circumstances rather than all surgery (8). This has paid attention to the risk index to each patient considering the expectation of the incidence of DSSWI. Some of the important patient's risk factors have been proven in the current work. This included insulin dependant diabetes mellitus, obesity, peripheral vascular arteriosclerosis, long-term low cardiac output, and immune compromised patients (9,10,11). However; peri-operative risk factors as shown during this work were individual. Re-opening of the patient before signs of healing for any reasons, inadequate haemostasis with insufficient drainage followed by pericardial effusion, using bilateral mammary artery in coronary artery bypass grafting and prolonged procedures with hypothermia are between operative incriminating factors of DSSWI (2,9,10,11.12).

Before restriction of using the antibiotics with preference to culture and sensitivity, coagulase negative staphylococci and group D enterocci were common. However, after restriction, Methicillin resistant staphylococcus aureus and vancomycin resistant enterocci are common (13). Staphylococcus aureus and enterocci represent 60% in incidence between the studied patients. Pseudomonas has virulent course and needs more time to be eradicated by the antibiotics.

Despite early diagnosis and prompt treatment, the outcome of DSSWI is not satisfactory. This relates to the extensive necrosis of the vital mediastinal tissues with consequent spread of infection and loss of tissues co-optation before clinical diagnosis take place. Loss of tissues coaptation induces discomfort and limitation of the respiratory functions. In addition toxins that are released from the microorganisms and the necrotic tissues produce toxaemia, shock and multiple organs failure. Up till now operating surgeons are usually responsible about the performance of the operation. For this reason conservative management or give antibiotics then wait and see was common. With more understanding of pre and per-operative risk factors of the event peoples appreciate the multi-factorial effect on the verdict of the operation. The current protocol of the study convinced the surgical team to admit as early as risk factors arise to point out to the susceptible patient of DSSWI. By this way timing of using the current technique was one of the pillars of its success.

Management of DSSWI is a subject of controversy. Few decades ago it was dependant on surgeon's own experience. However, the treatment has evolved over the past 40 years. At the beginning it was treated like an abscess in the form of open drainage followed by debridement with the wound left open and allowed to granulate for gradual closure by secondary intention. This technique was associated with significant prolonged hospital stay, morbidity and mortality (3,14). Schumaker and associates in 1963 described the technique of closed catheter antibiotics irrigation following debridement and rewiring of the sternum (15). Thirteen years later, Lee and colleagues treated patients who did not respond to catheter irrigation and rewiring with wide debridement followed by omental flap closure (16). Jurkiewicz and associates expanded on this concept by using muscle flap to fill the dead space remaining after radical debridement (17). Adequate sternal immobilization appears to have an effect on the incidence of post-median sternotomy mediastinitis (20). Robicsek was the first to describe sternal closure and muscle padding to provide sternal stability (19,20).

This was followed by using the pectorals major muscle as a myocutaneous flap for more support to the sternum (21). Argenta and Morykwas 1997 introduced the technique of vacuum-assisted closure based on applying negative pressure on the wound (6,22). Obdeijn and colleagues 1999 used vacuum-assisted closure to treat DSSWI (6,23). This technique has shown early infection control and shorter healing times than the classic treatment (6). It has been identified that the pressure range required for this maneuver from -75 to -100 mm Hg (6.24). By continuous suction, fluid excess and tissues edema are decreased there by reducing bacterial colonization. In addition uniform continuous negative suction improves the micro-circulation of the tissues optimizing the wound environment (6,24). However, the out come results of each management depends greatly on individual circumstances and the response mechanism of his body (20,25,26,27).

The current technique has been evolved over ten years and based mainly on appreciation of early intervention, closed system for drainage, minimal foreign materials for reconstruction. It has two stages. Initial stage controls the invasive sepsis. This was achieved by draining the collection, removing all suture materials and necrotic looking tissues at that site. This was followed by undue or opening the lower third of the wound including the rectus muscles down to the pericardial cavity without opening the sternum. Obvious and reachable loculi or unviable tissues could be removed by low grade suction through the rectus gap. A colostomy appliance tailored to fit wounds' gap followed by attachment of the colostomy bag.

This was concomitant with taken culture from debrided components with subsequent organism sensitivity to the available antibiotics. Immediately the triple antibiotic regimen was started, until the results of the cultures come back. We found that the triple antibiotic regimen was effective and we did not need to change it after the results of the sensitivity came back. However; the selected antibiotics routinely would be added to the regime.

The nutritional status under this circumstances was considered by given the maximum required calories and proteins to avoid the consequences of the catabolic event. Reassurance of the patient was mandatory too. It has been found that these patients were suffering from psychological trauma of re-operation soon after the first procedures. We intended to explain to them that surgical infection do not result from the mere presence of contaminated bacteria, but rather from a complex interaction between the host's defense mechanism and the pathogenic organism (21).

The second reconstructive stage consists of debridement of necrotic tissues and approximation of the healthy tissues. The technique was tried to limit using foreign surgical sutures and avoided stainless steel wires. The first remains for some times and forms nudes-of re-infection or stitch sinuses. The stainless steel wires cut through the fragile oedematous retained sternum and it lasts forever. Occasionally it forms small painful lumps under the skin. In considerable number of patients treated using wires, they needed removal of some of them at some stage in their life. We approximate retained viable sternum by Dixon No.2, in the form of interrupted figure of 8 sutures. The first one was to approximate the manubrium and to adjust the supra-sternal notch. The other two were distributed to approximate properly the rest of intercostals spaces. The pectoralis major muscle was used as an advancement myocutaneous flap. After debridement of the skin and the muscle edges without separation, it had been undermined for a distance enough to get proper approximation of the edges in the midline without tension. The flap is suitable supportive cover with blood supply for the fragile inflamed sternum. This technique is different than the other reported pectoralis major flap of complete dissection to the muscle off its insertion (19,21,28). All efforts been tried to minimize using diathermy in dissection to preserve the perforators of the intercostals blood vessels. The technique intended to approximate the flap using the secondary intention sutures technique. The basic rules were no gaps between the flap edges or dead space between the flap and the sternum. Other enforcement layer was taken to adjust the skin edges. Once the wound was dressed at the end of the procedures a chest belt is applied and was kept on and off for two months later. The corner stone of this technique is to keep stability of the sternum by careful handling and mobilization of the patients when they are under anaesthesia. Lifting up the patients from there arms was forbidden by all means. No vigorous movements would be allowed before 2 months of the date of the operation. For the same purpose of limiting foreign surgical materials, the drainage tubes used intra-operatively were removed once the blood and serous less than 50 mills per day and replaced by colostomy appliance with attached bag. Removal of the tube at this stage gets rid of port and track of infection. In addition removal would help the granulation tissues to fill the retro-sternal space as early as possible. The appliance will fit at the exit of the drainage tube. It was found that this was quite useful method for the general patients' hygiene and to send the patients home to be looked after by local medical persons. Discharging patients from the hospital occurred when they become ready to do so without long waiting for granulation tissues to reform. This is shortening hospital stay and its complications. Once the exit site filled by granulation tissues the colostomy bag and its appliances was replaced by soaked dressing with glycerol.

With encouraging results of this technique early diagnosis was noticed concomitant with prompt intervention. Subsequently the time lapsed to get the patient form stage I to stage II becoming less with early leave from the hospital. There was one late death reported 4 months after stage II. This patient was barber and he lost his career. It was not possible to get him out of his depression and eventually died from anorexia associated with marked loss of weight. In their follow up period and up to writing this work there was no reported mediastinal gap, recurrence of deep infection, stitch sinuses or mechanical skin dehiscence. There was residual chest wall pain related to

the site of the harvested internal thoracic artery in 3 patients. This was controlled by given anti-inflammatory medications on demand.

We would agree that prophylaxis is better than treatment (21). This would be achieved by avoiding the risk as much as possible from the patient's side and environmental surgical procedures of the other side. However; if infection could happen, on time wise decision for surgical intervention might change a lot forward in the patient's life.

Conclusion: The current technique is an alternative to the other methods of managing deep sternal surgical site infection with less postoperative complications.

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Perioperative Risk factors for Prolonged Mechanical Ventilation Following Cardiac Surgery for Congenital heart Disease in Pediatric Patients

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Background: **Prolonged mechanical ventilation (PMV) after cardiac surgery in children is associated with a high postoperative morbidity and mortality, as well as increased ICU and hospital resource utilization. This study was performed to evaluate the perioperative risk factors for PMV in children and infants undergoing cardiac surgery.**

Methods: **Clinical records of 110consecutive children (1 day-15 years) were reviewed. PMV was defined as mechanical ventilation (MV) > 72 h following operation. After univariate analysis, astepwise logistic regression analysis was used to evaluate the independent risk factors for PMV following cardiac surgery. The predictive ability of risk factors for PMV was assessed using an area under the receiver operating characteristic (ROC) curve.**

Results: **thirty sex patients required PMV after cardiac surgery. The median duration of MV was 295 h in PMV patients, while it was 21 h in non-PMV patients. The independent risk factors for PMV were preoperative mechanical ventilation (p < 0.05),risk adjustment for surgery for congenital heart disease (RACHS)-1 (p< 0.01), low cardiac output syndrome (LCOS) [p _ 0.001], postoperative Pulmonary hypertension (p <0.05), and postoperative arrhythmia (EF) [p < 0.01]. The value for the ROC curve was 0.874**

Conclusions: **The present results strongly suggest that preoperative mechanical ventilation ,risk adjustment for surgery for congenital heart disease (RACHS)-1, low cardiac output syndrome (LCOS), postoperative Pulmonary hypertension, and postoperative arrhythmia are risk factors for PMV in children and infants undergoing reparative surgery for congenital heart disease.**

Abbreviations: **AUC _ area under the curve; CPB _ cardiopulmonary bypass; DHCA _ deep hypothermia circulatory arrest; EF _ extubation failure; LCOS _ low cardiac output syndrome; MV _ mechanical ventilation; P-MODS _ pediatric multiple organ dysfunction score; PMV _ prolonged mechanical ventilation; RACHS _ risk adjustment for surgery for congenital heart disease; ROC _ receiver operating characteristic.**

Key words: **Cardiac surgery • children • perioperative • prolonged mechanical ventilation • risk factor • young infant**

Congenital heart disease (CHD) occurs in 0.5-0.8% of live births. The incidence is higher in still borns (3-4%), spontaneous abortuses, and premature infants. This overall incidence does not include mitral valve prolapse, patent ductus arteriosus (PDA) of preterm infants, and bicuspid aortic valves. Congenital cardiac defects have a wide spectrum of severity in infants. The diagnosis is established by one week of age in 40-50% of patients with congenital heart disease and by one month of age in 50-60% of patients. With advances in both palliative and corrective surgery, the number of children with congenital heart disease surviving to adulthood has increased dramatically[1].

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Innovation in surgical technique and improvement in myocardial protection and anesthesia management have made it possible for very young children to benefit from surgical intervention to correct or palliate congenital heart disease. Therefore, there is a growing population of neonates and young infants who undergo more complex surgery and require postoperative intensive care[2].

Duration of mechanical ventilation has become a critically important issue for resource allocation and is correlated with postoperative morbidity and mortality. Prolonged mechanical ventilation after pediatric cardiac surgery is defined as lasting on mechanical ventilation for 72 hours or more since the time of admission in cardiac intensive care unit[3].

A series of risk factors associated with prolonged mechanical ventilation after pediatric cardiac surgery have been identified. Although these risk factors were heterogeneous, to some extent, among different reports, younger age was an important predictor for prolonged mechanical ventilation[3].

This study was performed to evaluate the perioperative risk factors for prolonged mechanical ventilation in pediatric patients undergoing cardiac surgery for congenital heart disease.

PATIENTS AND METHODS

This study was performed according to the ethical standards. After approval by the local ethics committee and receipt of the written informed consent from the care giver and supervisor of the patient, the study was conducted in a 14-bed CICU over a one-year period (from July 2009 to July 2010) at a Klinikum Neiderhein Heart center in Duisburg Germany. One hundred and ten consecutive patients from one day old to 15 years old including 39 neonates undergoing congenital heart surgery with or without CPB were enrolled. All the patients admitted to CICU received MV.

Airway management and ventilator weaning

All the patients were nasally intubated in the operating room. Anesthesia was managed according to a standard protocol. The CPB circuit, which was identical for all patients, included a membrane oxygenator and a Stockert III roll pump. Myocardial protection was achieved using cold-blood cardioplegic solution unless otherwise indicated. The patients were transferred to CICU immediately following operation, and MV was administered using a Servo *I* ventilator (Siemens; Munich, Germany). The initial mode of ventilation was pressure regulated volume control in all patients. Once the patient was breathing spontaneously and ready for weaning, the ventilator mode was switched to pressure-controlled, synchronized, intermittent, mandatory ventilation.

The criteria for extubation was protocolized. Corticosteroids were routinely administrated 4 to 6 hours before extubation.

Data collection and definitions

Duration of MV (including noninvasive MV) was from the time of arrival at CICU to the time of successful extubation. The patients of this study were classified into two groups according to the duration of MV: Prolonged Mechanical Ventilation (PMV) group (≥ 72 hours), and non-PNV group (< 72 hours). This definition of PMV is based on studies[3,4] in which the median ventilation duration after pediatric cardiac surgery was 3 days.

Demographic data and preoperative variables included age, sex, weight, cyanosis, primary reason for first admission, Pediatric Multiple Organ Dysfunction Score (P-MODS), preoperative cardiovascular function, pneumonia, requiring MV preoperatively, pulmonary blood flow, preoperative pulmonary hypertension, and non-cardiac anomaly. The intraoperative variables included Risk Adjustment for Surgery for Congenital Heart disease (RACHS), CPB time, aortic cross-clamp time, exposure to DHCA, ultrafiltrated volume removal, and body fluid. The postoperative variables included nosocomial pneumonia, noninfectious pulmonary complication, Low Cardiac Output Syndrome (LCOS), postoperative arrhythmia, postoperative pulmonary hypertension, postoperative cumulative positive fluid balance, postponed sternal closure, and Extubation Failure (EF). The definitions for the variables were provided (table 1).

Statistical Analysis

First, univariate analysis was performed to compare demographic data, and preoperative, intraoperative, and postoperative variables of patients who required PMV to that of patients who required MV < 72 hours (non-PMV). Continuous variables were expressed as the mean ± SE or as median and ranges when appropriate. Comparisons between two groups were performed using the unpaired Student *t* test or the Mann-Whitney *U* test for continuous variables and X test for categorical variables. Logistic regression analysis was used to identify independent risk factors for PMV. The variables with a p value < 0.05 were entered into the logistic regression analysis in separate models for preoperative risk factors, intra-operative risk factors and postoperative risk factors. A p value < 0.05 was considered significant. Estimated odds ratios were calculated for the variables most strongly associated with mechanical ventilation time. Area under the Receiver Operating Characteristics (ROC) curve was used to assess the predictability of risk factors for PMV. Statistical analysis was performed using statistical software (SPSS 10).

RESULTS

Outcomes

During the study period, a total of 110 infants and children (1 day - 15 years) old were included in this study. In-hospital

Variables	Definition
Primary reason for first admission	Respiratory tract infection; LCOS; cardiac murmur; cyanosis; others
P-MODS	Descriptors for organ dysfunction identified in five organ systems including cardiovascular, respiratory, hepatic, hematology, and renal; a grading scale for each variable was set from 0 to 4. When the P-MODS was categorized into five levels, the risk of mortality increased substantially at each subsequent level compared with the first: level 1: score 0; level 2: score 1–4; level 3: score 5–8; level 4: score 9–12; level 5: score 13–20
Preoperative cardiovascular function	The cardiologists' assessment before surgery or the empirical need for oral anti congestive therapy or IV inotropic support before surgery
Preoperative pulmonary hypertension	Preoperative pulmonary hypertension was diagnosed by echocardiogram or cardiac catheterization
Non cardiac anomaly	Major structural anomalies such as cleft lip, bi-renal deformity, double intestine, and major chromosomal abnormalities, such as Down syndrome, Turner syndrome, and DiGeroge syndrome
RACHS-1	The RACHS method has six risk levels used to adjust for baseline risk differences and allow meaningful comparisons of in-hospital mortality for groups of children undergoing congenital heart surgeries, detailed in article by Jenkins et al
Nosocomial pneumonias	A documented source of infection in lungs by a positive microbiological culture finding, fever > 38.5°C or < 35°C, WBC count > 12 X 109/L or < 4 X 109/L
Noninfectious pulmonary complications	Pleural effusion, chylothorax, partial lung collapse, airway disorders, pneumothorax, pneumomediastinum, and pulmonary hypertension, phrenic nerve palsy
Postoperative LCOS	Requirement of $>0.1\ \mu$g/kg/min of epinephrine or > 5 ng/kg/h of milrinone, except for dopamine and dobutamine early after surgery or needing any inotropic drug beyond 72 h after surgery
Postoperative arrhythmia	Arrhythmia requiring infusion of anti arrhythmic drug or pacing, but not pacing aimed to increase the heart rate for circulatory improvement in the presence of age-appropriate sinus rhythm
Postoperative pulmonary hypertension	Diagnosed by direct pressure monitor via catheter or clinical features requiring nitric oxide or prostaglandin infusion after surgery
Postoperative cumulative positive fluid balance (fluid retention)	Cumulative fluid intake greater than cumulative output at 72 h after operation. Cumulative fluid intake: including residual body residual fluid after ultrafiltration, blood products, total parenteral nutrition, enteral feedings, and IV-administered medication and fluid. Cumulative fluid output: including urine, blood loss, nasogastric fluid, stool, and other output from other body cavities
Prolonged sternal closure	Patients discharged from the operating room with open thorax and achieved sternal closure at CICU
Acute renal failure	Urine output < 1 mL/kg/h, with a rise in creatinine level or blood urea nitrogen, or needing peritoneal dialysis
EF (Extubation Failure)	The reinstitution of mechanical ventilator support (including noninvasive mechanical support) within 24 h after extubation

Table 1. ***Definitions for the variables***

mortality for entire study period was one of 110 patients (0.9%) from PMV group due to LCOS postoperatively .Mean of duration of MV was 21hs in non PMV group compared with 295hs in PMV group.

Univariate analysis

Demographic data and preoperative, intraoperative, and postoperative variables were evaluated univariately as possible risk factors of PMV separately. Table 2 shows types of cardiac lesion included in study

In the analysis of demographic data and preoperative variables, 9 of 11 variables showed a significant association with PMV . Compared with patients who received MV for < 72 hours, the patients requiring PMV were significantly younger in age, lighter in weight, had increased pulmonary blood flow, higher risk score of P-MODS, were admitted to the hospital with a pulmonary infection or cyanosis, were more likely to require MV support, and were more likely to have cyanotic congenital heart diseases, abnormal preoperative cardiovascular function, pulmonary hypertension and pneumonia (all $p < 0.05$). The gender distribution and presence of non cardiac anomaly did not show a significant association with PMV.

In the analysis of the PMV-associated intraoperative risk factors, the patients requiring PMV were more likely to have a higher RACHS-1 score ≥ 3, prolonged exposure to DHCA, longer CPB and aortic cross-clamp time

All the enrolled postoperative variables excluding renal failure were significantly associated with PMV by univariate analysis (table 3). PMV was significantly associated with nosocomial pneumonia, noninfectious pulmonary complications, LCOS, arrhythmia, pulmonary hypertension, fluid retention, postponed sternal closure, and EF (all $p < 0.05$).

	Number of cases
Valvular lesions	
Aortic stenosis	4
Pulmonary stenosis/atresia	8
Mitral stenosis	1
Tricuspid atresia	1
Great arterial anomalies	
DTGA	8
LTGA/pulmonary atresia	1
Coarctation/hypoplastic aortic arch	14
Truncus arteriosus	2
Vascular ring	4
PDA	4
Pulmonary venous anomalies	
Total/partial anomalous pulmonary venous drainage	4
Cortriatriatum	1
Endocardial cushion defects	
AV canal	5
VSD	5
ASD	10
VSD + ASD + PDA	6
Fallot	7
Single ventricular anomalies	
Single ventricle	1
Hypoplastic left heart syndrome	2
Double inlet left ventricle + Rudimentary right ventricle	2
Double outlet right ventricle + TGA/HLHS	11
Others	
VSD + Aortic stenosis	4
VSD + ASD + Interrupted aortic arch	2
Ebstein anomaly	1
Truncus arteriosus + Interrupted arch + Common AV canal	1
Total	110

Table 2. Types of cardiac lesions included in the studied groups

	I(non PMV) (n = 74)		II(PMV) (n = 36)		X^2	p
	No	%	No	%		
MV duration						
Mean±SD	21.16±23		295±317			
Pneumonia						
-ve	68	91.9	13	36.1	38.82	< 0.001
+ve	6	8.1	23	63.9		
Noninfectious pulmonary complications						
-ve	57	77	12	33.3	19.78	< 0.001
+ve	17	23	24	66.7		
Low COPS						
-ve	72	97.3	13	36.1	51.63	< 0.001
+ve	2	2.7	23	63.9		
Arrhythmia						
No	70	94.6	20	55.6		
Tachycardia	4	5.4	11	40.6	26.02	< 0.001
Bradycardia	0	0	5	13.9		
Pulmonary HPN						
-ve	73	98.6	29	80.6	0.23	0.002
+ve	1	1.4	7	19.4		
+ve cumulative fluid balance						
Mean ± SD	-135.8 ± 299		409.1 ± 917.4		MW = 21.5	< 0.001
Range	-1850-590		-500-5000			
Median	-85		300			
Renal failure						
-ve	74	100	35	97.2	0.14	0.71 (NS)
+ve	0	0	1	2.8		
Delayed sternal closure						
-ve	74	100	16	44.4	50.25	< 0.001
+ve	0	0	20	55.6		
Extubation failure						
-ve	73	98.6	27	75	13.65	< 0.001
+ve	1	1.4	9	25		

Table (3): Univariate analysis of postoperative risk factors in relation to mechanical ventilation

Factors	Odds ratio	95% Confidence interval	P value
Preoperative mechanical ventilation	10.28	2.05-51.44	< 0.05
RACHS-1	8.24	3.35-20.25	< 0.01
Low cardiac output syndrome	63.69	13.37-303.39	0.001
Postoperative pulmonary hypertension	17.62	2.07-149.61	< 0.05
Postoperative arrhythmia	14	4.2-46.6	<0.01

Table 4. Logistic regression analysis: Independent risk factors associated with PMV

Multivariate analysis

An analysis of preoperative, intraoperative, and postoperative variables in separate models using logistic regression analysis .Regarding preoperative risk factors model, preoperative mechanical ventilation, preoperative pulmonary hypertension, and preoperative cyanosis appeared statistically significant.

The ROC (Receiver Operating characteristic) curve for this finding, with highest Area Under the Curve (AUC) of 0.874 with cut off values three risk factors demonstrated a strong predictive value for PMV by low cardiac output, postoperative hypertension, postoperative arrhythmia and preoperative mechanical ventilation and RACHS-1 in this study (figure 1).

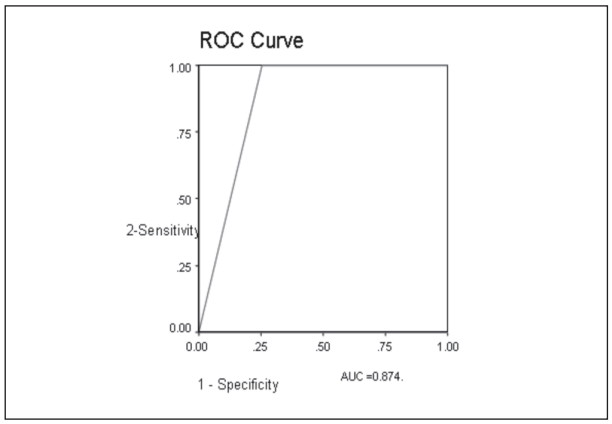

Fig. 1. ROC curve for the predictability of risk factors including preoperative MV, RACHS-1, Postoperative LCOS, postoperative arrhythmia and postoperative pulmonary hypertension. The AUC was 0.874, demonstrating a strong predictive value of risk factors in the present study

DISCUSSION

Duration of mechanical ventilation (MV) and length of intensive care unit (ICU) stay have become critically important issues of patient management. In the past, infants and children operated with congenital heart disease remained intubated for prolonged periods. Early extubation has become a popular technique as it shortens the length of stay, is cost-effective, and results in fewer complications. Recognition of patients who can be successfully extubated is still very difficult[3]. However, it is well known that not all patients are appropriate candidates for early extubation, although most are suitable for weaning and extubation in the early postoperative period despite complex operative procedures. With advances in anesthesia management, cardiopulmonary bypass (CPB), and surgical techniques, the trend in pediatric cardiac surgery toward 'fast tracking' and early extubation of patients seems to be feasible. Considering these developments, it is also important to recognize patients in whom early weaning from the ventilator should be avoided.

In this prospective study, 33% of children (one day - 15 years) required PMV after congenital heart surgery. The cutoff point of Prolonged mechanical ventilation in our study is 72 hours based on previous studies[3,4,5] which showed that in patients undergoing complex cardiac surgical procedure, cessation of ventilator support was usually achievable within 72 hours. The incidence for PMV with the cutoff point at 72 hours in this population was much higher than in older children reported by previous studies[4,6]**.** Szekely et al.[6] defined two cut off points for mechanical ventilation duration (61hours for medium mechanical ventilation was in 25% of population study and 7 days for long mechanical ventilation was in 9.2% of population study) but is lower than that reported by Shi et al.[3] whose study was in neonates and young infants and revealed that 35% of infants ≤ 3 months old required prolonged mechanical ventilation.

Pre-operative mechanical ventilation, LCOS, post-operative pulmonary hypertension, and postoperative arrhythmia were found to be independently associated with PMV in our study. The predictive value of risk factors for PMV in this study was good, with an AUC of 0.874 with cut off value 3 risk factors.

It is likely that some factors were significant in univariate analysis but not in the final logistic analysis, as shown in previous studies[6]. In this single center study, although 9 of 11 preoperative variables were significantly associated with PMV in the univariate analysis, there was only single preoperative variable proven to be an independent risk factor for PMV in the final results which is preoperative mechanical ventilation with a 10.28-folds higher likelihood of PMV than those without preoperative mechanical ventilation. Preoperative MV was observed in 22.2% of PMV group compared with 2.7% of non PMV group. This finding is consistent with Kanter et al.[7] who concluded that preoperative mechanical ventilation in children has been documented as a risk factor for prolonged mechanical ventilation, and with Janet et al.[8] who found that newborns requiring preoperative mechanical ventilation had greater risk of postoperative morbidity and mortality but inconsistent with Shi et al.[3] in which there was no significant statistical association between preoperative mechanical ventilation and prolonged mechanical ventilation postoperative in multivariate analysis.

Absence of other preoperative factors association with prolonged mechanical ventilation in multivariate analysis may suggest that preoperative data may not be able to predict the risk for prolonged duration of ventilation in young children.

Young age was found as independent risk factor for PMV in previous studies[8,9,10,11]. In concordance with the previous studies, young age was found strongly associated with PMV in univariate analysis in the present study with p value < .001 and odds ratio 11.446 (young infants ≤ 6months old have 11.44 folds to have PMV than older infants and children) .However age lost its significance in multivariate analysis (multiple logistic regression) when combined with postoperative factors .One possible explanation for this is that the periods of exposure to the detrimental stimulation (such as hypoxemia, acidosis and

tissue hypoperfusion) in neonates and young infants were much shorter compared to elder children, which may only lead to a transient and reversible insult on structure or function of heart and lung in young infants. The benefit of successful correction of cardiac lesions outweighed the negative effect of poor status before operation. In addition, when both preoperative and postoperative variables were analyzed simultaneously, the preoperative variables usually have little or no contribution to the final predictive analysis[3]. Another possible explanation is that the present study involves congenital heart surgery with CPB (90 patients) and without CPB (20 patients), and 12 out of 20 patients were ≤ 6months, while other studies focused on open cardiac surgeries only.

Weight was not an independent risk factor for PMV as in previous studies[3,6,11].But it is inconsistent with Neirotti et al.[12], which concluded that low weight was associated with failure of extubation in the first 6 hours postoperative.

Primary reason for first admission, PMODS, Pulmonary blood flow and preoperative Cyanosis were not independent risk factors for PMV in the present study which is consistent with Shi et al.[3].

In the present study, preoperative cardiovascular function was not an independent risk factor for PMV. This is in concordance with [3,6,9,11].

Also, preoperative pneumonia was not an independent risk factor for PMV. This is in concordance with Davis et al.[9], Shi et al.[3] and **Polito et al.**[11].

Preoperative pulmonary hypertension was found statistically significant in univariate analysis and with multiple logistic regression model involving preoperative risk factors but it was not found statistically significant in final logistic regression involving pre, intra and postoperative risk factors. This finding is consistent with Davis et al.[9] and **Shi et al.**[3] and inconsistent with Szekely et al.[6].

Non cardiac anomaly was not associated with PMV in the present study. This is consistent with Shi et al.[3]. However it is found an independent risk factor for PMV in[6,11]. We differ from Szekely et al.[6] in the cutoff value for PMV and from **Polito et al.**[11] in the study population as we have different RACHS levels (1-5 levels), however Polito works on complex congenital heart surgery with RACHS ≥ 3.

During cardiac surgery, both experimental and clinical studies have well documented that open heart surgery with CPB can result in systemic inflammatory response, impaired immune reaction, and organ dysfunction in children[2]. CPB time and DHCA have been reported to play a pivotal role in the duration of ventilation postoperatively[6]. Of note, this study indicates that RACHS-1 ≥ 3, a widely used risk-adjusted tool evaluating the surgical complexity and allowing meaningful comparisons of in-hospital mortality between groups of children undergoing cardiac surgery[13] is significantly and independently associated with increasing probability of prolonged postoperative MV. This is consistent with Szekely et al.[6] and **Shi et al.**[3]. The reason why only RACHS-1 with Odds ratio 8.24 and not the duration of bypass or other related variables was independently associated with PMV in this study is unclear. The small number of patients undergoing each individual procedure may account for this. However, the advanced techniques of CPB and the use of ultrafiltration in this study, to some extent, may contribute to the exclusion of CPB duration as an independent factor for PMV after operation.

Classification of RACHS < 3 and ≥ 3 is consistent with Polito et al.[11] which select complex congenital heart cases based on RACHS-1 ≥ 3 but is inconsistent with Mittnacht and Hollinger[14] who categorized RACHS ≤ 3 as frequently eligible for fast tracking and those with 4-5 score can be left to the opinion of pediatric cardiologist and intensivists to choose fast tracking or not but those with score 6 are not considered eligible for fast tracking.

As expected, a set of postoperative events were found to be associated with PMV, including, enhanced postoperative inotropic support, postoperative pulmonary hypertension, and arrhythmia. Low cardiac output syndrome was the strongest predictor for PMV found in this study, with a 63.69-fold higher likelihood of PMV than those patients without LCOS. This is Consistent with previous studies[6] in elder children, and[3] in neonates and young infants but inconsistent with Polito et al.[11]. Yet in the clinical setting, it is common and necessary to use inotropic drugs in order to maintain mean arterial BP above age-appropriate lower limit early after surgery, and to manage transient myocardial dysfunction after CPB. But the requirement of ≥ 0.1 μg/kg/min of epinephrine or ≥ 5 ng/kg/h of milrinone except for dopamine and dobutamine early after surgery and/or the need of IV inotropic support > 3 days after surgery indicate the occurrence of LCOS, which further predicted the possibility of PMV in our studied population.

A postoperative pulmonary hypertensive crisis is found to be strongly associated with prolonged mechanical ventilation with a 17.6 fold higher likelihood of PMV than those without postoperative pulmonary hypertension. It is associated with sudden onset of right ventricular failure and arterial hypotension and hypoxemia caused by an increase in pulmonary vascular resistance which cause difficult weaning from ventilator. This is consistent with previous studies[6,9] but inconsistent with Shi et al.[3] and Polito et al.[11]. As mentioned before, we differ from Shi et al.[3] and Polito et al.[11] in the study population.

Arrhythmias occur frequently in the postoperative cardiac surgical pediatric patient. Postoperative arrhythmia is found to be independent risk factor for prolonged mechanical ventilation with a 14-fold higher likelihood of PMV than those without arrhythmia. This is consistent with Szekely et al.[6] but inconsistent with Shi et al.[3] and Polito et al.[11].

Tan et al.[15] has demonstrated that the susceptibility to nosocomial pneumonia in infants after cardiac surgery correlates significantly with the complexity of cardiac surgery. Postoperative pneumonia was not found an independent risk factor for PMV in final multiple logistic regression model. This finding is consistent with Davis et al.[9] and Polito et al.[11] but

it is inconsistent with Szekely et al.[6] and with Shi et al.[3])who showed that postoperative pneumonia is an independent risk factor for PMV.

Non- infectious pulmonary complications were not associated with PMV in the final model .This is in concordance with Davis et al.[9] and Shi et al.[3] but inconsistent with Szekely et al.[6] and Polito et al.[11] .

The present study showed that the increased cumulative intake minus output per kilogram postoperatively is not associated with PMV in the final multivariate model. Likewise, Davis et al.[9], Randolph et al.[16], Szekely et al.[6] and Polito et al.[11] demonstrated that cumulative fluid intake minus output is not associated with ventilator weaning duration or extubation outcomes in children..Hoiwever our result is inconsistent with Venkataraman et al.[17] and, Shi et al.[3] who demonstrated that increased cumulative fluid intake minus output is correlated significantly an independently with PMV in young infants.

Renal failure was not associated with PMV in the present study .This is in concordance with Davis et al.[9], Shi et al.[3] and Polito et al.[11] but inconsistent with Szekely et al.[6].

In this study, failure of extubation was observed in 9.1% (10 of 110 patients) after excluding the aggressive earlier extubation in our studied population, which is similar to previously published data (range, 10 to 28%)[17]. However, EF was not an independent risk factor for PMV in final multiple logistic regression model This finding is consistent with Szekely et al.[6] and Polito et al.[11] but inconsistent with Davis et al.[9] and Shi et al.[3] who found extubation failure an independent risk factor for PMV.

Delayed sternal closure was not an independent risk factor for PMV in the present study. This is in concordance with Davis et al.[9], Shi **et al.**[3] and Polito et al.[11] but inconsistent with Szekely et al.[6] who found delayed sternal closure an independent risk factor for PMV.

Of all the variables analyzed, preoperative mechanical ventilation, RACHS-1, postoperative LCOS, postoperative pulmonary hypertension, and postoperative arrhythmia were identified as independent risk factors for PMV.

Limitations of the present study should be acknowledged. First, this study is based on a single center, local practice patterns, and a small size of cases, which might impede the application of present results to other institutions.

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Safety and Efficiency of Indomethacin in Preventing Postpericardiotomy Syndrome After Heart Valve Replacement

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Objective: **Indomethacin is an effective safe first line treatment of postpericardiotomy syndrome (PPS). The aim of this study is to prove its efficiency in preventing PPS as well; specifically in its highest period of prevalence during the first postoperative month.**

Methods: **Sixty rheumatic patients (mean age 36.9 ± 11.1 years, 69.6% females) scheduled for heart valve replacement were equally randomized to receive either indomethacin 200 mg/day or placebo, starting one day before surgery till the 10th postoperative day . Two cases were excluded from each group (6.7%), for causes unrelated to therapy. Follow-up was completed for the other 56 patients.**

Results: **Patients' demographics were comparable in the 2 groups. At one month, 10 patients developed PPS (17.9%); 90% being recorded during the first postoperative week. The rates of PPS were: 7.1% in indomethacin group and 28.6% in control group (P=0.036); with relative risk reduction of 75.2% (CI at 95%; 58.5 to 98.5%) and number needed to treat (NNT) of 5. At 10 days, PPS-free cumulative probability rates were: 92.9 ± 25.9% in indomethacin group and 70.5 ± 46.6% in the control group, with curves remaining parallel afterwards (P = 0.033). The use of indomethacin was associated with higher prevalence of drug-related side effects (P =.016), especially epigastric pain (P = 0.02), without serious complications or cases of drug intolerance.**

Conclusions: **This is the first randomised study to prove the safety and efficacy of Indomethacin in decreasing PPS rates postoperatively. However, the study is small and has to be followed by larger ones.**

Keywords: **Indomethacin, NSAID, postpericardiotomy syndrome, prophylaxis, heart valve replacement, clinical trial**

Postpericardiotomy syndrome (PPS) is a well-known complication of open heart surgery 1,16 that usually responds to empirical medical therapy by NSAID 6, colchicine 5 and corticosteroids 8. Up to date, only colchicine has recently proved a prophylactic role in adult patients undergoing coronary artery bypass grafting or valvular surgery 5,7. The aim of this study was to evaluate the safety and efficiency of the NSAID indomethacin in preventing PPS, among the relatively young rheumatic population undergoing heart valve replacement.

Patients and Methods

A prospective randomised placebo controlled study was conducted at Ain-Shams University Hospitals to evaluate the safety and efficacy of indomethacin in preventing of PPS among our rheumatic patients undergoing heart valve replacement with a mechanical prosthesis. Our inclusion criteria were young patients between 18 and 40 years of age, of both sexes, scheduled for elective mitral and/or aortic valve replacement, with or without tricuspid valve repair and accepting to participate in the study by signing an informed consent. Our exclusion criteria included: redo cases, patients with recent (≤2 months) endocarditis or rheumatic activity, as well as those patients with indomethacin related non-legibility conditions namely; known hypersensitivity, impaired hepatic or kidney function (≥2 normal serum transaminase or

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serum creatinine), history of gastritis, pregnancy and lactation.

The primary outcome was the occurrence of PPS during the first postoperative month, as diagnosed by the presence of 2 out of the following 5 criteria: fever lasting beyond the 1st postoperative week in absence of signs of systemic or focal infection, pleuritic chest pain, friction rub, radiologic evidence of pericardial or pleural involvement and echocardiographic evidence of a new pericardial effusion. Secondary outcomes included cardiac temponade needing evacuation and PPS related rehospitalisation for any cause, at one month.

The study plan was to randomise 60 legible patients into 2 equal groups: group 1 receiving 200 mg indomethacin, given orally in 2 divided doses for 10 days, starting one day before surgery and group 2 patients receiving placebo for the same duration. Unless contraindicated, our young rheumatic population usually receive a mechanical prosthesis and hence, they are all anticoagulated to target an INR level between 2.5 and 3.5. In this study, patients were planned to be withdrawn in the case where their INR reaches ≥4 or whenever they become intolerant to indomethacin side effects: nausea, vomiting, epigastric pain, headache, and dizziness; as assessed through questionnaire. Routine postoperative investigations included daily INR control and a panel formed of complete blood picture, blood sugar levels, hepatic and renal function tests as well as chest x-ray on the 3rd postoperative day. This panel was repeated -together with complete echocardiographic study- on the 7th postoperative day and at 1 month after surgery. Regardless of their study group, patients developing PPS were planned to be treated with a higher dose of indomethacin (300 mg/day). Pleural or pericardial effusion, cardiac temponade and indomethacin related side effects were planned to be treated as indicated.

Statistical analysis

Data were presented as mean ± SD or numbers (%). Categorical variables were compared by the Chi-Square or Fisher's exact test, as indicated. Means were compared by Student's test and continuous data were correlated with Spearman's test. The cumulative probability of PPS – free rate was calculated by the Kaplan-Meier method and factor group was evaluated by the Log Rank test. A P value ≤ 0.05 was considered statistically significant. Statistical analysis was performed by PASW statistics software package version 18, serial number 10146966.

Results

Four patients (6.6%) were excluded from the study: 2 patients in indomethacin group who showed an INR>4 since the second postoperative day and 2 patients from the control group who decided not to continue the study. The remaining 56 patients were followed up for one month after surgery. The mean age of the patients was 36.9 ± 11.1 years, 69.6% were females and the operative indications were mitral (51.8%), aortic (30.4%) or both: mitral and aortic heart valve replacement (17.8%). Table 1 shows the distribution of age, sex and operations performed; with no statistically significant difference between compared groups.

At one month, the overall rate of PPS was 17.9% and the frequency of PPS was significantly reduced with the use of indomethacin (28.6% in indomethacin group versus 7.1% in control group; P=0.036); with a relative risk reduction (RRR) of 75.2% (CI at 95% 58.5 to 98.5%) and a number needed to treat (NNT) of 4.67. Diagnosis of PPS was mainly made by the detection of pericardial effusion in all patients. The size of effusion varied from 1.5 - 3.5 cm; with a mean value of 2.75 ± 0.71 cm. Other PPS diagnostic criteria were: pleural effusion or unexplained persistence of fever beyond the first postoperative week in 80% of patients, pleuritic chest pain in 40% and pericardial rub in 33.3% of patients. With the exception of significantly lower rate of pericardial effusion (P=0.036), other PPS diagnostic criteria were less prevalent -but not statistically significant- among patients receiving indomethacin group, compared to those receiving placebo.

Figure 1 shows the distribution of PPS over time. The majority of patients (90%) developed PPS during the first postoperative week, with a mean PPS free rate of 25.5 ± 9.7 days (confidence interval at 95%: 35.2 to 15.8). At one month, the cumulative probability of being free from PPS was 81.8 ± 38.9%: 92.9 ± 25.9% in indomethacin group and 70.5 ± 46.6% in control group; P = 0.033. Interestingly, time to PPS positively correlated with the size of pericardial effusion (r=0.67; P = 0.034).

Drug related side effects included: nausea in 27 patients (48.2%), vomiting in 11 (19.6%), epigastric pain in 12 (21.4%), headache in 16 (28.6%) and dizziness in 27 patients (48.2%). As shown in Table 1, the prevalence of developing a drug related side effect (P =.016), suffering from epigastric pain (P = 0.02), showing higher INR levels (P = 0.03) and staying for longer period in hospital (P = non-significant) were more marked in patients on indomethacin prophylaxis, compared to those receiving placebo. We had no mortalities and only 2 serious PPS related complications were reported in this series. The first was a case of cardiac temponade (3.6%) in the control group that necessitated urgent sub-xiphoid surgical drainage on the 9th postoperative day. Another PPS patient in the indomethacin group was prematurely discharged and needed re-hospitalisation on the 12th day for continuation of medical treatment by indomethacin 300 mg twice daily.

Discussion

Postpericardiotomy syndrome (PPS) develops within days to months after cardiac, pericardial injury or both 10,20. Among the many hypotheses suggested, an autoimmune aetiology is the most accepted; where the damaged pericardium, tissues or

	Indomethacin group (28 patients)	Placebo group (28 patients)	P value*
1) Age (years)	35.54±9.636	38.39±12.503	0.343
2) Female sex	22(78.6%)	17(60.7%)	0.146
3) Type of surgery:			
-Aortic valve replacement	9 (32.1%)	8 (28.6%)	
-Mitral valve replacement	14 (50%)	15 (53.6%)	
-Aortic and mitral valve replacement	5 (17.9%)	5 (17.9%)	0.954
4) Frequency of PPS at 1 month	2 (7.1%)	8 (28.6%)	0.036
5) Prevalence of diagnostic criteria of PPS:			
- unexplained fever beyond 1st week	2 (7.1%)	6 (21.3%)	Ns.
- pericardial rub	1 (3.6%)	2 (7.1%)	Ns.
- pleuritic chest pain	1 (3.6%)	3 (10.7%)	Ns.
- pleural effusion	3 (10.7%)	6 (21.3%)	Ns.
- pericardial effusion	2 (7.1%)	8 (28.6%)	0.036.
6) Drug related side effects:			
-nausea	16 (57.1%)	11 (39.3%)	Ns.
-vomiting	5 (17.9%)	6 (21.4%)	Ns.
-headache	7 (25%)	9 (32.1%)	Ns.
-dizziness	16 (57.1%)	11 (39.3%)	Ns.
-epigastric pain	10 (35.7%)	2 (7.1%)	0.02
-absence of side effects	3 (10.71%)	11(39.3%)	0.016
7) Anticoagulation: Mean INR	1.93 + 0.62	1.62 + 0.61	0.03
8) Hospital stay (days)	9.6 + 3.4	12.1 + 6.1	Ns.

*Values are presented as mean ± SD or numbers (%), PPS = post pericardiotomy syndrome, * = Chi-Square test, Fisher's exact test or unpaired Student's test, as indicated.*

Table 1. Comparison of indomethacin and control groups

blood within the pericardial cavity are supposed to produce autoantibodies against the pericardial tissue and thus induce pericarditis 11,13. This concept was challenged by studies in which immunosuppression failed to supress PPS 2 and hence, the exact underlying mechanism is still unclear. Consequently, treatment is arbitrary with a variety of drugs starting from the usually recommended NSAID 1,12,6,15,2o to a second line treatment with colchicine 5 or corticosteroids 1,8 and up to the rare use of immunomodulating agents 16 or high-dose human immunoglobulin 9

Throwing more shadows, and on the clinical level, PPS is more than a single disease and can be thought off as a syndrome with different expressions of pleural and/or pericardial involvement and a wide spectrum of clinical severity ranging from mild isolated asymptomatic effusions to cardiac temponade and/or massive pleural effusions 5. Concordantly, the spectrum of prognosis also widens from being benign and self-limited, to symptomatic patients responding to drug therapy, 1,12,6,20,5,16,8; to complicated cases showing:

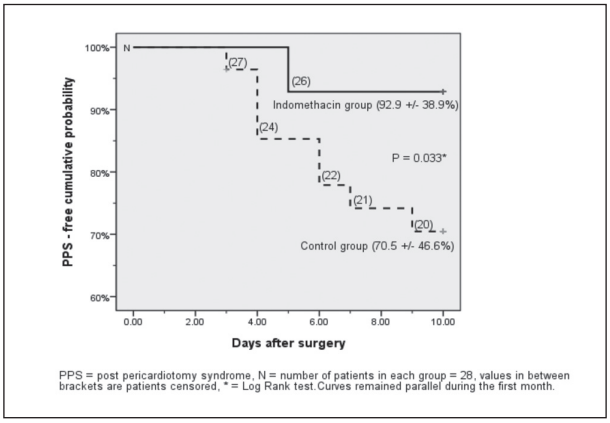

Fig 1. PPS-free cumulative probability after heart vavle replacement (Kaplan-Meier method.

multiple recurrences 4, resistance to treatment 5,14 cardiac temponade 17 and rarely constrictive pericarditis 11,19.

A main cause of such variability is authors adopting different combinations of criteria to diagnose a single disease; which explains the wide range of reported incidence of 10-40% 22,12,11,5,21. In order to minimize the subjectivity of diagnosis and for purposes of the analysis, we diagnosed PPS whenever 2 out of 5 criteria were met namely; unexplained persisting low grade fever, pleuritic chest pain, pericardial rub or radiological evidence of pleural or pericardial effusion 3,5. Table 2 shows 5 recent studies conducted to test a possible prophylactic role for drugs that proved efficient in treating PPS. With the exception of the study conducted by Gill and colleagues, the other prospective randomised studies showed a narrow overall range of PPS (15-17.9%), compared to the usually reported. In our study, as well as those studies adopting the same diagnostic rule 3,5. the incidence of PPS among control groups showed an also narrow range of variability of 21.9-28.3%. The relatively lower rate (15%) reported by Mott and coll. can be explained by those authors tightening their rules by necessitating the presence of at least 4 criteria to establish the diagnosis 2 (Table 2). The much lower incidence (2.8%) reported by Gill and colleagues reflects the facts that their study was retrospective, conducted over a long 20- years period -during which many patients did not benefit from echocardiographic control- and omitted the usually common postoperative pericardial effusion from their diagnostic criteria 4.

It is widely accepted that PPS mainly manifests during the first postoperative month. As shown in Table 2, the rates of PPS in controls were comparable, despite the significantly different follow-up durations of the prospective studies (1 month to 1 year), different patients' demographics and operative indications as well. More specifically, Imazio and colleagues have shown that 85% of their cases manifested during the first month; with 74% out of them being in the first 10 postoperative days 5. Mott and colleagues have shown that 72% of the cases manifested before 27 days 2; with a median of 7 days and Gill and colleagues showed a median of only 5 days 4. In concordance, 90% of our cases manifested as early as the first postoperative week. As being pointed to by others 5, Figure 1 shows this characteristic decrescendo pattern, regardless whether the patient was on indomethacin prophylaxis or not.

Although the efficiency of indomethacin in treating PPS is widely accepted 12,6,20, yet it is important to consider its side effects; especially when used for prevention. In addition to the well-known side effects of NSAID (gastrointestinal upset or bleeding, renal effects, platelet inhibition, etc…), it was suggested that indomethacin may not be suitable for patients with coronary artery disease due to its vasoconstrictor effect 20,16. Our study showed significantly more drug related side effects among indomethacin group, especially epigastric pain. On the other hand, the short 10-days course was not associated with renal or bleeding complications and none of our patients discontinued treatment for drug intolerance. View our young rheumatic population, we cannot comment on the suggested indomethacin induced coronary vasoconstrictive effect; especially that those side effects were not recorded in other studies that included patients with ischemic heart disease 12,6. Similarly, the clinical importance of indomethacin affecting prostaglandin synthesis by platelets appears to be doubtful from the standpoint of bleeding complications following its short-term use 12). In agreement, we did not note indomethacin-related bleeding episodes and our only reported case of haemorrhagic pericardial temponade was recorded among the control group. Unexplained, and unlike what was noted by others 12, the mean INR of our patients on indomethacin was significantly higher than that of recorded for their controls.

Up to date, only colchicine has recently proved its efficiency in decreasing: the rate of PPS, 4 out of the adopted 5 diagnostic criteria (with the exception of fever), as well as a combined rate of: disease-related re-hospitalization, cardiac temponade, constrictive pericarditis, and relapses 5. As shown in Table 2, neither salicylates nor corticosteroids have succeeded to show comparable prophylactic effect 2,4. In addition, the use of acetyl salicylic acid was associated with significantly more incidences of pericardial and pleural effusions 4 and the use of short-term methyl prednisolone was associated with significantly more overall PPS related complications (drug related hospital re admission, recurrence and pleural or pericardial effusions) 2; compared to their controls.

To our knowledge, our study is the second to show a safe and effective prophylactic effect of a pharmacological agent for preventing PPS. In comparison to colchicine, the use of indomethacin was associated with a relative risk reduction (RRR) as much as 75.2% (CI at 95%; 58.5 to 98.5%) and a number needed treat (NNT) of 5; compared to RRR of 57.9% (CI at 95%; 27.3–75.6) and NNT of 8 5. Although the use of indomethacin was associated with reduction of the 5 diagnostic criteria of PPS, yet our small number of patients did not permit reaching statistical significance, with the exception of a usually abundant pericardial effusion. Both drugs appear to be safe however, the rate of (non-serious) drug-related side effects were more noted with indomethacin (89.3% vs. 8.9%), while drug-related withdrawal was only recorded in patients receiving colchicine (Table 2). Lastly, Imazio and coll. have demonstrated that PPS-free curves of colchicine and treatment groups remained parallel for one year. In addition, the authors did not report the timing of their secondary end-points; which questions the true value of the much more long follow-up duration (Imazio 2010), compared to our study.

In conclusion

The rate of PPS appears to be largely dependent upon the diagnostic criteria, more than being related to patients' demographic or follow-up duration. Time to PPS is mainly within one month after surgery and the majority of which are

manifested as early as the first week. Although indomethacin-related side effects are numerous and mostly gastrointestinal, yet they appear to be well tolerated; which invites for larger studies and possible extension to other patients' groups.

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Restrictive Mitral Annuloplasty In Mild To Moderate Chronic Ischemic Mitral Regurgitation

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Background: **A number of surgical techniques have been developed for surgical correction of CIMR, these modalities remains debatable. The aim of this study is to compare restrictive mitral annuloplasty with coronary artery bypass graft (CABG) alone in mild and moderate CIMR in the Egyptian population.**

Materials and methods: **47 patients with ischemic heart disease (IHD) and mild to moderate mitral regurge were operated upon in the period between January 2008 and August 2010.The patients were divided into 2 groups: group 1 underwent CABG and constrictive annuloplasty of the mitral ring and group 2 benefited from CABG alone. The predominant criteria were male sex (93.6%), hypercholesterolemia (91.5%), diabetes mellitus (80.9%) and NYHA class III (87.2%). More than 40% had MI and/or were in need of diuretic therapy.**

Results: **Compared to group 2, a smaller percentage of group 1 patients were on positive inotropic support (P=0.018), had better clinical improvement (NYHA class; P= 0.001), had shorter ICU (P=0.086) and hospital stays (P=0.001). Group 1 patients showed a more decrease in LVEDD (P=0.1) and LVESD (P=0.042), as well as a better improvement in the LVEF% (P=0.057); compared to group 2 patients. The means of the differences of NYHA functional classes showed significant postoperative improvement in all patients (P=0.001) as well as in group 1 when compared to group 2 patients (P=0.001).**

Conclusion: **Restrictive MVA and CABG can provide good results in selected patients without severe dilatation and tethering with no negative impact on the morbidity or mortality.**

Key words: **Ischemic regurgitation; Restrictive annuloplasty**

CIMR is a controversial and complex aspect in the management of ischaemic heart disease. CIMR is common and occurs in 10% to 20% of patients with CAD and in 20—25% of patients who had previous myocardial infarction (MI), also 50% of patients who suffers post-infarction congestive heart failure (CHF) have associated CIMR. (1, 2, 3, 4) The exact frequency with which CIMR is detected, largely depends on the modality used to look for its presence and the timing with respect to the acute MI. ([5]) The mechanism of CIMR involves incomplete mitral leaflet coaptation which is a consequence of the annular dilatation secondary to left ventricular (LV) enlargement, and local LV remodeling with papillary muscle displacement, leading to restricted leaflet motion with apical tethering and tenting of the mitral leaflets. ([6])

CIMR have negative impact on prognosis in patients CAD. Hickey et al. demonstrated 1-year mortality for severe CIMR of 40%, for moderate CIMR of 17%, for mild CIMR of 10% and for patients without CIMR of 6% ([7]). The SAVE (Survival and Ventricular Enlargement) study demonstrated that mild CIMR increases the risk of cardiovascular mortality (29% vs 12%, $p < 0.001$) (3).

Despite the high prevalence of CIMR, few patients are referred for cardiac surgery and surgery is denied in a sector of them due to poor targets. The result is that no surgical center has a large experience with these complex patients. ([8])

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Although severe CIMR requires surgical correction associated with CABG surgery, surgical treatment of mild to moderate CIMR is still controversial, advocates of surgical intervention, argue that studies showed that CIMR persists in 40—60% of patients early after CABG alone and this is associated with decreased long term survival. (9, 10, 11) However other studies to confirm a survival benefit of a combined procedure in mild or moderate CIMR failed to establish a definite advantage on survival. ([12, 13, 14]) A number of surgical techniques have been developed for surgical correction of CIMR, these modalities remains also debatable.

The aim of this study is to compare restrictive mitral annuloplasty with CABG alone in mild and moderate CIMR in the Egyptian population in the light of the current practice of this complex pathology.

Material and methods

The material of this non-randomized study consisted of 47 patients with ischemic heart disease and mild to moderate mitral regurge who were operated upon at Ain-Shams University hospital (12 patients), Ain shams Specialized hospital (4 patients), Nasser Institute (24 patients) and Dar Elfouad Hospital (7 patients) in the period between January 2008 and August 2010.The patients were divided into 2 groups: group 1 who underwent coronary artery bypass grafting (CABG) and constrictive annuloplasty of the mitral ring and group 2 patients who benefited from CABG alone.

Patients were selected from those referred to the outpatient clinic for first time elective CABG: out of 2400 patients, 47 met our selection criteria: age between 35 and 65 years, both sexes, with mild to moderate mitral regurge, with or without controlled diabetes, systemic hypertension and accepting to participate to the study. Patients excluded from the study were those with unstable angina, recent MI within the last 8 weeks, having other cardiac lesions or hemodynamically significant / symptomatic peripheral vascular diseases.

Patients were operated upon under cardiopulmonary bypass (CPB), moderate hypothermia (30 °c) and cold enriched blood cardioplegia, given every 30 minutes. After implanting the left internal mammary (LIMA) on the left anterior descending artery (LAD), the former was clamped and a classical left atriotomy was performed. Mitral annuloplasty ring (Carpentier-Edwards Classic) (Edwards Life sciences, Irvine, Calif.) was secured with interrupted sutures buttressed with Teflon pledgets over the anterior mitral leaflet. LIMA was declamped and the ring was secured over the posterior mitral leaflet. Valve competence was visually tested on the beating heart before closure of the left atrium and by TEE after coming off bypass. The rest of operation was completed classically. The results of repair were judged postoperatively two weeks & 6 months after discharge trans-thoracic echo.

Table 1 shows the demographic criteria of the 47 patients who were included in this study. The predominant criteria were male sex (93.6%), hypercholesterolemia (91.5%), diabetes mellitus (80.9%), clinical presentation in New York heart association (NYHA) class III (41 patients; 87.2%), systemic hypertension and history of cigarette smoking (74.5%). More than 40% had a previous myocardial infarction and/or were in need of diuretic therapy. In the majority of patients, preoperative echocardiographic measurements showed an overall enlarged left ventricle, diastolic dysfunction and moderately impaired EF. Coronary angiography showed a predominance of 3-vessel disease (27 patients; 57.4%), and to a less extent 2 -vessel disease (18 patients; 38.3%), with only 5 patients (10.6%) showing a hemodynamically significant left main lesion.

Statistical Analysis

Statistical analysis was done using PASW Statistics version 18.0.2, serial number 10146966. Data were presented as mean (±SD) or numbers (%).The distribution of categorical variables among patient groups was analyzed by Chi-Square test or Fisher's exact test, as indicated. Postoperative echocardiographic measurements were subtracted from the preoperative values and the means of the differences were calculated and compared. Means were compared with the unpaired or paired Student's test, as indicated. Statistically significant variables on univariate analysis were introduced in a multivariate model to test the statistical significance of main group effect, effect of other variables and possible interactions. P values of 0.05 or less were considered as being statistically significant.

Results

Demographic, preoperative clinical and echocardiographic criteria were compared between both groups in Table 1. Group 1 patients included all 5 patients with significant left main disease (P=0.027). In the same group, echocardiographic measurements showed a significantly more impaired left ventricle as evident by lower EF% (P=0.025) and larger LVESD (P=0.028), a significantly more impaired right ventricle function as evident by a higher pulmonary artery pressure (P=0.001) and a significantly higher percentage of cases presenting with moderate mitral regurge (P=0.008); compared to group 2 patients. Despite a significantly higher incidence of hypercholesterolemia (P=0.027) in the latter group, those patients were less compliant to aspirin therapy (P=0.001). As shown in Table 1, the repartition of the other selected variables between both groups was statistically non-significant.

Table 2 shows the comparison of operative and postoperative selected variables in both groups. In addition to mitral annuloplasty, Group 1 patients benefited from significantly more complete revascularization (P=0.001), on the expense of significantly longer ACC and CPB times (P=0.001). A 28

Variables	All patients	Group 1	Group 2	P value*
Number of patients	47	20 (42.6%)	27 (57.4%)	-
Age (mean ± SD) (y)	54.5 ± 6.6	55.4 ± 7.1	53.8 ± 6.2	Ns.
Female Sex	3 (6.4%)	0	3 (11.1%)	Ns.
History of smoking	35 (74.5%)	16 (80%)	19 (70.4%)	Ns.
Diabetes mellitus	38 (80.9%)	15 (75%)	23 (85.2%)	Ns.
Hypertension	35 (74.5%)	17 (85%)	18 (66.6%)	Ns.
Family history of IHD	5 (10.6%)	2 (10%)	3 (11.1%)	Ns.
PCI	8 (17%)	4 (20%)	4 (14.8%)	Ns.
MI	22 (46.8%)	6 (30%)	16 (59.2%)	Ns.
Need for diuretics	19 (40.4%)	10 (50%)	9 (33.3%)	Ns.
LA (mean ± SD) (cm)	4.5 ± 0.28	4.6 ± 0.38	4.5 ± 0.2	Ns.
LVEDD (mean ± SD) (cm)	6.5 ± 0.76	6.7 ± 0.84	6.4 ± 0.68	Ns.
LVESD (mean ± SD) (cm)	5 ± 0.98	5.3 ± 0.99	4.7 ± 0.9	0.028
LV EF (mean ± SD) (%)	44 ± 8.1	40.9 ± 8.2	46.3 ± 7.5	0.025
PAP (mean ± SD) (mm Hg)	45.4 ± 12.2	53.4 ± 12.8	40.1 ± 10.7	0.001
NYHA class (mean ± SD)	2.96 ± 0.36	2.85 ± 0.37	3 ± 0.34	Ns.
Targets on angiography (mean ± SD)	2.6 ± 0.58	2.7 ± 4.7	2.5 ± 0.6	Ns
LMD	5 (10.6%)	5 (25%)	-	0.027
Mitral regurge:-				
mild	43 (91.5%)	16 (80%)	27 (100%)	0.008
moderate	4 (8.5%)	4 (20%)	-	

*Values are presented as n (%) or mean ± SD. Group 1 =patients benefiting from mitral valve repair with CABG, group 2 = patients benefiting from CABG alone, *= Chi-Square test, Fisher's exact test and Student's test; as indicated. Ns. = non-significant. IHD = ischemic heart disease, PCI = percutaneous intervention, MI =myocardial infarction, LA = left atrium, LVEDD = left ventricular end-diastolic dimension, LVESD = left ventricular end-systolic dimension, LV EF% = left ventricular ejection fraction %, PAP = pulmonary artery pressure, NYHA = New York Heart Association, LMD = left main disease.*

Table 1. Comparison of preoperative variables:

mm mitral annuloplasty ring was chosen in 16 cases (80%), a 26 mm ring in 3 (15%) and a size 32 ring in only 1 case (5%); with a mean ring size of 27.9 ± 1.21 mm. One patient in group 1 had a left ventricular aneurysm (LVEDD = 8.7 cm, LVESD of 7.5 cm and EF =30%) and benefited from left ventricular aneurysmectomy, in addition to 3 coronary bypass grafts and repair of a mild to moderate mitral regurge with an annuloplasty ring (size 28 mm). His ACC and bypass times were 150 and 200 minutes; respectively and his postoperative course was uneventful.

Compared to group 2, a smaller percentage of group 1 patients were on positive inotropic support (P=0.018) and in overall those patients showed better clinical improvement (NYHA class; P= 0.001) and had shorter ICU (P=0.086, non-significant) and hospital stays (P=0.001). As shown in Table 2, the comparisons of the rest of table 1 selected variables were statistically non-significantly different between the 2 groups (P>0.05).

Variables	All patients	Group 1	Group 2	P value*
Number of patients	47	20 (42.6%)	27 (57.4%)	-
Number of grafts (mean ± SD)	2.1± 1	3± 0.79	1.6± 0.64	0.001
ACC time (mean ± SD) (min)	78.8 ± 30.5	108.6 ± 20.3	56.7 ± 12.4	0.001
CPB time (mean ± SD) (min)	107.1 ± 36.1	141.5 ± 25.5	81.7 ± 15.8	0.001
Mechanical ventilation (mean ± SD) (hr)	28.7 ± 45.3	22.2 ± 18.3	32.7 ± 57.2	Ns.
Need of inotropes	19 (40.4%)	4 (20%)	15 (55.5%)	0.018
Postoperative bleeding	10 (21.3%)	5 (25%)	5 (18.5%)	Ns.
Arrhythmia	9 (19.1%)	4 (20%)	5 (18.5%)	Ns.
Renal dysfunction	10 (21.3%)	3 (15%)	7 (25.9%)	Ns.
Respiratory complications	10 (21.3%)	3 (15%)	7 (25.9%)	Ns.
Delayed recovery	4 (8.5%)	2 (20%)	2 (7.4%)	Ns.
Postoperative infection	7 (14.9%)	4 (20%)	3 (11.1%)	Ns.
ARDS	3 (6.4%)	2 (10%)	1 (3.7%)	Ns.
Uneventful recovery	20 (42.6%)	9 (45%)	11 (40.7%)	Ns.
ICU stay (mean ± SD) (hr)	48.7 ± 45.6	35.4 ± 21.5	58.5 ± 55.7	Ns. (0.086)
Hospital stay (mean ± SD) (d)	10.3 ± 3.1	8.1 ± 1.3	11.93 ± 3.1	0.001
Hospital mortality	3 (6.4%)	2 (10%)	1 (3.7%)	Ns.
NYHA class (mean ± SD)	2 ± 0.7	1.45 ± 0.5	2.41 ± 0.5	0.001
LVEDD (mean ± SD) (cm)	6.2 ± 0.7	6.3 ± 0.8	6.2 ± 0.6	Ns.
LVESD (mean ± SD) (cm)	4.7 ± 0.9	4.8 ± 0.9	4.6 ± 0.9	Ns.
LVEF (mean ± SD) (%)	44.3 ± 7.8	43.8 ± 7.5	44.6 ± 8.1	Ns.

*Values are presented as n (%) or mean + SD. Group 1 =patients benefiting from mitral valve repair with CABG, group 2 = patients benefiting from CABG alone, *= Chi-Square test, Fisher's exact test and Student's test; as indicated. Ns. = non-significant. IHD = ischemic heart disease, PCI = percutaneous intervention, MI =myocardial infarction, LA = left atrium, LVEDD = left ventricular end-diastolic dimension, LVESD = left ventricular end-systolic dimension, LV EF% = left ventricular ejection fraction %, PAP = pulmonary artery pressure, NYHA = New York Heart Association.*

Table 2: Comparison of operative and postoperative variables:

Echocardiography was repeated before patient discharge and showed no residual mitral regurge in group 1 and the same preoperative degree of regurge in group 2 patients. As there was a statistically significant difference between preoperative echocardiographic measurements of both groups (Table 1), we have estimated any possible post surgical difference by subtracting the postoperative from the preoperative echocardiographic measurements, calculated for each patient. Table 3 shows the means of those differences (±SD) and collectively both groups of patients have shown a statistically significant decrease in both: LVEDD and LVESD (P=0.001) and a statistically significant improvement in LVEF% (P=0.001). However, Group 1 patients showed a more decrease in LVEDD (Figure 1; P=0.1) and LVESD (Figure 2; P=0.042), as well as a better improvement in the LVEF% (Figure 3; P=0.057); compared to group 2 patients. In the same table, the means of the differences of NYHA functional classes showed significant postoperative improvement in all patients (P=0.001) as well as in group 1 when compared to group 2 patients (Figure 4; P=0.001).

Variables	All patients	P value*	Group 1	Group 2	P value*
Number of patients	47	-	19 (42.6%)	27 (57.4%)	-
NYHA class (mean ± SD)	0.96 ± 0.6	0.001	1.4 + 0.5	0.6 + 0.5	0.001
LVEDD (mean ± SD) (cm)	-0.26 ± 0.4	0.001	-0.37 ± 0.4	-0.18 + 0.38	Ns. (0.1)
LVESD (mean ± SD) (cm)	-0.31 ± 0.54	0.001	-051± 0.59	-0.167 + 0.46	0.042
LV EF (mean ± SD) %	0.15 ± 7.6	Ns.	2.7 ± 6.1	-1.6 ± 8.1	Ns. (0.057)

*Values are presented as means of the differences between the pre and postoperative measurement calculated for each patient ± SD,. Group 1 =patients benefiting from mitral valve repair with CABG, group 2 = patients benefiting from CABG alone, *= Paired Student's test, Ns. = non-significant. LVEDD = left ventricular end-diastolic dimension, LVESD = left ventricular end-systolic dimension, LV EF% = left ventricular ejection fraction %.*

Table 3: Difference between preoperatively and postoperatively measured variables as calculated per patients' groups:

Preoperative Variables	Mortalities	Survivors	P value*
Number of patients	3 (6.4%)	44 (93.6%)	-
Age (mean ± SD) (y)	60.3 ± 8.7	54.1 ± 6.3	Ns.
Female Sex	0	3 (6.8%)	Ns.
History of smoking	3 (100%)	32 (72.7%)	Ns.
Diabetes mellitus	3 (100%)	35 (79.5%)	Ns.
Hypertension	3 (100%)	32 (72.7%)	Ns.
Hypercholesterolemia	2 (66.6%)	41 (93.2%)	Ns.
Family history of IHD	0	5 (11.4%)	Ns.
PCI	0	8 (18.2%)	Ns.
MI	0	22 (50%)	Ns.
Intake of Aspirin	2 (66.6%)	29 (65.9%)	Ns.
Need for diuretics	2 (66.6%)	17 (38.6%)	Ns.
LA (mean ± SD) (cm)	4.6	4.5 ± 2.9	Ns.
LVEDD (mean ± SD) (cm)	6.6 ± 0.34	6.5 ± 0.78	Ns.
LVESD (mean ± SD) (cm)	5.4 ± 0.4	4.9 ± 1	Ns.
LV EF (mean ± SD) (%)	39.3 ± 4	44.3 ± 8.3	Ns.
PAP (mean ± SD) (mm Hg)	53.4 ± 12.8	40.1 ± 10.7	0.03
NYHA functional class	3	2.9 ± 0.37	Ns.
Targets on angiography (mean ± SD)	2.3 ± 5.8	2.6 ± 0.58	Ns
LMD	0	5 (11.4%)	Ns.
Mitral regurge:- mild moderate	 3 (100%) -	 40 (90.9%) 4 (9.1%)	Ns.

*Values are presented as n (%) or mean ± SD. Group 1 =patients benefiting from mitral valve repair with CABG, group 2 = patients benefiting from CABG alone, *= Chi-Square test, Fisher's exact test and Student's test; as indicated. Ns. = non-significant. IHD = ischemic heart disease, PCI = percutaneous intervention, MI =myocardial infarction, LA = left atrium, LVEDD = left ventricular end-diastolic dimension, LVESD = left ventricular end-systolic dimension, LV EF% = left ventricular ejection fraction %, PAP = pulmonary artery pressure, NYHA = New York Heart Association, LMD = left main disease*

Table 4. Preoperative variables related to Hospital Mortalities

Operative and postoperative Variables	Mortalities	Survivors	P value*
Number of patients	3 (6.4%)	44 (93.6%)	-
Group 1 (20 patients)	2 (66.6%)	18 (40.9%)	Ns.
Number of grafts(mean ± SD)	2.3 ± 0.58	2.6 ± 0.57	Ns
ACC time (mean ± SD) (minutes)	97.3 ± 35.7	77.5 ± 30.2	Ns.
CPB time (mean ± SD) (minutes)	123.7 ± 45.8	106.03 ± 35.7	Ns.
Duration of mechanical ventilation (hrs.)	128 ± 167.8	21.4 ± 12.9	0.001
Need of inotropes	3 (100%)	16 (36.4%)	0.06
Postoperative bleeding	2 (66.6%)	8 (18.2%)	Ns.
Arrhythmia	2 (66.6%)	7 (15.9%)	Ns. (0.09)
Renal dysfunction	3 (100%)	7 (15.9%)	0.01
Respiratory complications	3 (100%)	7 (15.9%)	0.007
Delayed recovery	2 (66.6%)	2 (4.5%)	0.016
Postoperative infection	0	7 (15.9%)	Ns.
ARDS	3 (100%)	0	0.001
Uneventful recovery	0	20 (45.4%)	Ns.
ICU stay (hrs.)	136 ± 161	42.7 ± 21	0.001
Hospital stay (mean ± SD) (d)	10.7 ± 2.9	10.3 ± 3.2	Ns.
LVEDD (mean ± SD) (cm)	6.1 ± 0.6	6.3 ± 0.7	Ns.
LVESD (mean ± SD) (cm)	4.8 ± 1	4.7 ± 0.9	Ns.
LV EF (mean ± SD) (%)	39.3 ± 7	44.6 ± 7.9	Ns.

*Values are presented as n (%) or mean ± SD. Group 1 =patients benefiting from mitral valve repair with CABG, group 2 = patients benefiting from CABG alone, *= Chi-Square test, Fisher's exact test and Student's test; as indicated. Ns. = non-significant. IHD = ischemic heart disease, PCI = percutaneous intervention, MI =myocardial infarction, LA = left atrium, LVEDD = left ventricular end-diastolic dimension, LVESD = left ventricular end-systolic dimension, LV EF% = left ventricular ejection fraction %, PAP = pulmonary artery pressure, NYHA = New York Heart Association, LMD = left main disease*

Table 5. Operative and postoperative variables related to Hospital Mortalities

Variables	Mortalities	Survivors	P value*
Number of patients	3 (6.4%)	44 (93.7%)	-
LVEDD (mean ± SD) (cm)	-0.5 ± 0.5	-0.24 + 0.39	Ns.
LVESD (mean ± SD) (cm)	-0.27± 1.2	-0.31 + 0.5	Ns.
LV EF (mean ± SD) (%)	0 ± 7.8	0.16 ± 7.7	Ns.

*Values are presented as means of the differences between the pre and postoperative measurement calculated for each patient (± SD). *= Paired Student's test, Ns. = non-significant. LVEDD = left ventricular end-diastolic dimension, LVESD = left ventricular end-systolic dimension, LV EF% = left ventricular ejection fraction %.*

Table 6. Difference between pre and postoperative echocardiographic measurements calculated for hospital mortalities and survivors

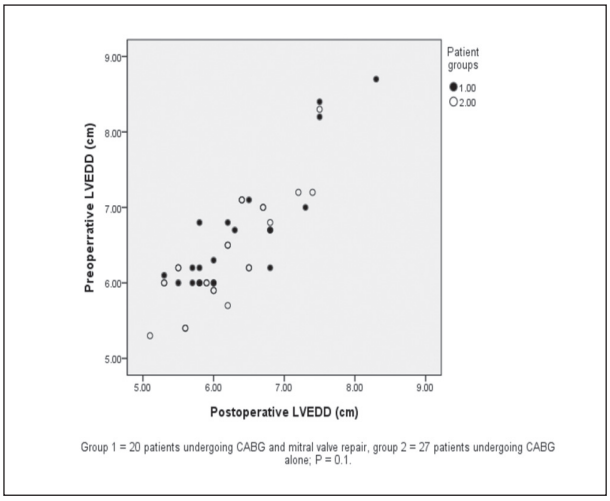

Fig 1. Change in left ventricular end-diastolic dimension (LVEDD %)

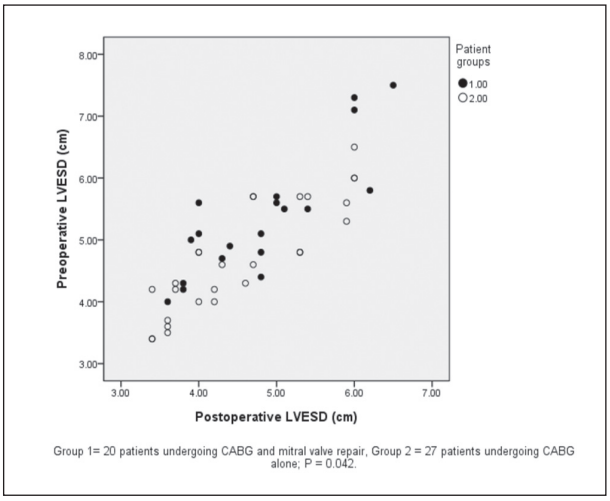

Fig 2. Change in left ventricular end-systolic dimension (LVESD %)

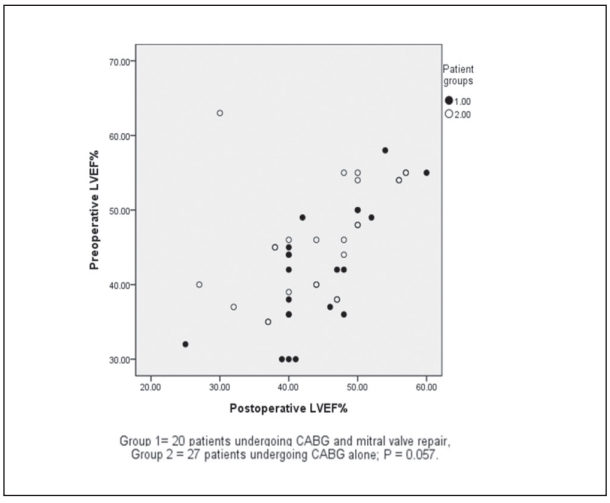

Fig 3. Change in left ventricular ejection fraction (LVEF %)

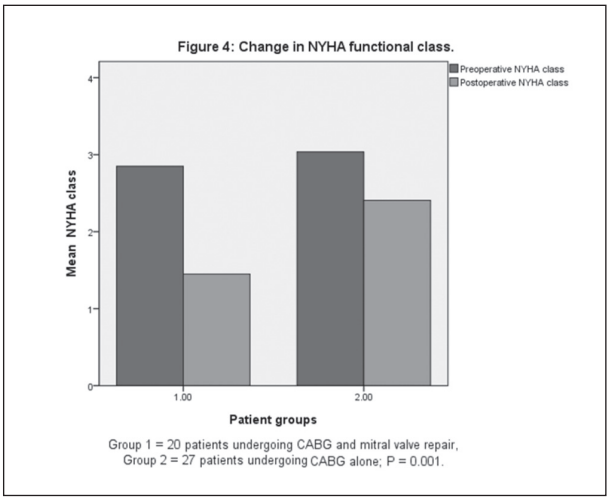

Fig 4. Change in NYHA functional class

There were 3 hospital mortalities (6.4%): 2 in group 1 (10%) and 1 in group 2 patients (3.7%; P = non-significant). The cause of death was multi organ failure in 2 patients and postoperative low cardiac output in the third patient. Tables 4 and 5 show that mortality was significantly associated with a higher preoperative pulmonary artery pressure (P=0.03), prolonged duration of postoperative mechanical ventilation (P=0.001), development of ARDS (P= 0.001) or respiratory complications (P=0.007), development of renal dysfunction (P=0.01) and delayed recovery (P=0.016). Other selected variables were significantly unrelated to hospital mortality; including the means of the differences of echocardiographic measurements shown in Table 6.

A multivariable model was constructed with the statistically significant variables on univariate analysis for evaluation of independent predictors of statistically significant outcome variables namely NYHA class change, LVESD change and length of hospital stay. Statistically significant different preoperative variables - namely LVESD, pulmonary artery pressure, LVEF% as well as ACC and CPB times and number of grafts implanted during surgery - were introduced as covariates. Fixed factors included the patient groups and presence of a left main disease. Mitral annuloplasty was the only independent predictor of postoperative improvement as indicated by the selected outcome variables (P=0.026). Compared to CABG alone, mitral annuloplasty was associated with better clinical improvement by the NYHA standards (P=0.012) and shorter total hospital stay (P=0.043). On the other hand, change of LVESD was statistically non-significant (P=0.4) on multivariate analysis.

Discussion

Although the patients in group 1 appear to have more impaired cardiac function (lower EF, higher ESD, higher PAP, more LM disease and more moderate MR), all patients showed impaired functions as evidenced by high mean ESD and mean PAP (5.0 ± 0.98 and 45.4 ± 12.2 respectively) and lower mean EF (44 ± 8.1). The metanalysis study published by Vassileva et al showed that most patients referred for repair of CIMR repair showed some degree of cardiac function impairment as evidenced by higher NYHA class presentation and low EF ranging from 12 % to 48 %. [6]

Aklog and colleagues advised to evaluate the grade of MR preoperatively rather than under anesthesia for guiding decisions on mitral valve surgical management at time of CABG, as general anesthesia reduces the grade of MR especially if the MR is caused by geometric change due to LV dilatation and tension of LV. [9] Two aspects of diagnosis should be assessed first the severity of regurge using color Doppler to measure the effective regurgitant orifice area (ERO) and the regurgitant volume (RV) using the PISA method (proximal isovelocity surface area) according to the American Society of Echocardiography recommendations for evaluation of the severity of native valvular regurgitation. [15] Secondly the mitral valve morphology is assessed by measuring the degree of annular dilatation and mitral valve tethering by several parameters like tenting area (TA) (the area between the tented leaflets and the annular plane in systole) and tenting height (TH) (distance between the point of leaflet coaptation and the mitral annular plane in systole) show a strong and positive correlation with the ERO. These parameters together with posterior and anterior leaflet tethering angles (PTA and ATA) and interpapillary muscle distance (IPMD) has also shown to provide prognostic information about the surgical treatment results of CIMR.[16, 17] In our study, careful preoperative echo examination of the valve morphology and the degree of the regurge using ERO and RV is undertaken. Also, intraoperative TEE was used to assess the repair after careful adjustment of the filling pressure.

There are no clear guidelines for indications for surgery in CIMR; however there is a general agreement that patients who have indications for CABG with moderate-to-severe IMR (3 or 4) should also undergo concomitant MV surgery.

It is controversial whether CABG patients with mild to Moderate MR (1or 2) should undergo concomitant MV surgery. Mallidi and coworkers found a higher prevalence of heart failure symptoms and decreased cardiac event free survival in MR patients during follow-up. In addition, 30% of patients progressed to 3 or 4 MR during a mean follow-up of 16 months. [18] Lam and coworkers found that CIMR does not reliably resolve with CABG surgery alone and is associated with reduced survival. [11] Aklog and coworkers found persistent moderate or severe MR in 77% of patients treated with revascularization alone. [9] Wong et al and kang et al could not find a definite advantage on long term survival, among patients who underwent isolated CABG versus patients who underwent CABG plus MV repair. [13, 14]

Such findings would suggest that MV surgery should be performed at the time of CABG in patients with mild-to-moderate IMR. However, the risk of long-term CIMR and CHF progression must be balanced against the increased perioperative risk of mitral valve surgery. Perioperative mortality for a combined procedure in CIMR according to Data from the STS database is increased by roughly twofold (6—15% vs 3—5%). [18] In our series, all patients with moderate mitral regurge were repaired, however in mild regurge, repair was done only in patients with ventricular dilatation to minimize the perioperative risk.

Declamping of the mammary artery after putting the anterior leaflet sutures allows visual testing of the competence of the mitral valve on beating heart, we used this technique to decrease the incidence of residual mitral regurge.

There are no published prospective randomized trials comparing repair with replacement in patients with CIMR to date. However several retrospective studies has proved MV repair was associated with lower perioperative mortality.[19-21] Moreover, the recent metaanlysis study comparing MVR with MV repair in CIMR confirmed that mitral valve repair for IMR is associated with better short-term and long-term survival compared to mitral valve replacement. [6] However, Mitral valve replacement should be considered for patients with chronic IMR and multiple comorbidities, complex regurgitant jets or severe tethering of both MV leaflets. [22, 23]

We have used restrictive annuloplasty to repair all cases with no concomitant repair technique as Alfieri stitch, or chordal handling. We have not replaced the mitral valve in any of our cases as there was no patient that has complex regurge that necessitate replacement. We used rigid classic carpentier-edwards ring in all patients to undersize the valve by only 1 or 2 sizes to prevent high recurrence rate.

Careful sizing of the annulus is undertaken to avoid excessive downsizing of the valve. Annular downsizing does not relieve leaflet tethering, but it does shift the posterior annulus and leaflet anteriorly, which leads to restored coaptation. [24] Excessive downsizing of the valve displaces the posterior annulus anteriorly and can lead to a significant increase in the posterior leaflet angle. Consequently, augmented asymmetric tethering with predominant posterior leaflet tethering occurs. This phenomenon is associated with persistent or recurrent CIMR after surgery. [17, 25] In addition, even mild residual CIMR contributes to continued LV negative remodeling and increased tethering, leading to a vicious circle whereby MR begets more MR.[26]

Bax and Braun et al. showed that use of rigid or semi-rigid, complete annuloplasty rings that are one to two sizes smaller than

the measured inter-trigonal length provide excellent freedom from CIMR recurrence up to 2 years by avoiding excessive under sizing. They also demonstrated that preoperative LV dimensions predict LV reverse remodeling, which is unlikely if preoperative LV end-diastolic diameter exceeds 65 mm and/or end-systolic diameter exceeds 51 mm. [27, 28] Gorman et al also it has been suggested that in order to decrease recurrence a complete remodeling annuloplasty should be used rather than a posterior band because the anterior mitral annulus dilates as well. [29]

Different studies reported a high rate of persistent and recurrent CIMR after restrictive MVA and showed that up to 30% of patients experience recurrence of MR in the early postoperative period (<6 months). (24, 26, 30) Adherence to strict selection criteria for patients to perform restrictive annuloplasty, meticulous echocardiographic examination and usage of the fore mentioned surgical techniques will reduce these high rates of recurrence reported.

Our results did not show a significant difference in mortality nor morbidity between the two groups, however isolated Mitral annuloplasty was identified as the only independent predictor of postoperative improvement as indicated by better clinical improvement by the NYHA standards (P=0.012) and shorter total hospital stay (P=0.043). Also The ESD, EDD and EF were better with annuloplasty. These results suggest that low-risk patients with mild-to-moderate IMR should undergo concomitant MV surgery provided the procedure can be performed with low mortality rates. However, we agree with Borger et al recommendations that patients with mild-to-moderate IMR and multiple comorbidities, or a life expectancy of less than 5 years, should be treated conservatively and undergo CABG only. [8]

Study limitations

The small numbers in each group of patients with this uncommon disease made case matching impractical. But for the reasons mentioned before few cases are referred for surgery.

The assignment of patients to a group and hence a modality of treatment is not random. The assignment is the result of some selection process that may be biased and this leads difficulties in the attribution of causality. In our series the choice of type of surgery was related to characteristics of the patient at presentation.

Conclusion

Restrictive MVA and CABG can provide good results in selected patients without severe dilatation and tethering with no negative impact on the morbidity or mortality. Every effort should be exerted to accurately size the mitral annulus, use complete rigid or semi-rigid rings and accurately assess the mitral repair on perfused heart to avoid recurrence of MR.

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Different Surgical Modalities For Management of Acute Type A Aortic Dissection

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Background: **Aortic dissection is the most frequent and serious form of acute aortic syndrome, with more than 60% mortality in the first week of evolution if suitable treatment is not rapidly begun.**

Objectives: **To study the preoperative selection of cases of acute type A aortic dissection and the different surgical modalities for management of these cases and the outcome of these surgical techniques.**

Patients and methods: This study was conducted on 30 consecutive patients at the Cardiac Surgery Department, Mauriziano Umberto I Hospital, Torino, Italy, for whom surgical interference was performed for acute type "A" Aortic Dissection. They included 21 male patients and 9 female patients with a mean age of 62 ± 10.8 years.

Results: **The peak of incidence was in winter and least incidence in summer. The most significant risk factor was hypertension. All patients were admitted as emergency cases. The majority of these patients were operated for Ascending Aortic replacement solely while the rest had some kind of modification beside the ascending Aorta. The mean bypass time was 187.1 ± 60.9 minutes; with mean Aortic cross clamp time of 96.8 ± 36.7 minutes and total circulatory arrest time of 26.8 ± 10 minutes and mean temperature of arrest 20.1 ± 2.5 ˚C. The mean ICU stay was 4.66 ± 3.7 days. The mean hospital stay was 11.3 ± 1.4 days with overall mortality of 30% after 24 months of follow up.**

Conclusion: **Early diagnosis and management of Acute type "A" Aortic Dissection is empirical for less complications & better operative & post-operative results.**

Keywords: **Acute • aortic dissection • type A • surgery**

Aortic dissection is the most frequent and serious form of acute aortic syndrome, with more than 60% mortality in the first week of evolution if suitable treatment is not rapidly begun [1].

The Stanford classification of aortic dissection distinguishes between type A and type B. Type A means the dissection includes the ascending aorta, a type B dissection does not involve the ascending aorta[2].

While no single disorder is responsible for aortic dissection, several risk factors have been identified that can damage the aortic wall and lead to dissection These include direct mechanical forces on the aortic wall (i.e. hypertension, hypervolemia, derangements of aortic flow) and forces that affect the composition of the aortic wall (i.e. connective tissue disorders or direct chemical destruction)[3].

The speed of lethality and the mode of death which often involves severe physiologic derangements from complications such as pericardial tamponade, myocardial infarction, malperfusion syndromes to the brain, kidney, spinal cord and/or gut or frank exsanguination from aortic rupture has magnified the importance of early diagnosis and treatment which continues to be critical to survival[4].

The objectives of surgical therapy for aortic dissection are to resect the damaged segment, excise the intimal tear, and obliterate the entry into in the false lumen. Suturing

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the edges of the dissected aorta both proximally and distally obliterates the entry into the false lumen. The desirability of obliterating the entrance to the false lumen is controversial because of multiple portals [5].

The aim of this work is to study the preoperative selection of cases of acute type A aortic dissection and the different surgical modalities for management of these cases and the outcome of these surgical techniques.

PATIENTS AND METHODS

This study was conducted on 30 consecutive patients at the Cardiac Surgery Department, Mauriziano Umberto I Hospital, Torino, Italy between March 2008 and March 2010.

Patients will fulfilled the following criteria:

·Patients suffering from acute type A aortic dissection.

·No history of chronic medical disease, coagulopathy.

·No Recent cerebrovascular accident.

·No Severe left ventricular dysfunction.

·Not pregnant woman.

Preoperative assessment included History, Examination and Complete blood picture, liver and kidney function tests, electrocardiogram, chest X-ray, spiral CT angio of the chest, echo-cardiogram (trans-thoracic or trans-esophageal or both as needed for diagnosis) and chest MRI (if needed). According to the condition of the patient, patients were sedated or mechanically ventilated and anti-hypertensive therapy was started. Patients were transferred to operative room, general anaesthesia (propofol and fentanyl) was used with monitoring of temperature (rectal and esophageal), invasive blood pressure monitoring of palpable non-dissected artery, EEG and BIS index (bispectral index) for brain activity were applied.

Surgical technique

Surgical preparation of common artery (mostly right common femoral artery) provided that it is not dissected (guided with the CT angio) and pulse is felt. Standard median sternotomy, longitudinal pericardiotomy. Canaulation of the femoral artery and right atrium with double stage cannula. Starting the extracorporeal circulation and systemic cooling. CO_2 insufflation was started in the field. Clamping the aorta, aortotomy was done in the ascending aorta and cold crystalloid cardioplegia was infused in the coronary ostia. If ascending aorta only was dissected, resection of the ascending aorta above sinotubular junction and capitonage (felt sandwich technique) of the dissected wall and Bioglue (Cryolife International Inc., Kennesaw, GA)was applied between the dissected wall and Teflon felt reinforcement. When temperature descended to the desired temperature and BIS index showed no brain activity, head of the patients was tilted down, corticosteroid and mannitol were given, CPB is stopped and declamping of the aorta and either retrograde or antegrade cerebral perfusion was started.

Capitonage of the distal end of the aorta was done after excision of the dissected aorta and anastomosis of the distal end with the prosthetic (Dacron) tube graft after proper sizing. Stoppage of cerebral perfusion and deareation after resuming the CPB and clamping the prosthesiswas done. Control of haemostasis, then proximal anastomosis was done between the aortic root and the tube graft after cutting to the appropriate length, deareation through vent and rewarming the patient then declamping the aorta. When aortic root is dissected and according to aortic valve if it is competent David's valve sparing technique of aortic root replacement is done but if aortic valve is dissected or severely incompetent, modified Bentall De Bono operation was done. If aortic valve was incompetent without root dissection, resuspension of commisures was done. If dissection was reaching the arch either hemiarch or total arch replacement was done by individual insertion of great vessels or reinsertion of island of the aortic arch bearing the great vessels according to the extent of dissection. After core temperature reached normal value and blood pressure and ECG were accepted weaning of bypass was proceeded and TEE was done for evaluation of aortic valve, aortic root, arch and descending aorta and other valvular affections. Postoperative assessment of mediastinal surgical drain ECG changes, units of blood transfused, CBC liver function, kidney function and coagulation profile were done. Duration of mechanical ventilation and neurological assessment, wound infection, sternal dehiscence, ICU and hospital stay and mortality data were collected. CT chest was done before discharge and 3-6 months postoperatively.

Statistical analysis

Data were checked, entered and analysed by using SPSS version 15 software computer package. Data were expressed as mean + SD for quantitative variables, number and percentage for categorical variables.

RESULTS

The overall number was 30 patients; 21 (70%) were male patients and 9 (30%) were female patients. The mean age was 62 ± 10.8 years with a range of 35-81 years. The highest months of occurrence were January (8 cases, 26.6%), November (6 cases, 20%), October and December (3 cases each, 10%) and the rest of cases are distributed over the remaining months. 26 (86.6%) patients were diagnosed as classic aortic dissection and 3 (10%) patients were diagnosed as intramural hematoma and one (3.3%) patients was diagnosed as penetrating aortic ulcer.

29 (96.7%) patients had history of hypertension, 3 (10%) of patients had arteriopathy. (table 1).

All 30 patients (100%) were presented as emergency cases. (table 2).

20 (66.7%) patients were operated for ascending aortic replacement with tube graft, 3 (10%) patients had modified Bentall De Bano operation. Only one (3.3%) patient had ascending aortic replacement and aortic valve replacement, 4 (13.3%) patients had ascending aortic replacement and aortic valve repair (resuspension of the commissures), 2 (6.7%) patients had ascending aortic replacement and hemiarch replacement (table 3).

The mean bypass time was 187.1 ± 60.9 minutes ranging 80-383 minutes. The mean and range of cross-clamp time ware 96.8 ± 36.7 and 33-188 minutes respecively. The mean of total arrest time was 26.8 ± 10 minutes ranging 10-47 minutes. The mean of temperature of total circulatory arrest was 20.1 ± 2.5°C ranging from17-24°C.

The mean time for postoperative intubation was 75 ± 85.5 minutes. The mean volume of blood and blood products needed as replacement were 1105.5 ± 831 ml. The mean ICU stay time was 4.66 ± 3.7 days ranging from 0-17 days.

20 patients (66.7%) had postoperative complications; 9 patients (30%) were re-explored for bleeding, 9 patients (30%) had postoperative atrial fibrillation, (table 4).

The mean hospital stay time was 11.3 ± 7.4 days ranging from 0-34 days with overall survival of 21 (70%) patients and overall mortality of 9 (30%) patients.

	No	**%**
Hypertension	29	96.7
DM	0	0
Obesity	1	3.3
COPD	1	3.3
EF		
Mean ± SD(Range)	54.5 ± 4.8(50-60)	
Euroscore		
Mean ± SD(Range)	10.97 ± 2.67(7-17)	
Arteriopathy	3	10
Marfan	1	3.3
Bicuspid aortic valve	1	3.3

Table 1. Risk factors

	No	%
Emergency	30	100
Renal failure	0	0
Neurological complications	2	6.6
Shock	3	10
Tamponade	3	10
Preoperative intubation	4	13.3

Table 2. Preoperative complications

Type of intervention	No	%
Ascending aortic replacement with tube graft	20	66.7
Modified Bentall De Bono (one of them is accompanied with mitral valve repair)	3	10
Ascending aortic replacement + Aortic valve replacement	1	3.3
Ascending aortic replacement + Aortic valve repair	4	13.3
Ascending aortic replacement + Hemiarch replacement	2	6.7

Table 3. Types of intervention

	No	%
Complications	20	66.7
Reopening for bleeding	9	30
Sternal revision	1	3.3
Infection	0	0
Pneumothorax	0	0
Acute MI	0	0
Atrial fibrillation	9	30
Intraoperative aortic rupture	2	6.7
Failure weaning of bypass	1	3.3
Tracheostomy	1	3.3
Acute renal failure	5	16.7
Psychic complications	3	10
Intracerebral hemorrhage	1	3.3
Coma	3	10
Rupture and dissection of aortic root	3	10
Pericardial window after effusion or tamponade	2	6.7
Respiratory insufficiency	3	10

Table 4. Complications

DISCUSSION

AAD is a severe disease with low incidence (about 2.9 in 100,00/year) but with a high in-hospital mortality rate (about 27.4%); mortality for this disease, if left untreated or only treated medically, is estimated to be 80 to 90% in the first 15 days after onset of symptoms[6].

The mean age in our study was consistent with other reports by **Tsai et al.[4] and Olsson et al.[7]** and the IRAD (International Registry of Aortic Dissection) although the range was higher as only one Marfan patient was operated in our report in contrast with those results.

Highest occurrence occurred in late autumn and winter and least occurrence in summer. This is consistent with reports of **Sumiyoshi et al.[8] and Prakash et al.[9].** This may be attributed to the seasonal variation of blood pressure which is higher in winter months than in summer due to sympathetically mediated vasoconstrictors caused by cold climate.

Only 3(10%) patients were diagnosed as intramural hematoma (IMH) and 1(3.3%)patient as penetrating aortic ulcer consistent with reports by **Tsai et al.[4] and Chen et al.[10]** but a wide range is found in other report by **Erbel et al.[2]**. This may be attributed to the awareness of the appearance of IMH during diagnosis.

In general, there is discrepancy between the occurrence of risk factors among different research work but in general hypertension is the most common although in our work it is much higher**.[4] [11] [12]**.

The percentage of ascending aortic replacement solely is consistent between our results and the other research work by **Santini et al.[13] and Suehiro et al.[14]**. The discrepancy in percentage of other procedure (root replacement, valve repair and arch replacement) between different work research may be attributed to the rapidity of entering operation room before extension of dissection, the surgical preference and capability of surgeon, as complex surgical procedure requires higher surgical skills, also may be attributed to the risk factors or pathology of dissection as Marfan syndrome and dissecting aortic aneurysm which may necessitate aortic root and valve replacement or arch replacement.

As regard postoperative complications, 66.7% of our patients had one or more complications in the postoperative period. The most prominent were re-exploration for bleeding, atrial fibrillation, acute renal failure, respiratory insufficiency, rupture and/or dissection of aortic root in the postoperative period, coma and sternal revision. This was consistent with other reports by **Santini et al.[15] Chiappini et al.[16] and Gallo et al.[17]** with some difference in the percentage of each complication.

Hospital stay, in our study, was 11.3 ± 7.4 days and after the follow-up period which was 24 months, the overall mortality was 30%. This is consistent with other reports **Olsson et al.[7] Campbell-Lloyd et al.[11] and Suehiro et al.[14]** with noting the progress in mortality rate over the last two decades compared to 40% early mortality reported by **Centofanti et al.[18].**

CONCLUSION

- Early Diagnosis of Acute type "A" Aortic Dissection is empirical for less complications & better operative & post-operative results.
- Recent modalities of imaging studies like TEE and MRA, helical CT, and 3D reconstruction of Aorta have made a huge leap in the diagnosis & management of Acute type "A" Aortic Dissection & its complication and follow-up.
- For Acute type "A" Aortic Dissection, surgery is the optimal management unless there is contra-indication.
- Cerebral & spinal cord protection is a corner stone in such types of surgery especially if expected time of total circulatory arrest is long.
- Control of post-operative complication is important and suggested temperature of arrest to be 24˚C to avoid long bypass time (longer time of re-warming) with effect on coagulation system (30% of complication are re-exploration for bleeding), kidney and brain.
- The best results seem to be obtained from early diagnosed patients with dissection confined to Ascending Aorta only. Arch, root involvement bears more risk of complication & mortality.

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Short and Mid Term Result of Mitral Valve Repair Using Artificial Chordae

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Objective: **Mitral valve repair with artificial chordea for mitral regurge is widely adopted. We assessed the early and mid-term outcomes for mitral valve repair with expanded polytetrafluroethylene sutures (GORE-TEX sutures).**

Methods: **Between March 2008 till September 2011, 40 consecutive patients underwent mitral valve repair with artificial chordea. Mean age was 54.5 ± 10.5 years, males 13(32.5%), females 27 (67.5%). in 20 cases (50%) additional surgical procedures were performed in the form of coronary bypass surgery in 11 cases (27.5%), tricuspid valve repair in 8 cases (20%), atrial fibrillation ablation in 1 case (2.5%), post-operative follow up was performed for 38 patients(95%).**

***Results*:** **Artificial chordea were used to correct prolapse of anterior leaflet in 32 cases (80%), and in posterior leaflet prolapse in 2 cases (5%), rupture chordea in 7 (17.5%) cases, and both leaflets in 1 case (2.5%). Postoperative echocardiography reveled no mitral residual mitral regurge (MR) in 69.2%, trivial or mild MR in 25.6% and moderate MR in 5.1%. In hospital mortality was 2.5%. None of the patients were re-operated during the follow-up period.**

***Conclusion*:** **Mitral valve repair using artificial chordea is safe, effective and associated with low operative mortality as regard short and mid term follow up.**

***Keywords*:** **Mitral valve repair • chordea replacement • GORE-TEX suture • artificial chordea.**

Mitral valve (MV) repair has become the procedure of choice for the treatment of mitral regurgitation (MR), with superior results relative to MV replacement.[1] . The Carpentier quadrangular resection, with or without concomitant sliding plasty, is considered the standard surgical technique to correct posterior leaflet prolapse [2]. Various types of reconstructive procedures, including triangular resection, chordal transfer, chordal shortening, edge-to-edge technique, and papillary muscle repositioning, have been used to repair anterior leaflet prolapse [2]. MV repairs with these techniques are not always satisfactory, and some of these procedures are considered technically demanding [3-5].

Chordal replacement with expanded polytetrafluoroethylene (ePTFE) sutures was introduced experimentally by Frater and colleagues[6] in the early 1980s. Current use in clinical practice has permitted repair of complex mitral lesions which is now widely adopted technique [3,7,8]

In this study, we reviewed our early and midterm results of mitral valve repair using artificial chordae to determine its safety, efficacy and durability in patients with mitral valve regurge

Patients and methods

From March 2008 to September 2011, a total of 40 patients with MR underwent MV repair with artificial neochordae implantation at Zagazig university hospitals and in Catharina hospital in Netherlands. There were 13 (32.5%) male and 27 (67.5%) female. Age ranged from 16 to 84 (mean 54.5 ± 10.5) years, 38 patients had annular dilataion

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95%, 32 patients had anterior leaflet prolapse 80%, 7 patients had rupture anterior chordea (17.5%) and 2 patients had rupture posterior chordea (5%) (Table 1)

No. of Patients	40
Male/female	13/ 27
Age, y	
Electrocardiography (No.)	
Sinus rhythm	31 (77.5%)
Atrial fibrillation	9 (22.5)
Mitral valve lesions	
Annular dilatation	38 (95%)
Anterior leaflet prolapse	32 (80%)
Posterior leaflet prolapse	1 (2.5%)
Rupture anterior chordae	7 (17.5)
Rupture posterior chordae	2 (5%)
New York Heart Association functional class (No.)	
I	
II	
III	39 (72.5%)
IV	11 (27.5%)
Associate diseases (No.)	
Total cases	19 (47.5%)
Coronary artery disease	11 (27.5%)
Tricuspid valve regurgitation	8 (20%)

TABLE 1. Clinical characteristics of patients with mitral regurgitation

Operative Techniques

The approach to the heart was exclusively by means of a midline sternotomy with aortic bicaval standard cannulation. Myocardial protection was achieved by tepid blood antegrade intermittent cardioplegia . The MV was approached through a standard left atriotomy just behind the interatrial groove. Insertion of self retaining mitral retractor. The entire MV apparatus was then carefully inspected, symmetrically assessed and evaluated for suitable method of repair. Depending on the analysis, PTFE sutures Double armed (CV5) suture was used to replace chordae tendinae of the anterior leaflet and/or the posterior leaflet. In most instances, two PTFE sutures are necessary; if more are needed based on inspection they are all placed at this time. The suture is first passed through the tip of the papillary muscle to the margin of the mitral leaflet in the prolapsing area then a couple of knots will be tied after adjustment of the length and then suture passed from atrial to ventricular side so that the knot will finally lie on the ventricular side of the mitral leaflet outside the coaptation zone. The sequence of the next steps depends on the need for further repair maneuvers such as insertion of annuloplasty ring done in all cases (Carpentier –Edward physio ring), quadrangular resection of posterior leaflet, posterior leaflet augmentation, commissural placation, anterior leaflet augmentation and chordeal shortening. The operative data summarized in (Table 2)

Operation performed	
Chordal replacement with e-PTFE	40 (100%)
Anterior chordal replacement	38 (95%)
Posterior chordal replacement	2(5%)
Quadrangular resection of posterior leaflet	2(5%)
Chordal shortening	2(5%)
Posterior leaflet augmentation	7(17.5%)
Commissural placation	2(5%)
Anterior leaflet augmentation	1(2.5%)
Mitral annuloplasty (flexible ring)	40(100%)
Ring size (mean±SD)	30.60 ± 1.64
Additional procedures	
Coronary artery bypass grafting	11(27.5%)
Tricuspid valve repair	8(20%)
Maze procedure	1(2.5%)
Cardiopulmonary bypass time (min,range,median)	(52-247) 80

TABLE 2. Operative data

Follow up

The patients were followed up regularly by complete clinical assessment and transthoracic echocardiography at 6, 12 and 18 months. At 6 months 39 patients (97.5%) were examined and as one patient died on tht 2nd day post-operativly. At 12 and 18 months 38 patients (95%) were examined as one patient is missed during the follow-up. MR was determined according to the published guidelines and was graded on a scale of 0-4 where 0: none, 1: trivial-to-mild, 2: moderate, 3:moderate-to-severe. And 4: severe [9].

Statistical analysis

Categorical data are expressed as percentages and continuous data as mean ± standard deviation throughout the manuscript. Continuous data were compared with unpaired t-tests or Wilcoxon rank sum tests where appropriate. P value was considered statistically significant if $p<0.05$, we used SPSS Chicago 11 for statistics.

Results

There was very highly significant improvement in functional status for patients during the follow up as shown in (Table 3)

NYHA	Preoperative (n = 40)	6 months (n = 39)	12 months (n = 38)	18 months (n = 38)
I	-	36(92.3%)*	35(92.1%)*	35(92.1%)*
II	-	3(7.7%)*	3(7.9%)*	3(7.9%)*
III	29(72.5%)	-		
IV	11(27.5%)	-	-	-

**p < 0.001: Very highly significant*

TABLE 3. NYHA functional class changes after 3 and 6, and one year postoperatively.

There was very high significant improvement of MR grade postoperatively. After 6 months, it was found that there was no MR in 27 patients (69.2%), mild MR in 10 patients (25.6%) and moderate MR in two patients (5.1%). All patients have oral anticoagulant for 3 months to keep INR 2-2.5 and oral anticoagulant is continued for patients who are still have atrial fibrillation rhythm. Also, after 12 months it was found that there was no MR in 27 patients (69.2%), mild MR in 8 patients (20.5%) and moderate MR in 3 patients (7.6%). After 18 months it was found that there was no MR in 27 patients (69.2%), mild MR in 8 patients (20.5%), moderate MR in 3 patient (7.7%) as shown in (table 4)

There was only one case of mortality (2.5%) related to low cardiac output with failure of weaning from mechanical ventilation and this case died at the second day postoperative.

Discussion

Mitral repair techniques for posterior MV prolapse consist mostly of quadrangular leaflet resection are associated with excellent peri-operative and long-term outcomes [3,10]. However, anterior MV prolapse is more difficult to repair and may result in higher MR recurrence rates [11]. A variety of techniques have been described to correct anterior MV prolapse including chordal shortening, chordal transfer, leaflet resection or plication, and neochordae formation with PTFE (Gore-Tex[3]. Chordal shortening and leaflet resection/plication have been abandoned by most centers because of unsatisfactory rates of recurrent MR [12]. Although chordal transfer and neo-chordae formation have been performed with very good results, these techniques have other disadvantages [13,14]. Chordal transfer is limited by the availability of unaffected native chordal tissue, while neo-chordae formation is limited by technical complexity.

The primary problem with neo-chordae replacement for anterior MV prolapse is determining the appropriate length for the Gore-Tex sutures, which can be particularly challenging [3]

Grade of mitral regurge	Pre-operative (n=40)	Postbypass (n=40)	6 months* (n=39)	12 months* (n=38)	18 months* (n=38)
No MR	0 (0%)	25 (62.5%)	27(69.2%)	27 (69.2%)	27 (69.2%)
Mild MR	0 (0%)	14 (35%)	10 (25.6%)	8 (20.5%)	8 (20.5%)
Mild to moderate MR	0 (0%)	1 (2.5%)	0 (0%)	0 (0%)	0 (0%)
Moderate MR	0 (0%)	0 (0%)	2 (5.1%)	3 (7.7%)	3 (7.7%)
Moderate to severe	6(15%)	0 (0%)	0 (0%)	(0%)	0 (0%)
Severe MR +	34(85%)	0 (0%)	0 (0%)	(0%)	(0%)

**p < 0.001: Highly significant*

TABLE 4. Echocardiography of MR grade postbypass and follow-up after 6 months, 12 months and after 18 months

Some principles should be observed during any neochordae construction procedure including precise measurement of the required chordal length, secure anchoring of the proximal end of the Gore-Tex suture to the papillary muscle, and attachment of the distal end at the level of the annulus.. The use of PTFE avoids damage of the leaflet tissue, which has been observed with other suture materials [15].

The current study reveals that the use of Gore-Tex sutures results in outcomes that are comparable to conventional MV repair techniques such as posterior leaflet resection, and chordal transfer. Our perioperative outcomes were very good with a 30-day mortality rate of only 2.5%, despite the fact that approximately half of patients underwent concomitant procedures including tricuspid valve repair, coronary bypass surgery and Maze operation. In addition, echocardiographic results were very satisfactory at early follow up with 69.2% of patients having no residual MR and 20.5% having mild MR. These results compare favorably to a study by Flameng et al. [16], who reported freedom from non-trivial degrees of regurgitation of 94.3% in 242 patients early after mitral valve repair.

Mid-term follow-up in the current study revealed no MV reoperation rate, occurring. Although the length of follow-up in the current series is relatively short (18 months), the MV reoperation-free rate of 100% 18 months postoperatively is low and compares favorably to other series [3,17]. Our results have led us to conclude that the artificial chordea is safe, effective and durable, at least in the mid-term.

One possible disadvantage of using the artificial chordae is the fact that the diseased portions of the MV leaflets are left in place and not resected. It is possible that degeneration of the remaining portions of the MV could occur more quickly in the presence of retained diseased leaflet tissue[16]. However, it should be stressed that the current other method for repair of anterior leaflet prolapse, i.e. chordal transfer, or chordal shortening also involve retention of diseased portions of the leaflet. Anterior leaflet resection for prolapse has long been abandoned by most cardiac surgery centers, and yet the current results for repair of anterior leaflet prolapse are excellent [3]. It remains to be seen if our technique of retaining diseased leaflet tissue in both the anterior and posterior leaflets will adversely affect the durability of this operation. However, we currently have 18 months follow-up in 38 patients and the results in these patients continue to be excellent. Although we do not expect the durability of this technique to deteriorate over time, it is important that we continue to closely follow these patients to asses long term results.

Conclusion

Mitral valve repair with GORTE-TEX artificial chordae is effective, safe, and associated with low operative mortality. Artificial chordae showed excellent biologic adaptation, retaining flexibility, tension and durability with time

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Impact of Prosthesis Mismatch on Left Ventricular Mass In Patients Having Aortic Valve Replacement

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Background: **Small aortic annulus still represent a dilemma to the surgeon. Either to enlarge or to use a small sized mechanical prosthesis with the functional and hemodynamic implications of Valve Prosthesis-Patient Mismatch(VP-PM).**
Methods: **This prospective study included 30 patients who underwent elective isolated AVR with various mechanical bileaflet prostheses labeled size 19, 21,23 and 25 during a 2 year period. Survival status, functional status and hemodynamic performance were assessed in all patients after surgery.**

Results: **After AVR, 10 patients (33.3%) showed mild VP-PM, 17 patients (56.6%) showed moderate VP-PM, and only three patient (10%) showed severe VP-PM. At follow up, patients with size 21 , 23 and 25 valves prosthesis were asymptomatic. Amongst the 10 patients who received size 19 valve prosthesis, one patient (3.3%) had (NYHA) class 111, 5 patients(16.7%) had NYHA class 11 and the remaining were asymptomatic. The mean postoperative peak systolic gradient (PSG) and the mean Postoperative left ventricular mass index (LVMI) in the patients receiving size 19 valves was significantly higher than those receiving size 21, size 23 and size 25 valves .**

Conclusion: **In spite of having VP-PM the functional outcome and hemodynamic performance of size 21, 23 and 25 valves was found satisfactory. As against this the VP-PM seen in patients in the group receiving size 19 valve was poorly tolerated.**

Patients with small aortic roots undergoing (AVR) are not an uncommon finding, and they still represent a special challenge to the surgeon regarding the operative technique and selection of prosthesis (1). In the late seventies Rahimtoola (2) noticed that patients receiving small sized mechanical prosthesis faced problems including improvement in functional status less than expected, progressive deterioration of cardiac function, acute valve thrombosis and sudden death. He identified this as VP-PM. The problem of VP-PM and small aortic annulus is very closely related.

VP-PM is technically present, when the implanted valve has an Effective Orifice Area (EOA) less than that of the normal valve for that Body Surface Area (BSA) (2). The normal area of the aortic valve ranges from 2.6 - 3.6cm^2 (2.0cm^2/ m^2 BSA). Mechanical prosthesis of size less than 25, have an EOA of less than 2.5cm^2 and by definition these valves are inherently stenotic. Thus theoretically the concept of VP-PM should be considered whenever AVR is performed with various small sized prosthesis (3-6).

The aim of our study was to evaluate the impact of prosthesis mismatch on left ventricular mass in patients having aortic valve replacement.

Patients and Methods

This prospective study included 30 patients who underwent elective isolated AVR with various mechanical bileaflet prostheses labeled size 19, 21, 23and 25 during a 2 year period between December 2009 and December 2011 at Zagazig University Hospitals.

These patients included in the study also fulfilled the following criteria: 1) Isolated aortic valve disease with no significant involvement of other valves, 2) Had

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no previous history of valve replacement or repair, 3) Sinus rhythm, and 4) Had no associated coronary artery disease .

All patients underwent isolated AVR by standard anaesthesia. Through a median sternotomy, cardiopulmonary bypass was performed with standard moderate hypothermia (28°C). Antegrade intermittent blood cardioplegia through the coronary ostia. AVR with mechanical bileaflets valves was performed with the standard routine technique in all patients. The largest suitable valve was always selected for a given patient. Aortic prosthesis was implanted in anatomic position.

all the surgical records were reviewed in order to determine the size and type of the aortic prosthetic valve used and the aortic cross clamp and cardiopulmonary bypass durations.

Data was reviewed and analyzed, including preoperative clinical data, 2D and Doppler transthoracic echocardiographic results using Comprehensive Two dimensional with Colour Doppler echocardiographic assessment was performed in all patients (< 30 days) before AVR and before patient discharge and 6 months and one year after surgery by a Hewlett Packard 5500 ultrasound system with a 2.5 MHz transducer (HP, Andover, MA). Cardiac catheterization was done when needed.

Left Ventricular Mass (LVM) was calculated using the Devereux formula: LVM = 0.8(1.04[(IVSd +LVIDd +PWTd)3 - LVID3] -14 g) (LVM=left ventricular mass in g, IVSd= left ventricular end-diastolic septum thickness in mm, LIVDd= left ventricular end diastolic internal diameter in mm, PWTd the left ventricular end diastolic posterior wall thickness in mm).

Left Ventricular Mass Index (LVMI) was calculated by indexing the LV mass to the body surface area. The Effective Orifice Area (EOA) was calculated using the continuity equation as described by Skjaerpe et al (10). To make the values comparable between the patient groups the prosthetic EOA was indexed with the body surface area of the patient to give the Effective valve orifice area index (EOAI).

The Guidelines used for defining VP-PM in this study were the same as that recommended by Rahimtoola (2). The EOAI was used to divide the patients into three groups. Those with EOAI more than or equal to 0.9 cm^2/m^2 BSA were included as Mild VP-PM, between 0.6 and 0.9 as Moderate VP-PM and less than or equal to 0.6 as Severe VP-PM.

Statistical analysis

Continuous variables are presented as mean ± standard deviation and categorical variables were expressed as percentages. The data was subjected to independent and paired Students t-test and chi-square test to determine the p-value and statistical significance of the variables being compared. Differences were considered statistically significant if the p value was less than 0.05.Data were entered checked and analysed using SPSS, Inc, Chicago,Ill.

Results

The preoperative demographic and clinical data of all operated patients are shown in Table (1,2).

Variables	
Age(year)	
Mean	37.3±15.37
Range	20-58
Sex	
Male	20 (66.7%)
Female	10 (33.3%)
Body surface area(m^2)	
Mean	1.73±0.27
Range	1.2-2.12
NYHA functional class	
ll	9 (30%)
lll	16 (60%)
lV	3 (10%)
Heart rate(min)	78±12
Aortic valve pathology	
Stenosis	16 (53.3%)
Regurge	4 (13.3%)
Mixed	10 (30.3%)
Etiology	
Rheumatic	27 (90%)
Calcific	3 (10%)

Table 1. Preoperative Clinical Data (n=30).

Variables	
Labeled valve size (n)	
19	10 (33.3%)
21	10 (33.3%)
23	7 (23.3%)
25	3 (10%)
Aortic cross-clamp time (min)	70.3±15.4
Cardiopulmonary bypass time (min)	110.2±15.3

Table 2. Operative Data (n=30).

According to the Guidelines used for defining VP-PM in this study, after AVR 10 patients (33.3%) showed mild VP-PM and 17 patients (56.6%) showed moderate VP-PM. Only 3 patient (10%) in this study showed severe VP-PM received size 19 valve prothesis (table 3).

EOAI Criteria	Patient(n)(%)	Degree Of VP-PM	Valve size used (n) 19 21 23 25
EOAI≥ 0.9cm²/m²BSA	10 (33.3%)	Mild VP-PM	0 0 7 3
EOAI 0.6-0.9 cm²/m²BSA	17 (56.6)	Moderate VP-PM	7 10 0 0
EOAI≤ 0.6 cm²/m²BSA	3 (10%)	Severe VP-PM	3 0 0 0

Table 3. Criteria for VP-PM (Rahimtoola et al).

Parameters					P value					
	Size19 (n=10)	Size21 (n=10)	Size23 (n=7)	Size 25 (n=3)	19vs. 21	19 vs. 23	19 vs. 25	21 vs. 23	21 vs.25	23 vs. 25
Mean Pre-operative	91.8±15.6	90.6±30.7	53±20.8	103±24.2	NS	<0.001	<0.001	<0.01	<0.05	<0.001
Mean 1 year Post-op.	40±1.9	24±1.1	22±1.6	18±3.4	0.001<	<0.001	<0.001	NS	<0.05	NS

Table 4. The transaortic peak systolic gradient(mmHg) pre-and postoperative

Parameters					P value					
	Size19 (n=10)	Size21 (n=10)	Size23 (n=7)	Size 25 (n=3)	19vs. 21	19 vs. 23	19 vs. 25	21 vs. 23	21 vs.25	23 vs. 25
Mean Pre-operative	148.6±25	174.4±59.1	252.6±68.2	253.3±117.2	NS	<0.01	<0.01	<0.01	<0.01	NS
Mean 1 year Post-op.	116.2±30.9	99.6±41.6	93.5±19.6	118.8±27.5	NS	<0.01	NS	NS	NS	<0.05

Table 5. The left ventricular mass index (gm/m²)per-and postoperative

Nonfatal complications occurred in two cases (6.6%) in the postoperative period. One patient was reexplored for bleeding and one had a sternal infection.

Follow up was available for all patients . Follow up period was 12.2±6.1 months (range from 12 months to 18 months). There were no late deaths over the follow-up period. Those patients with size 21, 23 and 25 valves prosthesis were asymptomatic. Amongst the 10 patients who received size 19 valve prosthesis, one patient (3.3%) had NYHA class 111 symptoms (this patient with severe VP-PM), 5 patients(16.7%) had NYHA class II symptoms (these patients with moderate VP-PM) and the remaining were asymptomatic.

There was a significant fall in PSG in all patients after AVR irrespective of the size of the valve used (p<0.05) (Table 4).

Also there was a significant fall in LVMI following surgery in all patients (p<0.05) (table 5).

Discussion

Aronow and colleague reported that aortic stenosis is a common valvular heart disease associated with life threatening complications and mortality rate up to 90% in a 2 year natural history of symptomatic patients (3).

The concept of VP-PM was introduced to describe the condition of when the effective orifice of aortic valve prosthesis is less than that of a normal human valve. VP-PM leading to clinical symptoms and requiring reoperation is a reality. Its mechanism is high Transprosthetic energy loss that increases left ventricular work reduces left ventricular mass regression and this can lead to an increased operative mortality, decreased long-term survival and reduced symptomatic benefit. It has been accepted that patients receiving prothesis < 21 mm show higher gradients than patients receiving a larger valve (1 1, 12)

Nonetheless, VP-PM has frequently been observed, mostly for two reasons. First, patients with aortic valve disease frequently exhibit annulus calcification and fibrosis as well as left ventricular (LV) hypertrophy, and these pathologic processes can reduce the size of the aortic annulus. Second, because the prosthesis is inserted within the same aorta and has its own structural support; the EOA of the prosthesis is necessarily less than that which a normal native valve would have within the same aorta. Obviously, the support apparatus of mechanical valves or stented bioprostheses creates a relative obstruction to the flow and it has been shown that the EOA available for blood flow represents only 40% to 70% of the total area occupied by the valve (1). In addition, the EOA of the implanted valve is further reduced, by tissue in-growth and endothelialisation(3).

Concern has been raised about significant residual gradients when small aortic prostheses are used, particularly in patients with a large BSA, in whom VP-PM may often occur (2). There were publications by groups in favor of the hypothesis that VP-PM is an independent predictor of mortality (13, 14). In contradiction there are others that found that survival after AVR appears not to be adversely affected by VP-PM (15). Recently, the low gradients demonstrated across newer mechanical prosthesis (7) has lead many investigators to question the relevance of VP-PM in the era of tilting disc and bileaflet prosthesis and prompted many to relegate this phenomenon, as reminiscent of the era of ball and cage prostheses. This raises issues regarding whether patients should be subjected to technically demanding and certainly more risky procedures like aortic root widening when simple aortic valve replacement would be functionally adequate. Although for patients with small aortic ring, there are appropriate annulus-enlarging technigues to implant a larger valve, they often result in increasing morbidity and mortality risks of the operation, thus limiting their applicability (16). Another altentative might be the use of valvular homografts, which have good hemodynamics but are not readily available to most centers (1).

In this study we tested the hypothesis that VP-PM had significant implications on clinical and hemodynamic outcomes after AVR with small aortic prostheses, We observed that some degree of VP-PM was present in all our patients (Table 3). Even though many previous studies reported high mortality in small-size" valves (13, 14) it is still uncertain if VP-PM may affect the postoperative mortality (15). Rao et al. (14) reported the in vitro calculated EOA/BSA < 0.75 cm^2/m^2 to have a strong impact on survival. In our study, follow up period was I0.2±4.l months (range from 6 months to 18 months) and there were no late deaths over the follow-up period.

The functional outcome of the size 21, 23and 25 prostheses were found to be satisfactory despite the VP-PM and all those patients with size 21 and 23 valves prosthesis were asymptomatic. As against this the VP-PM seen in patients in the group receiving size 19 valve was poorly tolerated and one patient (3.3%) had NYMA class 111 symptoms (this patient with severe VP-PM), 5 palients(16.7%) had NYHA class 11 symptoms (these patients with moderate VP-PM), even though the drop in PSG and LVMI regression were maximum in this group. Fernandez and coworkers (17) failed to demonstrate any correlation between P-PM and postoperative clinical status.

The hemodynamic performance of the size 21, 23and 25 prostheses were found to be also satisfactory. In this study the patients with size 19, 21, 23 and 25 valves showed significant drop in the TPG with size 19-valves recording the maximum drop. These observations compared favorably with those reported by Sharma et al (18) and Butchart and associates (19). However the residual gradient across size 19 valves following surgery remained significantly high (mean PSG = 51.8±16.9 mmHg). The PSG across size 21, 23 and 25 were comparable to those reported by other investigators. Similarly significant regression was seen in the LVMI in the 4 groups. The regression was maximal in patients with size 19 valves. Yet the mean postoperative LVMI of this group (116.2± 30.9gm/m^2 BSA) was significantly higher than that of the patients with size 21 (99.6±41.6gm/m^2 BSA) , 23 valves (93.5±19.6 gm/m^2 BSA) and 25 valves (118.8±27.5 gm/m^2 BSA) at the end of the follow up period. The explanation for this is evident in the observations made in table 4 and 5. Though the drop in PSG and LVMI is maximal in size 19 valves, the mean Postoperative PSG and LVMI are comparable to the mean preoperative PSG and LVMI in patients with size 21 and 23 prostheses as the high Preoperative LV Mass in size 19 group could explain the high residual LVMI inspite of the significant fall in the gradients in the group also can be explained by the presence of an element of residual obstruction in the valve rather than the high preoperative LVMI.

Del Rizzo et al. (7) showed a strong correlation between EOAI and the extent of LV mass regression. The improvement in the gradients and the LVMI in spite of implanting stenotic valves can be explained by the fact that studies on the animal heart have shown the relationship between transvalvular gradients and EOA to be curvilinear with no gradients demonsiraied across the valve until the EOA falls below 40-60% of normal valve area (2). By a similar argument it can be said that even minor changes in the EOA of the valve after surgery can result insignificant improvements in the gradients across the valves in spite of the valve being stenotic. However this trend shown by the TPG and LVMI is finite as proven earlier by Natsuaki (6) and Sharma (18). They showed that the drop in TPG and regression in the LVMI reaches a stable value by 6 months following surgery, The lower PSG and LVMI in the patients with size 21 and 23 valves contribute towards the better functional outcome in these patients (20).

In conclusion, our study indicates that VP-PM of varying severity occur in all our patients after AVR , but its clinical significance may be less then previously hypothesised. In spite of having VP-PM the functional outcome and hemodynamic

performance of size 21 , 23 and 25 valves was found satisfactory. As against this the VP-PM seen in patient in the group receiving size 19 valve was poorly tolerated.

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Simple Technique for Preservation of The Entire Mitral Valve Apparatus During Mitral Valve Replacement in Mitral Regurgitation

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Background: **Although the outcome is better with the more you preserve from the native mitral valve apparatus during mitral valve replacement, most surgeons retain only the posterior leaflet with chordae tendinae because of concerns about potential complications with complete preservation as interference with prosthetic mechanism, left ventricular outflow tract obstruction, the need to undersize the prosthesis and higher technical complexity with longer surgical time.**

Patients and methods: **Thirty patients with chronic rheumatic severe mitral regurgitation underwent mitral valve replacement using mechanical prosthesis. Only in 22 patients the entire mitral valve apparatus could be preserved without increasing the risk of complications.**

Results: **There was no operative mortality, no prosthetic valve dysfunction, no significant pressure gradient across left ventricular outflow tract and no prosthetic valve mismatch. Left ventricular function was improved and pulmonary hypertension was decreased significantly.**

Conclusions: **This technique for preservation of the entire mitral valve apparatus during mitral valve replacement for rheumatic pure mitral regurgitation is simple and safe technique that can be applied in selected cases without left ventricular outflow tract obstruction or interference with prosthetic valve leaflets movement.**

Key words: **Mitral valve replacement, mitral apparatus preservation, rheumatic mitral regurgitation, prosthetic heart valve.**

In the early sixties, Lillehei et al. (1) suggested that the high mortality rate associated with Mitral valve replacement (MVR) could be reduced by retention of the papillary muscles and chordae tendineae. He preserved the posterior leaflet during mitral valve replacement and noted a decreased incidence of postoperative low cardiac output syndrome that used to be in early open-heart surgery. In addition, he also confirmed his prediction of a lower operative mortality in these patients.

Around twenty years later, Hetzer et al. (2) became interested in Lillehei's technique utilizing tissue valve. This resurgence of interest was prompted because conventional MVR continued to be associated with a high prevalence of postoperative left ventricular dysfunction leading eventually to death. The most common cause of the late mortality is cardiac failure.

Reports have since appeared in the literature described the superior results of saving the entire valve apparatus. The crossed papillopexy technique in mitral valve replacement also seeks to preserve mitral valve apparatus and thereby preserves left ventricular function. On follow up it was found to lead to improvement of ventricular remodeling (3).

However, most surgeons retain only the posterior leaflet with chordae tendinae because of concerns about potential complications with complete preservation such as interference with prosthetic mechanism, left ventricular outflow tract (LVOT) obstruction, the need to undersize the prosthesis and higher technical complexity with longer surgical time (4-6).

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The aim of this study is to apply a simple technique for total preservation of the mitral apparatus during mitral valve replacement that can be easily done and to evaluate its outcome regarding the main complications of the entire mitral valve apparatus preservation.

Patients and methods

This study was carried out after approval of institutional ethical committee and written informed consent from the patients.

This study is an observational study that was carried out during the period from June 2010 to June 2011 and includes 30 patients with chronic rheumatic severe mitral regurgitation who underwent mitral valve replacement using mechanical prosthesis.

Exclusion criteria in this study were patients with associated cardiac lesions that need further surgical interference other than MVR, e.g. coronary artery bypass or other valvular surgeries and patients with more than mild mitral stenosis.

As repair is always our first choice in mitral valve surgery, we also exclude patients on them mitral valve repair can be done intraoperative.

Preoperative diagnosis was based on transthoracic echocardiography and sometimes transeosophageal echocardiography for confirmation of the diagnosis if needed.

Operative technique

The procedures of mitral valve replacement were carried out through standard median sternotomy, aortic and bicaval cannulation using moderate hypothermic cardiopulmonary bypass and cold crystalloid antegrade cardioplegia and topical ice slush. After aortic cross calmping left atriotomy was done and mitral valve was carefully inspected and assessed. An insicion was made in the two commisures to open the commisure if it fused and separate the anterior and posterior mitral leaflet from each other completely. Mattress sutures (Ethibond 2/0) were taken in the annulus from the atrial to the ventricular side then taken in the edge of the leaflet from the ventricular to the atrial side and this technique was applied for both the posterior and also anterior mitral leaflets. After proper sizing of the prosthesis sutures were taken in the sewing ring of the prosthesis and tied so that the leaflet is compressed between the prosthetic ring and the annulus and does not impinge on prosthesis causing it to malfunction. Orientation of the prosthesis was usually perpendicular to the anatomical position (anti-anatomical) and the prosthesis was tested for free movement of the leaflets before closure of the left atrium (Figure 1).

The choice of the prosthetic mitral valve size was defined on the basis that mild mismatch occurs if the indexed effective orifice area is within the range of 0.9 to 1.2 cm2/m2 and severe mismatch is defined by an effective orifice area index of less than 0.9 cm2/m2 (7, 8)

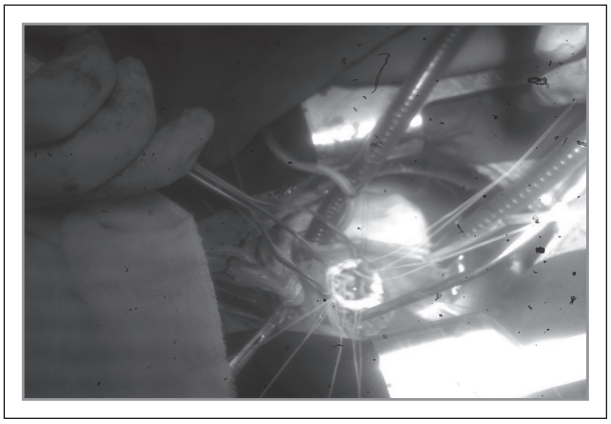

Fig 1. Preservation of the entire mitral valve apparatus.

Postoperative data include hemodynamics of the patients and echocardiography within one week of the surgery (predischarge from the hospital) and after 3 months with special concern on prosthetic valve malfunction, gradient on the prosthetic valve and gradient on LVOT.

The data were analyzed using the statistical software (SPSS V.16). Appropriate tests were selected depending on the variables being compared and the significance level was set at 0.05.

Results

This study included 30 patients with pure severe rheumatic mitral regurgitation who subjected to mitral valve replacement using mechanical prostheses. The patients were 11 male (36.7%) and 19 female (63.3%) with age 35.7 ± 8.8 years.

Intraoperative preservation of the entire mitral valve apparatus can be done in only 22 patients (73.3%) and the other 8 patients(26.7%) total preservation cannot be done because of severe calcification in 3 patients and because of small size annulus that interfere with implantation of proper size prostheses in 5 patients.

Of these 22 patients St. Jude mechanical valves were used in 15 patients and ATS mechanical valves were used in 7 patients. The indexed effective orifice area was 1.24 ± 0.14 cm2/m2. Aortic cross clamp time was 75.2 ± 18.7 minutes and total cardiopulmonary bypass time was 97 ± 21.3 minutes.

There was no operative mortality and all patients were easily weaned off cardiopulmonary bypass and maintained stable hemodynamic parameters.

Postoperative mechanical ventilation was 5.3 ± 3.7 hours and all patients were weaned off inotropic support for the heart within 6.6 ± 5.9 hours.

Postoperative echocardiography done within one week of surgery and 3 months after surgery showed that no prosthetic valve dysfunction occurred in any of the patients with normal free movement of both valve leaflets in all prostheses. Also there was no significant pressure gradient across left ventricular outflow tract in any of the patients (< 10 mmHg).

Although there was no significant difference (P value > 0.05) between preoperative and immediate postoperative data regarding ejection fraction, left ventricular end-systolic and end-diastolic diameters but the myocardial function was significantly improved (P value <0.05) within 3 months postoperative. Also pulmonary artery systolic pressure was significantly decreases immediate and 3 months postoperatively (P value <0.05) (table 1)

	Preoperative	1 week postoperative	3 months postoperative
LA diameter mm	52.7 ± 7.4	51.9 ± 7.6	48.3 ± 6.9
LVED diameter mm	59.6 ± 5.2	59.3 ± 5.1	54.9 ± 3.6
LVES diameter mm	37.7 ± 4.5	37.3 ± 4.7	34.1 ± 4.7
Left ventricular EF %	55.8 ± 7.3	56 ±7	60.5 ± 6.7
PASP mmHg	55.2 ± 9.9	49.9 ±10.2	44 ± 9.3

LA: left atrium, LVED: left ventricular end-diastolic, LVES: left ventricular end-systolic, PASP: pulmonary artery systolic pressure.

Table 1. Echocardiographic variables preoperative, 1 week and 3 months postoperative

Discussion

There is a worldwide agreement in cases of mitral valve replacement that the more you preserve from the subvalvular apparatus, the better the results as preservation of ventriculo-annular continuity through the retained leaflet, its chordae, and the papillary muscles is beneficial for maintenance of original left ventricular geometry. It helps to prevent acute left ventricular dilation, which may occur namely in severely impaired left ventricles after complete mitral valve excision and longer ischemic heart arrest. Also it prevents the decrease of left ventricular ejection fraction after mitral valve excision (9).

Results of bileaflet preservation forced several institutions to improve the technique, and several modifications have been described. These techniques for preservation of the subvalvular apparatus are aimed at preventing the preserved tissue from interfering with prosthetic valve function, allowing implantation of an adequate size of prosthesis, and avoiding left ventricular outflow tract obstruction (10).

The entire chordopapillary apparatus was preserved by several techniques. In one technique, the anterior leaflet was divided into two or more segments and reattached to the annulus (11). Another technique was described by Miki and associates as larger patches with chords could be implanted with lower risk of LV outflow tract obstruction (12).also a technique of posterior transposition of the anterior leaflet was performed in which the whole leaflet was detached and reimplanted as a patch (13).

As in pure rheumatic mitral regurgitation the mitral valve annulus is usually dilated and can accommodate large size of valve easily, so we try to use this simple technique for entire mitral valve apparatus preservation and although it cannot be done in all the patients but it can be done easily and safely in at least more than half of the patients without evidence of either LVOT obstruction or interference with prosthetic valve leaflets movement.

Preservation of the entire mitral valve apparatus was preserving the left ventricular function without decrease in the early postoperative period and in addition it helped to improve left ventricular function and diameters within 3 months after surgery. Also pulmonary artery pressure was significantly decreased after mitral valve replacement.

This is in agreement with Fuster et al. who studied one of the largest series of rheumatic patients reported from a western country undergoing chordal-sparing mitral valve replacement and conclude that complete chordal preservation is possible in a large percentage of rheumatic patients. Higher reductions in LV volumes may especially be obtained in patients with mitral regurgitation. Consequently, LV ejection fraction and pulmonary hypertension may improve with time because of more favorable LV remodeling. Clinical outcomes may also improve with subvalvular preservation, especially with complete preservation. Avoidance of complete mitral valve resection should be mandatory in modern cardiac surgery (14).

We conclude that this technique for preservation of the entire mitral valve apparatus during mitral valve replacement for rheumatic pure mitral regurgitation is simple and safe technique that can be applied in selected cases without left ventricular outflow tract obstruction or interference with prosthetic valve leaflets movement.

Limitations of the study were small number of patients, being an observational study and lack of comparison between different techniques of preservation of the mitral valve apparatus.

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The Value of Risk Algorithms in Predicting Outcomes for Octogenarians Undergoing Aortic Valve Replacement With or Without CABG

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***Background*: Aortic valve replacement (AVR) and AVR with coronary bypass surgery (AVR/CABG) are increasingly performed in octogenarians. Assessment of risk based on predictive algorithms could preclude some octogenarians from the benefits of conventional therapy. The objective of this study was to determine the predictive value of risk algorithms on early and late outcomes in this select group of patients.**

***Methods:* Between 1999 and 2009, 394 octogenarians underwent AVR (178, 45%) or AVR/CABG (216, 55%) at our institution. Mean age was 83 +/- 3 yrs; 209 (53%) were male and 388 (98%) received a bioprosthesis for predominantly aortic stenosis (385, 97%).**

The expected hospital mortality was calculated using the STS predictive risk of mortality (STS) and Logistic EuroSCORE (LES) algorithms. The STS and LES scores were further divided into low (STS<5.0%, LES <10%), medium (STS 5-10%, LES 11-20%) and high (STS>10%, LES>20%) risk groups. Mean follow-up was 4.7 yrs (range 0.8-11.4, 1699 patient-years) and complete. Parametric and non-parametric analyses were used to determine predictors of outcomes. Observed over expected (O/E) ratios were calculated.

***Results:* Hospital mortality was 32 of 394 (8.1%, AVR 7.3%, AVR/CABG 8.8%, *P*=0.5). Mean expected mortality was 6.5% (STS, O/E=1. 25) and 14.3% (LES, O/E=0. 56).**

Mean STS expected mortality in low, medium and high risk patients was respectively 3.3% (O/E=2. 3), 6.8% (O/E=1. 0) and 14.6% (O/E=0. 76); mean expected LES mortality in low, medium and high risk was respectively 8.1% (O/E=0. 61), 14.3% (O/E=0. 70) and 31.9% (O/E=0. 49). Observed mortality rates stratified by all risk groups did not differ between AVR and AVR/CABG (*P*=0. 08).

Predictors of hospital mortality included Congestive Heart failure (CHF) (*P*=0. 001), low cardiac output state (*P*=0. 001), prolonged ventilation (*P*=. 00002) and previous Cerebrovascular attack (CVA) (*P*=0. 02); predictors of late mortality were coronary artery disease (*P*=0. 002), postoperative CVA (*P*=0. 01) and Chronic Obstructive Pulmonary disease (COPD) (*P*=0. 001). STS (*P*=0. 32) and LES (*P*=0. 68) scores did not predict early or late mortality.

One, 5 and 10-yr survival was respectively 95% (AVR 96%, AVR/CABG 94%), 80% (AVR 84%, AVR/CABG 77%) and 61% (AVR 63%, AVR/CABG 59 %) (*P*=0.13).

***Conclusions:* The STS risk algorithm most closely approximates observed hospital mortality rates at different levels while LES risk algorithm often overestimated them. Neither instrument predicted early or late outcomes.**

In view of current surgical results and encouraging survival, octogenarians should not be deprived of surgery based on predictive risk assessment alone.

***Key words:* Aortic valve replacement • Octogenarian • Risk scores**

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With the advancement of medical care the projected life expectancy of the elderly people continues to rise in the developed world (1). Aortic stenosis is the number one cause of surgical valve replacement in the western countries. Severe aortic stenosis has a poor outcome if untreated, with the average survival after the onset of symptoms of 3 years. (2). Aortic valve replacement (AVR) is the gold standard for the treatment of severe symptomatic aortic stenosis. (3).As elderly patients tend to have multiple comorbidities, friable tissue and limited physiological reserve; Many of patients in this age spectrum are denied surgery based on the current risk scoring system used in cardiac surgery such as EURO score and STS score (4)(5)(6). Although percutaneous valve replacement is a valid option in this situation , patients with calculated high risk scores are often denied this alternative procedure (7) .At the same time the long term results of the percutaneous valve is not comparable to surgical aortic valve replacement. Technical advances in cardiac surgery, better myocardial protection, and improved perioperative care have enabled the safe performance of valve replacements in the high risk octogenarian population as evidenced by the progressive decrease in mortality for cardiac procedures during the last decade (8) (9). Our hypothesis is to study the predictive valve of EuroSCORE and STS score in early and late outcomes in octogenarian patients undergoing aortic valve replacement either alone or with coronary artery bypass grafting surgery.

Patients and methods

Patient population

After obtaining Ethics Review Board approval and waiver of informed consent, the data of all patients who underwent aortic valve replacement with or without coronary artery bypass grafting surgery at our institution were reviewed. This retrospective review of prospectively collected data involved the compilation of two different databases: the perioperative data base and valve clinic data base .Both data bases are subjected to periodic quality assessment for accuracy and completeness. Patients who required additional valvular or aortic surgery were excluded from this study. Between 1999 and 2009, 394 octogenarians underwent AVR (178, 45%) or AVR/CABG (216, 55%) at our institution.

Outcomes

The outcome variables evaluated separately in this study included perioperative morbidity, operative mortality and long term outcome including survival.

The Hospital mortality was defined as deaths that occur during the index hospitalization or within 30 days after surgery, plus any deaths that occur more than 30 days after surgery that were the direct result of a perioperative surgical complication.

Perioperative morbidity is defined as the presence of any of the following major complications, alone or in combination: sternal wound infection, reoperation for bleeding, prolonged ventilation for longer than 48 hours, stroke and any complication necessitating cardiopulmonary resuscitation. Perioperative myocardial infarction was defined by the appearance of new Q waves in the ECG, and or new areas of regional wall motion abnormalities at echocardiogram. Stroke was defined as any neurological deficit lasting longer than 24 hours and confirmed by neurological assessment and CT scan. Postoperative renal failure necessitated haemofiltration or haemodialysis and perioperative atrial fibrillation (occurrence of prolonged atrial fibrillation >1 hour and / or required treatment.

Scoring system

Logistic *EuroSCORE*

The operative risk expressed as percentage was calculated retrospectively for each patient by logistic EuroSCORE using Euro score risk calculator (http.www.euroscore.com). The risk factors used for the calculation are listed in table no 1 and included 3 main factors:1-patients related factors(age ,gender, COPD, extracardiac arteriopathy, neurologic dysfunction, renal dysfunction, previous cardiac surgery, active endocarditis and critical preoperative state) , cardiac related risk factors(unstable angina, left ventricular dysfunction, presence of myocardial infarction(MI), pulmonary and hypertension)and operation related factors (emergency, other than isolated CABG, thoracic aorta and surgery for post MI ventricular septal defect(VSD) (10). Logistic EuroSCORE (LES) risk stratification: Surgical risk was defined as low risk (LES < 10%), moderate risk (10% < LES < 20%), and high risk (LES > 20%).

STS score:

Over 40 clinical variables are used for risk calculation for mortality and major morbidities (11). The risk calculation is done for each patient using on line risk calculator available on line (www.sts.org). (http://66.89.112.110/STSWEBRISK-CALC261/dw.aspex). The STS score calculator (table no 1)

The STS score was defined as: Low :< 5%, Moderate : 5-10% and High risk :> 10%

The calculated scores were used to evaluate early mortality, early morbidity and long term mortality. Receiver operating curves were calculated for all scores. Observed versus predicted mortality for each tested model.

Operative technique

All procedures were performed via median sternotomy with slandered anesthetic and surgical and perioperative management protocols. Transesophegeal echocardiography was utilized in all patients. All procedures were carried out with cardiopulmo-

Preoperative Risk Factor	EuroSCORE	STS
Age	√	√
Gender	√	√
Race		√
Weight/BSA		√
IABP/inotropes	√	√
LV function	√	√
Renal disease	√	√
Lung disease	√	√
PVD	√	√
Pulmonary Hypertension	√	
Diabetes		√
Hypertension		√
Immunosuppressive therapy		√
Neurological dysfunction	√	√
Active endocarditis	√	
CHF (NYHA)		√
Angina		√
Unstable angina or recent MI	√	√
Preoperative arrhythmia		√
Angiogram details		√
Previous cardiac surgery	√	√
Combined surgery	√	√
Aortic involvement	√	√
Valve surgery	√	√
Emergency surgery	√	√
Ventricular septal rupture	√	

Comparison of Preoperative Risk Factors Risk Stratification Models

NOTES: EuroSCORE = European System for Cardiac Operative Risk Evaluation; STS = Society of Thoracic Surgeons; CABG = coronary artery bypass graft; BSA = body surface area; IABP = intraaortic balloon pump; LV = left ventricle; PVD = peripheral vascular disease; MI = myocardial infarction;.

Table No 1: Operative risk calculator

nary bypass and mild systemic hypothermia (32-34°C). Cardiac arrest was achieved with cold crystalloid (1999-2004) or blood cardioplegia (2005-2009). Coronary artery bypass grafting was performed whenever occlusive disease involved major epicardial vessels with a stenosis greater than 50%.

Statistical methods

Graphs and statistical analyses were performed using the Intercooled Stata version 9.0 (2005) statistical package (StataCorp LP, College Station, TX, USA). Continuous variables are expressed as mean +/- SD and categorical data as proportions throughout the manuscript. Parametric and non-parametric analyses were used to determine predictors of outcomes. Observed over expected (O/E) ratios were calculated. The predictive performance of each model was assessed by looking at discrimination (using receiver operating characteristic (ROC) curves) and Calibration (observed versus predicted mortality for each tested model). All tests were 2-tailed, and statistical significance was set at $P<0.05$.

Results

The demographic data of this cohort of patients are presented in table No 2. Mean age was 83 ±3 yrs; 209 (53%) were male. Type of prosthesis: 388 (98%) received a bioprosthesis for predominantly aortic stenosis (385, 97%). The common valve size used in this study was 23 and 21 (Figure No 2). Operative and postoperative characteristics are shown in table no 3 and 4.

Hospital outcomes

Postoperative outcomes are shown in Table No 4 .Aortic valve replacement with or without CABG can be performed safely in octogenarians with stroke rate 4.8%, wound infection rate 1.5%., Postoperative renal failure 4.8% and incidence of postoperative atrial fibrillation of 29.6%

Observed vs. Predicted 30-day mortality

Hospital mortality was 32 of 394 (8.1%, AVR 7.3%, AVR/CABG 8.8%, $P=0.58$). Mean expected mortality was 6.5% (STS, O/E=1. 25) and 14.3% (LES, O/E=0. 56).

Mean STS expected mortality in low, medium and high risk patients was respectively 3.3% (O/E=2. 3), 6.8% (O/E=1. 0) and 14.6% (O/E=0. 76); mean expected LES mortality in low, medium and high risk was respectively 8.1% (O/E=0. 61), 14.3% (O/E=0. 70) and 31.9% (O/E=0. 49) (Figure 1) .Observed mortality rates stratified by all risk groups did not differ between AVR and AVR/CABG ($P>0.08$). Receiver operating characteristic area under the curves were 0.40 and 0.56 for STS and Euro scores respectively, this denotes that both risk scoring systems have limited discriminative power in detecting the outcome (figure 3).**Predictors of hospital mortality** included CHF ($P=0.001$), low cardiac output state ($P=0.001$), prolonged ventilation ($P=0.0002$) and previous CVA ($P=0.02$) .STS ($P=0.33$) and LES ($P=0.68$) scores did not predict early mortality (Table No 5).

Preoperative Characteristics	All patients	Isolated AVR	AVR+CABG	P
Number of Patients	394	178	216	NA
Age (yrs)	82.94 ±1. 95	82.98±2.00	82.91±1.90	0.76
Male	209 (53%)	79 (44%)	130 (60%)	. 001
Diabetes	79 (20%)	29 (16%)	50 (23%)	0.09
Hypertension	279 (70.8%)	147 (82.5%)	132 (61%)	0.18
Preoperative Stroke	7 (1.7%)	2 (1.1%)	5 (2.3%)	0.37
COPD	45 (11.4%)	24 (13.4%)	21 (9.7%)	0.24
Preoperative Creatinine	103.93±42.14	98.21±30.75	108.64±48.91	0.014
CHF	19 (4.8%)	10 (5.6%)	9 (4.1%)	0.50

**P value: comparing AVR versus AVR+CABG*
Data presented as Mean +/- SD , or number and percentage
CHF=congestive heart failure, COPD=chronic obstructive pulmonary disease

Table No 2: Clinical Characteristics of Patients

Operative Characteristic	All patients	Isolated AVR	AVR+CABG	P
Preop AV area (cm2)	0.70 ±0. 22	0.68±0.21	0.72±0.23	0.07
Preop Aortic Peak Gradient (mmHg)	73.23±28.40	77.66±29.07	69.58±27.63	0.01
LVEF %	0.53+0.12	0.53±0.12	0.52±0.11	0.25
PASP	40.16±10.36	40.60 ±11. 12	39.80±9.74	0.41

**P value: comparing AVR versus AVR+CABG*
Data presented as Mean +/- SD .
LVEF left ventricular ejection fraction, PASP: pulmonary artery systolic pressure

Table No 3: Echocardiography Characteristic

Postoperative Characteristic	All patients	Isolated AVR	AVR+CABG	P value*
Hospital mortality=N (%)	32 (8.1%)	13 (7.3%)	19 (8.7%)	0.58
Duration of Ventilation (Hours)	64.95 ± 67.24	55.15 ± 148.50	73.03± 180.81	0.75
ICU stay (Days)	4.877±8.80	4.18± 7.84	5.44± 9.49	0.94
Length Of Stay (Days)	15.62 ± 15.20	17.57 ±13. 69	17.00±17.64	0.99
Postoperative LCOS	142 (36%)	59 (33%)	83 (38.4%)	0.05
Stroke=N (%)	19 (4.8%)	8 (4.4%)	11 (5%)	0.78
Atrial Fibrillation =N (%)	117 (29.6%)	56 (31.4%)	61 (28.2%)	0.48
Postoperative renal failure=N (%)	23 (5.8%)	9 (5%)	14 (6.4%)	0.02
Wound infection=N (%)	6 (1.5%)	3 (1.6%)	3 (1.3%)	0.89
Tracheostomy =N (%)	15 (3.8%)	5 (2.8%)	10 (4.6%)	0.34

**P value: comparing AVR versus AVR+CABG*
Data presented as Mean +/- SD, or number and percentage
ICU: intensive care unit, LCOP: low cardiac output,

Table No 4 : Postoperative Characteristic

Variable	OR	95%CI	P value
CHF	4.05	1.58-037	0.001
Low Cardiac Output	2.25	1.23-4.11	0.001
Prolonged Ventilation	4.36	1.51-2.56	0.0002
Previous CVA	2.06	0.45-9.39	0.02
STS	1.05	0.95-1.16	0.33
Euro Score	0.38	0.003-43	0.68

Abbreviations: CVA=cerebrovascular attack, CHF=congestive heart failure, COPD=chronic obstructive pulmonary disease, STS =society of thoracic surgery score

Table No 5: Predictors of Hospital Mortality on Multivariate Analysis

Variable	OR	95%CI	P value
CHF	4.05	1.58-037	0.001
Low Cardiac Output	2.25	1.23-4.11	0.001
Prolonged Ventilation	4.36	1.51-2.56	0.0002
Previous CVA	2.06	0.45-9.39	0.02
STS	1.05	0.95-1.16	0.33
Euro Score	0.38	0.003-43	0.68

Abbreviations: CVA=cerebrovascular attack, CHF=congestive heart failure, COPD=chronic obstructive pulmonary disease, STS =society of thoracic surgery score

Table No 5: Predictors of Hospital Mortality on Multivariate Analysis

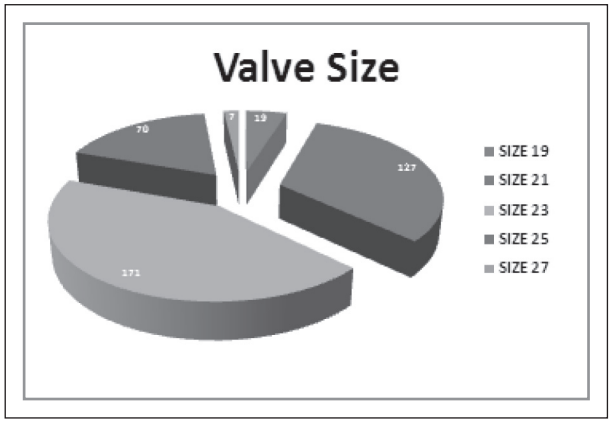


Fig. No 1. Valve sizes

Fig. 1: The graph shows the mean valve size was 23 followed by 21; small number of patients had size 19 or 27 inserted.

Predictors of late mortality were coronary artery disease (*P*=0. 002), postoperative CVA (*P*=0. 01) and COPD (*P*=. 001). STS (*P*=0. 28) and LES (*P*=0. 45) scores did not predict late mortality (Table No 6).

Survival

One, 5 and 10-yr survival was respectively 95% (AVR 96%, AVR/CABG 94%), 80% (AVR 84%, AVR/CABG 77%) and 61% (AVR 63%, AVR/CABG 59 %) (P=.13). (Table No 3) (Figure **3)**

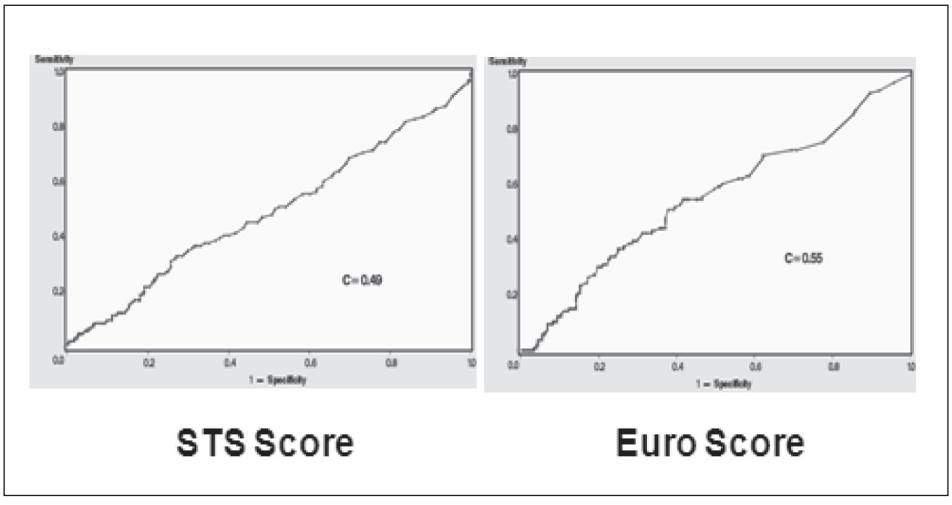


Figure No 2. Area under curve for EURO and STS score

Fig. 2. The graphs show The AUC for both EURO score and STS are around 0.5 , which means poor predictive ability of both risk score algorism in prediction of the outcome

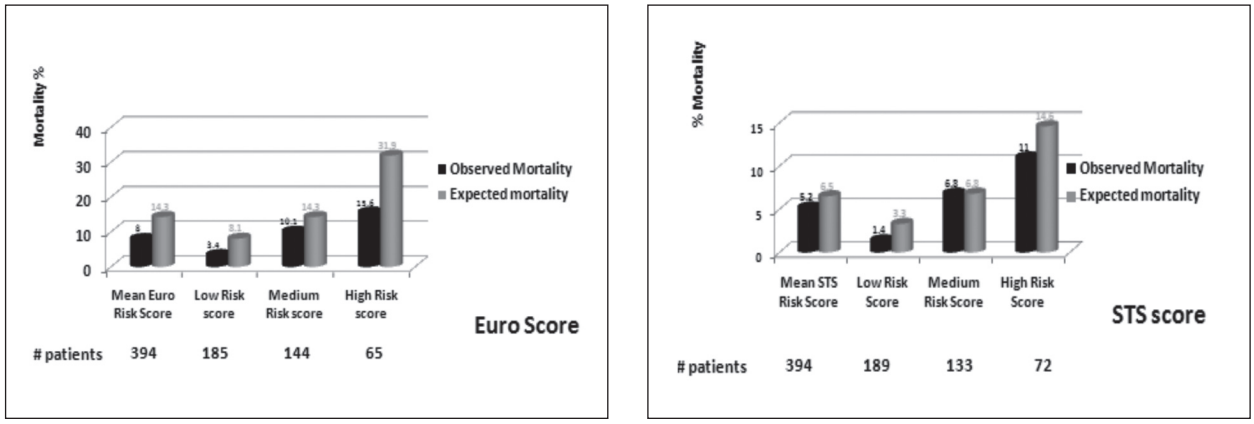
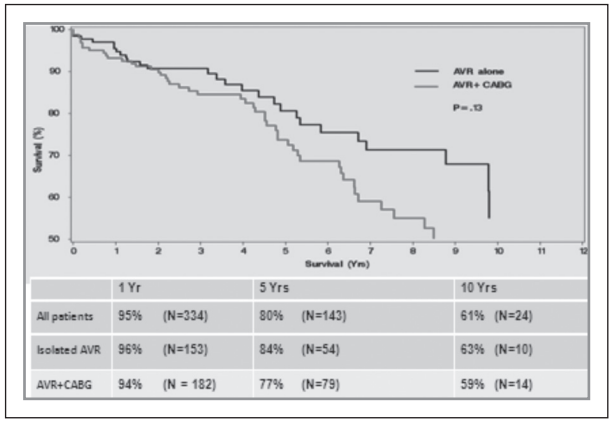


Fig. No 3. Observed versus Expected Mortality

Fig. 3. Graph show the observed over expected mortality rate for Euro score and STS score



	1 Yr	5 Yrs	10 Yrs
All patients	95% (N=334)	80% (N=143)	61% (N=24)
Isolated AVR	96% (N=153)	84% (N=54)	63% (N=10)
AVR+CABG	94% (N = 182)	77% (N=79)	59% (N=14)

Fig. No 4. Survival Curves:

Fig. 4. Graph shows the cumulative survival rate of octogenarian patients after aortic valve replacement alone (black line) or with coronary artery bypass grafting surgery (red line)

Discussion

Life expectancy is generally increasing in the western countries and this also true for octogenarian population. Life expectancy is estimated to be 8.1 years at 80 years of age and 6 years at 89 years of age (1) (12). An increasing number of octogenarian patients are referred for surgical replacement of the aortic valve. These patients often have multiple comorbidities, such as renal insufficiency, chronic obstructive pulmonary disease, peripheral vascular disease, cerebrovascular diseases, and general frailty. The decision to undergo surgery for these patients are complex and many of them are considered high risk patients and are either denied surgery or recently considered for percutaneous valve replacement alternative. However, Long term results of TAVI still unknown (13) (14). In a recent report more than 40% of the patients either refused AVR or were not proposed for AVR, although an operation was recommended on the basis of both current and prevailing guidelines (15). The results of aortic valve replacement with or without CABG are encouraging with acceptable perioperative risk and long term survival (12)(16).In this study 30-day mortality was : 32 of 394(8.1%)for all the cohort of patients ,isolated AVR has hospital mortality of 7.3% while combined AVR/CABG has hospital mortality 8.8%.This figures are in agreement with what reported in previous literatures. Bridges et al (17) reported 7.1% hospital mortality for patients 80 years or more who had a valve replacement included in the STS database .In a European study of the United Kingdom heart valve registry , hospital mortality was reported 6.6% for all patients who required aortic valve replacement either alone or combined with another procedure (18).

The purpose of this study was to evaluate two commonly used cardiac surgical risk scores with regard to their validity in a large single-institute patient population. At present, there is an easy to use online calculator for STS score (www.sts.org)and Euroscore(www.euroscore.org). Both risk scorer are commonly used in Europe as well as North America and both was found generally reliable in risk calculation (10) (19). In contrast to the EuroSCORE, the data entry required for the STS calculator is far more detailed and extensive. The mortality is the primary outcome in both models. However, the STS database has also been used to produce models that can calculate a wide variety of endpoints. Such as composite morbidity and 30-day mortality, length of stay, neurologic injury, prolonged ventilation, deep sternal wound infections, reoperation and renal failure.(20,21). The accuracy of the EuroSCORE risk stratification system is debated, particularly in higher risk populations (21).

We studied the validity of both risk scoring models in octogenarian population .We found that STS score is better in predicting the hospital mortality while EuroSCORE tends to overestimate it, although it is a simpler model. Both risk score models failed to predict the early or late outcomes .

In their study that included 4400 CABG patients, Nilsson et al. found the EuroSCORE is better in predicting mortality compared to the STS model with an actual mortality rate of 1.89%, the EuroSCORE area under the curve (AUC) was 84% vs. 71% for the STS (22). This also was demonstrated by others (10). However these studies only included CABG patients and included younger patients, this suggested that Euroscore may work well in CABG patients with moderate risk .The STS score is more comprehensive with over 40 clinical variable and many valve related variables, so it is expected that it works well in higher risk patients who need valve surgery.

In the current study we found STS score is more accurate in estimating the hospital mortality compared with Euro score; however both scores were not accurate in predicting early or long term outcomes. In agreement with our results Wendt etal 2009(23) in their study that included 652 patients undergoing isolated AVR, found that the EuroSCORE highly overestimates mortality, whereas the STS score seems to be actually more suitable in assessing perioperative mortality for these patients. EuroSCORE greatly overpredicts mortality in octogenarian or non octogenarian patients who are considered at high risk for AVR . The mean logistic EuroSCORE in this study was 17.2% while actual hospital mortality was 7.8% (23) .It was also reported that EuroSCORE is overestimating the risk for patients referred for TAVI procedures (7).

In their study, Grossi et al 2008 (24) studied 731 patients (331 of them were octogenarian) who underwent AVR , they reported 7.8% operative mortality while it was 17.2% as predicted by Logistic EuroSCORE giving an observed over expected mortality ratio of 0.45.

Leontyev et al 2009 (25) studied the predictive value of EuroSCORE in 282 octogenarian patients, they found that AVR can be done safely in those patients with in-hospital mortality was 7.5% (low risk), 12.6% (moderate risk), and 12.5% (high risk) with good 1,5 and 8 years survival . EuroSCORE risk stratification was imprecise for prediction of perioperative mortality among octogenarian patients.

Maslow et al found that the STS score slightly overestimated the mortality risk of low and medium risk category but not high risk category while the Logistic EuroSCORE was overestimating the observed mortality in octogenarian patients who underwent AVR with or without CABG at all the three levels of risk categories .Both risk scoring algorithms were not predictors of short or long term mortality.

We found that AVR with or without CABG can be done safely with acceptable risk, this also was demonstrated Piérard et al 2011 (14) by who found that AVR can be performed at acceptable risks in octogenarian patients AVR restores an almost normal life expectancy. By contrast, patients treated conservatively have a twofold excess mortality compared with AVR patients.

Our data showed that in this series the stroke rate 4.8%, wound infection rate 1.5%.postoperative renal failure 4.8% and incidence of post operative atrial fibrillation of 29.6%. **Multivariable logistic analysis showed that the Predictors of hospital mortality** were CHF, low cardiac output state , prolonged ventilation and previous CVA while **Predictors of late mortality** were coronary artery disease, postoperative CVA and COPD .Our results are in accordance to previously published reports (9,24-26)

Neither EuroSCORE nor STS were predictors for early or late mortality. This suggests that octogenarians with severe AS should not denied AVR based on risk calculation alone. There is a need for better risk calculator for those populations, until this risk model is found clinical judgment and frailty index can be used to aid decision making for surgical intervention in octogenarian patients requiring aortic valve replacement

Limitations

Although this study included a large number of patients and analysis based in 2 verified data bases, It has the limitations of a retrospective study and being a single center study.

Conclusion

The STS risk algorithm most closely approximates observed hospital mortality rates at different levels while LES risk algorithm often overestimated them. Neither instrument predicted early or late outcomes.

In view of current surgical results and encouraging survival, octogenarians should not be deprived of surgery based on predictive risk assessment alone.

Abbreviations

AVR : Aortic valve replacement

CABG: coronary artery bypass surgery

CHF: Congestive Heart failure

COPD: Chronic Obstructive Pulmonary disease

CVA: Cerebrovascular attack

LES: Logistic EuroSCORE

MI : Myocardial Infarction

O/E: Observed/Expected

STS : Society of Thoracic Surgery

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Descending Necrotizing Mediastinitis; Surgical Outcome after Early and Radical Drainage

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Background: **Descending necrotizing mediastinitis (DNM) is a virulent form of mediastinal infection requiring early diagnosis and treatment to reduce the high mortality. Early aggressive surgical drainage and antibiotic therapy are essential for treatment.**

Methods: Nine patients with DNM were managed surgically at King Faisal and King Abdulaziz specialized Hospital, Altaif, Saudi Arabia. Surgical treatment was carried out by cervical drainage alone or associated with mediastinum drainage through a thoracic approach for radical surgical debridement of the mediastinum with complete excision of necrotic tissue, decortications (if needed) and pleural drainage with adequate chest tubes for mediastino-pleural irrigation.

Results: **Two patients out of 9 classified as type I and was treated only by cervical drainage. 6 patients (66.6%)was classified as type II and was treated by cervical drainage plus thoracotmy and mediastinal drainage, one patient out of the 6 needs bilateral thoracotomy and mediastinal drainage who died due to septicemia and multiple organ failure. One patient classified as type III was treated by cervical drainage plus thoracotmy and mediastinal drainage and laparotomy because of spread of infection to peritoneal cavity, patient died due to septicemia and multiple organ failure. Mortality rate was 11.1% (one patient).**

Conclusion: **Early diagnosis and surgical management of DNM is essential to reduce mortality and get good outcomes.**

Keywords: **Descending necrotizing mediastinitis, surgical management, cervicotomy, thoracotomy.**

Acute mediastinitis is a severe infection of the mediastinal connective tissue that fills the interpleural mediastinal space and its thoracic structures. It can also occur as a complication of primary oropharyngeal infection progressing to the cervical region and spreading through the fascia to the mediastinum. In the latter case, the disease is termed descending necrotizing mediastinitis (DNM).[1]The esophageal and aortic hiatuses represent potential routes of spread into the peritoneum and retro-peritoneum. The diagnostic criteria of DNM were defined by Estrera in 1983[2] including; clinical manifestations of severe infection; characteristic roentgenographic features (mediastinal widening on simple on chest X-ray and non-capsulated fluid collections or abscesses with gas bubbles on chest computed tomographic CT); documentation of necrotizing mediastinal infection at operation or postmortem examination, or both and establishment of the involvement of the necrotizing mediastinal process.

Despite the introduction of modern antimicrobial therapy and CT imaging, this form of mediastinitis has mortality rates reported between 25% and 40% in the literature.[3]This poor prognosis could be due to the difficulty in establishing adequate surgical drainage as DNM spreads among the fascial compartments of the neck and chest. Delay of diagnosis and inappropriate drainage of the mediastinum are the main causes of mortality in this life-threatening condition. Early diagnosis and aggressive surgical drainage are very important for successful treatment of descending necrotizing mediastinitis.[4]

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Complications of DNM include; abscesses, bilateral empyema, pleural and pericardial effusions, pneumonia, acute respiratory distress syndrome, intra-thoracic hemorrhage, pleuro-oesophageal fistula, and cardiac tamponade. Reported vascular complications include internal jugular and brachiocephalic venous thrombosis and carotid artery pseudo-aneurysm.[5]

Endo and coworkers[6], proposed classifying DNM into three groups on the basis of infection extension: type I, infection localized in the upper mediastinum above the tracheal bifurcation and not always requiring aggressive mediastinal drainage; type II A, infection extending to the lower anterior mediastinum; and type II B, infection extending to the anterior and lower posterior mediastinum and demanding complete mediastinal drainage.

In this study 9 patients were evaluated for the outcome of our management strategy in the treatment of DNM.

Patients and Methods

A retrospective study of 9 patients diagnosed as DNM were managed at King Faisal and King Abdulaziz specialized Hospital, AlTaif, Saudi Arabia from January 2005 to August 2011. Our strategy in management includes; early diagnosis, adequate antibiotic coverage, and effective drainage of pus.

DNM was diagnosed by clinical findings; the primary infection as oropharyngeal, peritonsillar abscess or odontogenic abscess in addition to signs appeared in cervico-thoracic and upper abdominal CT that shows: soft-tissue swelling of the neck, mediastinal encapsulated fluid collections, pleural collection, peritoneal collection or mediastinum abscess. Follow-up CT was performed to assess the adequacy of therapy.

We classified our patients according to the extent of DNM as follows: type I: localization of abscess in the upper mediastinum above the tracheal bifurcation; type II: extension to the lower mediastinum; type III: extension from neck outside the mediastinum into pleural space or peritoneal cavity. Infection study was done for all patients, including blood culture before starting antibiotics and cultures for any collected fluids aspirated from neck abscess, the pleural cavity, peritoneal cavity or mediastinum by ultrasound or CT guided aspiration. All patients were received broad-spectrum antibiotics empirically as soon as DNM was suspected and adjusted according to culture and sensitivity tests. We often used two types of antibiotics simultaneously for covering both aerobic and anaerobic bacteria.

Surgical treatment in the form of cervical drainage was performed for all patients either alone or combined with thoracotomy and mediastinal drainage.

Cervical drainage was usually approached through an incision anterior to the sternomastoid muscle or a collar bilateral incision. The involved cervical spaces and submandibular spaces in odontogenic cases were opened followed by debridement of necrotic tissue and drainage with insertion of Penrose drains catheters.

Mediastinal drainage was performed through a thoracic approach usually from the right thoracic cavity because the aortic arch interferes with radical debridement from the left side, but we had two patients underwent bilateral thoracotomy for surgical drainage due to extension of infection. Surgical treatment included radical surgical debridement of necrotic tissue of the mediastinum and decortications if needed. According to the severity of disease, one or two chest tubes were inserted for mediastino-pleural irrigation. In one case, laparotomy was done for drainage and irrigation of the peritoneal cavity due to extension of infection to peritoneum with insertion of drainage suction tube.

Mediastinum and thoracic cavity irrigated with warm saline Petadine 10% (approximately 2000 ml) during the operation. The duration of irrigation and drainage was dependent on clinical progress, a return to normal CT scanning aspects and the results of the cultures of fluids aspirated from the mediastinal tubes.

Results

Nine patients diagnosed as DNM included in this study, 7 were males and 2 females. Patients' age ranged from 26 to 53years with mean age 40 years. Mortality rate was 11.1% (one patient) because of severe septicemia with multiple organs failure. Common symptoms at hospitalization were fever accompanied with one or more of the following symptoms; neck swelling, mandiblular swelling, dyspnea, sore throat and dysphagia. The site of primary infection were parapharyngeal abscess in 2 patients, post-extraction odontogenic abscess in 5 patients, cervical abscess in one patient and one patient without obvious cause. The time between onset of symptoms and the hospitalization varied from 1 to 5 days with the mean 3.6 days.

Fluid culture from the neck and mediastinum was done for all patients; the result showed a mixed infection of aerobic and anaerobic with streptococci as a common organism plus or minus bacteroides, kelbsiella, pseudomonas aeruginosa and E.coli.

Chest X-ray and CT were done in all patients; the result showed widening of the mediastinum and pleural effusion, while three of them additionally had a pneumo-mediastinum. We had two cases type I; six cases type II and one case type III, the time between hospitalization and surgery varied from 1 to 4 days.

Cervical drainage only was done in 2 cases, cervical drainage and thoracotomy in one setting done in 4 cases, one patient had cervical drainage, thoracotomy and laparotomy drainage in one setting. Two patients had cervical drainage and needs thoracotomy after 0 to 3 days (table 1).

Surgical approach	No.	%
Cervical	2	22.2
Cervical + Rt. Thoracotomy	4	44.4
Cervical + Bilateral thoracotomy	2	22.2
Cervical + Bilateral thoracotomy + Laparotomy	1	11.1

Table 1. Surgical approaches.

The post-operative outcome was good for all patients which displayed in table 2. Mechanical ventilation was provided in all cases, the mean duration of ventilation was 16±7hours. On the third day post-operatively; mediastinal residual abscess was detected in one patient by post-operative CT, so re-thoracotomy was done to complete the drainage. The mean duration of chest tube retention was 15±8.3 days, and the mean hospital stay was 32.3±14.9 days.

	The mean
Mean duration of ventilation	16±7 hours
Mean duration of chest tube insertion	15±8.3 days
Mean hospital stay	32.3±14.9days

Table 2: Postoperative outcomes.

Discussion

Descending necrotizing mediastinitis is a rare and serious form of mediastinal infection requiring prompt diagnosis and treatment to reduce the high mortality associated with this disease.[7]

DNM remains a life-threatening infection. An improved understanding of the natural history of this infectious process and the relevant anatomy continue to promote improvements in therapy for affected patients.[8]

In the pre-antibiotic era, Pearse[8] recorded 110 patients with mediastinitis from cervical infections; 21 of these cases resulted from oropharyngeal infections, with 55% mortality rate (86% mortality in non-operative patients and 35% in surgical patients), while according to the review of Estrera and associates[2] they reported a 40% mortality rate in the antibiotic era. Intravenous broad-spectrum antibiotic therapy alone is not efficient without adequate surgical drainage of the cervical and mediastinal collections, extensive debridement and excision of necrotic tissue and wide mediastino-pleural irrigation.[9]

Until the 1980s, the main treatment strategy was trans-cervical mediastinal drainage,[10] but since the 1990s, early aggressive drainage by thoracotomy has been advised by many authors like Marty-Ane and associates[11] who reported that delayed diagnosis and inadequate drainage are the main causes of the high mortality rate in DNM. Routine use of the CT scan is highly recommended in patients with a deep cervical infection for early detection of mediastinitis at a time when the chest roentgenogram is still normal. The CT scan accurately defines the extent of spread of the septic process and is a valuable guide to plan adequate surgical drainage. The most common anatomic pathway is the lateral pharyngeal space through the retrovisceral space, inferiorly into the mediastinum.[11]

Corsten and coworkers[12] found a statistically significant difference in survival between patients underwent trans-cervical mediastinal drainage (53%) versus that receiving trans-thoracic mediastinal drainage (81%) in a subsequent meta-analysis. However, the necessity of thoracotomy especially when localized in the upper mediastinum remains controversial. Because DNM often spreads rapidly and insufficient drainage cannot protect against the progression, we performed thoracotomy for all our patients in type II (those with extended infection to the lower mediastinum anteriorly or posteriorly), and this considers one of the causes of our good outcome with lower mortality.

Endo and associates[6] classified DNM into three types according to the extension of DNM as diagnosed by CT, and proposed differential surgical management according to this classification. They insisted on a trans-cervical approach for type I (localized in the upper mediastinum above the tracheal bifurcation), on irrigation through subxiphoidal and cervical incisions with additional percutaneous thoracic drainage for type IIA (extending to the anterior lower mediastinum), and on complete irrigation and debridement of the entire mediastinum through a standard thoracotomy for type IIB (extending to the anterior and posterior lower mediastinum).

Freeman and associates[13] insisted that standard posterolateral thoracotomy was the best approach because it allows good access to a hemithorax including the ipsilateral mediastinum and pericardium. Successful management through median sternotomy or clamshell incisions has been reported in the series of Rib and associates[14] who used the clamshell incision for bilateral decortications and drainage, they stated that the clamshell incision offers an excellent exposure for a complete one-stage operation with debridement of all affected tissues with the mediastinum and both pleural cavities, but it should be used with caution in unstable, critically ill patients. However, the risk of subsequent osteomyelitis of the sternum should be considered, so we avoid this technique in our study because of the high risk of sternal osteomyelitis and the risk of phrenic nerve palsy.

Several authors have reported using video-assisted thoracoscopic surgery (VATS).[15] VATS can provide effective drainage for DNM, but after the mediastinal pleura has been opened, because residual empyema can occur because the cervical pus readily descends into the pleural cavity through

the mediastinum. However it is controversial whether VATS obtains sufficient drainage and irrigation for severe cases.[16]

In our study we have lower mortality and good surgical outcome in comparison with other studies because of the following: all our patients were nearly in middle age; all our patients had no history of any chronic illness; surgical interference was early and aggressively for all patients.

Conclusion

Early diagnosis and surgical management of DNM is essential to reduce mortality and get good outcomes. Our surgical policy has allowed us to maintain good results with lower mortality rate (11.1%) in a series of 9 patients with this highly lethal disease.

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Intraannular Versus Supraannular Position of the Aortic Valve Prosthesis, Does it affect the Redo Surgery?

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Background: **Since the introduction of valve replacement surgery in the early 1960s the outcome of patients with valvular heart disease has dramatically improved and survival after valve replacement has also improved. Consequently, the rate of redo valve replacement surgery due to different indications is also increasing.**

Patients and Methods: **This study was carried out during the period from January 2010 to December 2011 and included 26 patients had been subjected before to aortic valve replacement (AVR) and required redo AVR. Patients were classified into 2 groups; group1: 14 patients with intraannular position of the aortic valve prostheses and group 2: 12 patients with supraannular position of the aortic valve prostheses.**

Results: **Aortic cross clamp time and cardiopulmonary bypass time were longer in group 2 (102.9 ± 16.7 and 129.2 ± 19.9 min) respectively than group 1 (89.6 ± 14.9 and 113.9 ± 16.8min) also some technical difficulties were encountered in group 2 and not in group 1. Mortality was 2 cases from group 2 and 1 case from group 1. Operative reports for primary surgery were deficient for both groups.**

Conclusions: **Supraannular position of the aortic valve prosthesis with the Teflon pledgets put towards the ventricular side is one of the technical difficulties added to redo aortic valve replacement.**

Key words: **Aortic valve replacement, Redo cardiac surgery, suprannular aortic prosthesis. Aortic valve prosthesis.**

Since the introduction of valve replacement surgery in the early 1960s the outcome of patients with valvular heart disease has dramatically improved. Approximately 280 000 valve substitutes are now implanted worldwide each year; approximately half of which are mechanical valves and half are bioprosthetic valves (1). Consequently, the rate of redo valve replacement surgery due to different indications is also increasing.

The overall survival for reoperative heart valve surgery is reported as 65% at 5 years, 51% at 10 years, 47% at 15 years and 42% at 20 years and this means that surviving patients have a low risk of death (4%) per year (2). Some authors report on a significantly increased risk of a redo prosthetic exchange of mechanical heart valves compared with the replacement of the tissue valves (3).

In order to reduce the perioperative risk for redo AVR, reoperation at an earlier stage (immediately when the prosthetic dysfunction has been identified) before occurrence of numerous risk factors is desirable. This requires a closer and more accurate patient follow up leading to an earlier and more optimal timing for reoperation (4, 5).

The technique for implantation of mechanical valves and that for stented bioprostheses is basically the same. It is based on fixation of the valve sewing ring into the patient's annulus. The fixation can be achieved by means of various modifications of single or continuous sutures. Isolated single stitches and figure of eight stitches were used in the past. This technique enabled good intraannular implantation of the valve. Pledgeted stitches were introduced in mid-1980s, and since then mattress stitches with

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pledgets placed supraannulary or subannulary or continuous stitches were the most frequently used techniques (6).

The aim of this study was to compare the effect of the aortic valve position, either intraannulary or supraannulary, and type of sutures during primary aortic valve replacement on the second surgery for redo aortic valve replacement.

Patients and Methods

After approval of the institutional ethical committee, this study was carried out during the period from January 2010 to December 2011 and included 26 patients had been subjected before to aortic valve replacement (AVR) and required redo AVR whatever the indications of the redo surgery.

Exclusion criteria of this study were patients subjected to any associated other cardiac surgeries with the redo AVR such as other valve replacement or repair, replacement of the ascending aorta and coronary artery bypass grafting CABG.

Patients were classified into 2 groups according to the position of the aortic valve prostheses during the primary surgery; group1: patients with intraannular position of the aortic valve prostheses using mattress sutures with Teflon pledgets (if used) put towards the aortic side and group 2: patients with supraannular position of the aortic valve prostheses using mattress sutures with Teflon pledgets (if used) put towards the ventricular side.

Operative technique

Redo AVR was done through standard median sternotomy using oscillating saw with precautions taken during resternotomy to avoid cardiac injury and dissection of the adhesions from the previous surgery was done carefully to allow conventional surgical approach for AVR. Cannulation of the heart was done using suitable size aortic cannula in the ascending aorta, single venous cannula in the right atrial appendage, right superior pulmonary vein cannula to the left ventricle for intraoperative suction and deareation of the heart, aotic root cannula and/or coronay sinus cannula for delivering both antegrade and/or retrograde cardioplegia solutions. Aortic cross clamp was applied and cold crystalloid cardioplegia and topical ice slush were used as the procedures were performed in mild hypothermia (28 - 32 ºC). Aortotomy was done and removal of the previous prosthesis was done very carefully to avoid dropping of sutures or Teflon pledgets in the left ventrivle. After complete removal of the previous prosthesis, complete debridement was done for the infected tissues if present and meticulous inspection and several times wash of the left ventricle were done as much as possible. Fixation of the new prosthesis was done either in intraannular or supraannular position using Teflon bledget 2/0 Ethibond interrupted mattress sutures. Closure of the aortotomy, deairing and decannulation of the heart and closure of the wound were done.

Preoperative data of the patients included age, sex, myocardial function, original disease for aortic valve, indications for redo AVR, type of the primary prosthesis, duration from the primary to redo procedure and revision of the operative details written in the report of the primary surgery.

Operative data of the patients included urgency of surgery, position of the primary prosthesis (intraannular or supraannular), if there were Teflon pledgets used with sutures of the primary surgery or not, aortic cross clamp time and cardiopulmonary bypass time, type and size of implanted prosthesis, intraoperative technical difficulties and mortality.

Postoperative data of the patients included duration of inotropic support, the use of intraaortic balloon support, duration of mechanical ventilation, postoperative complications and mortality.

Also, all operative reports for the primary surgery were evaluated for the specific information included in them regarding type and size of prostheses, the position of the aortic prosthesis (intraannular or supraanular), the type and number of sutures used for implantation of the aortic prosthesis, the use of Teflon pledgets in the sutures and the number of Teflon pledgets used.

Results

During the period of study 26 patients fulfilled the inclusion criteria and were classified into 2 groups according to the position of the aortic valve prostheses during the primary surgery; group1: include 14 patients with intraannular position of the aortic valve prostheses and group 2: include 12 patients with supraannular position of the aortic valve prostheses.

Preoperative data (table 1) showed that there were no statistically significant differences between the 2 groups regarding age, sex, myocardial function, original disease for aortic valve, indications for redo AVR, type of the primary prosthesis, duration from the primary to redo procedure. Most of the cases in both groups had rheumatic disease of the heart. The valves implanted in the primary surgeries were mechanical in all patients in this study and indications for redo surgery were all non structural dysfunction in the form of valve thrombosis, infective endocarditis with vegetations on the valve or pannus formation with valve obstruction.

Operative data of the patients (table 2) showed that most of the redo procedures were elective in both groups and Teflon bledgets were not used routinely in all cases during primary surgery for AVR in this study.

In this study all the redo AVR in both groups were done using mechanical prosthesis and there were statistically significant differences between the 2 groups regarding aortic cross clamp time and cardiopulmonary bypass time.

		Group 1 n = 14	Group 2 n = 12	P value
Age (years)		40.7 ± 6.8	41.4 ± 8.1	> 0.05
Sex	Male	6 (42.8%)	6 (50%)	> 0.05
	Female	8 (57.2%)	6 (50%)	
Ejection fraction EF		57.6 ± 7.2	55.6 ± 9.2	> 0.05
Original disease of aortic valve	Rheumatic	12 (85.7%)	12 (100%)	> 0.05
	Others	2 (14.3%)	0	
Indications for redo surgery	Thrombosis	3 (21.4%)	3 (25%)	
	Infective endocarditis	6 (42.8%)	4 (33.3%)	> 0.05
	Pannus	5 (35.7%)	5 (41.7%)	
	Structural dysfunction	0	0	
Type of valve	Mechanical	14 (100%)	12 (100%)	> 0.05
	Bioprosthesis	0	0	
Duration from primary to redo surgery (years)		6.8 ± 4.1	7.1 ± 4.3	> 0.05

Table 1. Preoperative data of the patients.

		Group 1 n = 14	Group 2 n = 12	P value
Redo surgery	Elective	10 (71.4%)	10 (83.3%)	> 0.05
	Urgent	4 (28.6%)	2(16.7%)	
	Emergent	0	0	
Teflon pledgets in primary surgery	Yes	11 (78.6%)	10 (83.3%)	> 0.05
	No	3 (21.4%)	2 (16.7%)	
Cross clamp time (min)		89.6 ± 14.9	102.9 ± 16.7	< 0.05 *
Cardiopulmonary bypass time (min)		113.9 ± 16.8	129.2 ± 19.9	< 0.05 *
Prosthesis implanted	Mechanical	14 (100%)	12 (100%)	> 0.05
	Bioprosthesis	0	0	
Size of Prosthesis implanted		21.8 ± 1.8	21.2 ± 1.6	> 0.05
Intraoperative mortality		0	0	

Table 2. Operative data of the patients. **** significant***

Although there were no statistically significant differences between both groups regarding intraoperative mortality but some technical difficulties were encountered in group 2 and not in group 1 in the form of difficult excision of the prosthesis from the aortic annulus as it was always encroaching on the aortic annulus and also difficulty to be sure that all of the Teflon pledgets used in the primary sutures were extracted and none of them dropped away in the left ventricle.

Postoperative data of the patients (table 3) showed that there were no statistically significant differences between the 2 groups regarding the need for inotropic support, intraortic balloon, mechanical ventilation and duration of ICU stay. But one case of cerebral stroke in group 2 was excluded from the statistics because this patient had a very long duration of mechanical ventilation and stay in ICU which would falsify the data.

	Group 1 n = 14	Group 2 n = 12	P value
Duration of Inotropic support (hours)	14.1 ± 11.1	13.9 ± 12.5	> 0.05
Intraaortic balloon required	2 (14.3%)	2 (16.7%)	> 0.05
Duration of mechanical ventilation (hours)	11.1 ± 6.3	11.6 ± 5.4	> 0.05
Duration of ICU stay (days)	2.4 ± 0.9	2.5 ± 1	> 0.05

Table 3. Postoperative data of the patients

Regarding postoperative complications, there were no statistically significant differences between both groups but there was one case of cerebral stroke occurred in group 2 and none in group 1 (table 4) Regarding postoperative mortality group 2 had higher incidence of mortality than group 1 as the only mortality in group 1 was due to low cardiac output and heart failure while the 2 cases of mortality in group 2 were one from low cardiac output and one from cerebral stroke.

	Group 1 n = 14	Group 2 n = 12	P value
Reexploration for bleeding	1 (7.1%)	1 (8.3%)	
Permanent heart block	1 (7.1%)	1 (8.3%)	> 0.05
Cerebral stroke	0	1 (8.3%)	
Sterna dehiscence	0	0	
Superficial wound infection	2 (14.3%)	2 (16.7%)	
Mortality	1 (7.1%)	2 (16.7%)	

Table 4: postoperative complications

Although there were no statistically significant differences between both groups regarding the accuracy and the fulfilled data of the operative reports, but most of the operative reports had great defects and incomplete data regarding important items such as intraannular or supraannular position of the valve and also the exact number of the sutures used for implantation of the prosthesis and whether all of them had Teflon pledgets or not (table 5).

Operative reports were available only in 11 patients of group1 (78.3%) and in 10 patients of group 2 (83.7%)

Fulfilled data in available operative reports	Group 1 n = 11	Group 2 n = 10	Total n= 21
Type of prosthesis	11 (100%)	10 (100%)	21 (100%)
Size of prosthesis	11 (100%)	10 (100%)	21 (100%)
Position of prosthesis (intraannular or supraanular)	8 (72.8%)	8 (80%)	16 (76.2%)
Type of sutures	10 (90.9%)	10 (100%)	20 (95.2%)
Number of sutures	5 (45.4%)	3 (30%)	8 (38.1%)
Teflon pledgets used or not	8 (72.8%)	8 (80%)	16 (76.2%)
Number of Teflon pledgets	2 (18.2%)	2 (20%)	4 (19%)

Table 5: Fulfilled data in primary surgery operative reports

Discussion

The number of patients undergoing reoperation for valvular heart disease is increasing significantly and will continue to increase as the general population ages (7). Aortic valve replacement in patients with a small aortic annulus is often associated with increased pressure gradients. For this reason, prostheses for supra-annular placement have been developed (8).

The patients in our study mostly had rheumatic pathology of the native valves and this explains that they were relatively younger in age and all of them had mechanical prostheses in the primary surgery.

Edmunds (9) also reported since long time that mechanical prostheses usually are selected for younger recipients because of their proven durability over time. However, the risk of anticoagulant-related bleeding, as well as thromboembolic events, in these valves is not trivial and depends on valve design, structural materials, and host related interactions.

In our study, although aortic cross clamp time and cardiopulmonary bypass time were longer in group 2 (102.9 ± 16.7 and 129.2 ± 19.9 min) respectively than group 1 (89.6 ± 14.9 and 113.9 ± 16.8min) but both of them were within acceptable limits. Christiansen et al. (10) reported that aortic cross clamp time and cardiopulmonary bypass time were longer in redo aortic valve replacement (80.4 ± 23.4 and 130.3 ± 37.1 min) respectively than primary surgery.

Many authors reported the technical difficulties in redo aortic valve replacement and mostly emphasis on sternal reopening with the risk of right ventricular injury, dissection of

adhesions around the heart, cannulation of the heart, myocardial protection and delivery of cardioplegia solution, the presence of more advanced cardiac pathology and aortic wall disease, and the existence of more frequent comorbidities (11-14).

In our study, another technical difficulties were encountered with the supraannular position of the aortic valve specially when Teflon pledgets were used in the sutures because these Teflon pledgets on the ventricular side cannot be seen and grasped before cutting the sutures so they might drop in the left ventricle and were difficult to be extracted by repeated wash of the left ventricle. Also, in some cases the Teflon pledgets number was not equal to the number of sutures so we had lost a lot of time searching for non existing Teflon pledgets. On the other hand the intraannular position when the Teflon pledgets on the aortic side were easier to be seen and grasped during cutting the sutures without the risk to be dropped in the left ventricle. Also, these technical difficulties did not encountered with non Teflon pledgeted sutures in neither supraannular nor intraannular position of the aortic prosthesis.

In our study, cerebral stroke was reported in one case from group 2 but not in group 1and CT scan of the brain showed that it was occlusive stroke denoting cerebral embolisation. Although the source of cerebral embolism cannot be defined due to multiple factors in open heart surgery but the possibility of embolisation of lost Teflon pledget in the left ventricle was present. Overall mortality in our study was 3/26 (11.5%) while with Christiansen et al. (10) it was 4/52 (7.7%) and with Leontyev et al. (15) it was 3.5%.

The other important findings in our study were that the operative reports in most of the cases were deficient and did not include some operative details that greatly influence the redo surgery such as the number of interrupted sutures used for fixation of the aortic valve in position and whether all of them had Teflon pledgets or not as some surgeons did not use Teflon pledgets in all sutures and did not include this point in the operative reports, so it was time consuming to search for non existing things in the operative field.

Limitations of this study were small number of patients that may affect the accuracy of the statistics.

Conclusions

Supraannular position of the aortic valve prosthesis with the Teflon pledgets put towards the ventricular side is one of the technical difficulties added to redo aortic valve replacement.

Recommendations

When the aortic valve prosthesis has to be implanted in supraannular position with Teflon pledgets put towards the ventricular side, operative report should include the exact number of sutures and number of Teflon pledgets used in implantation of the prosthesis.

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Early Repair of Complete Atrio-Ventricular Canal Malformations

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The ideal timing for repair of CAVC malformations remains controversial. Some authors advocate primary repair at the age of six months or earlier before the onset of irreversible pulmonary hypertension especially in the presence of Down syndrome. Others suggest two-stage repair consisting of pulmonary artery banding as a first stage followed by complete repair thereafter.

The aim of that work was to evaluate the early results of total repair of CAVCD before six months of age with the hypothesis that, with modern techniques, the current risks of CAVSD repair in children younger than 6 months and those older than 6 months are equal.

Patients & Methods: **Twenty patients (11 females 9 males) below 6 months of age with isolated CAVC *(study group*) undergone primary total repair. Another 20 patients (12 females & 8 males) with CAVC who undergone total repair above the age of 6 months were selected for comparison (*control group*), in the period between November 2009 and August 2011, at Cairo university hospitals. The mean age in the study group was 5.3±0.49 & 12± 8.5 months in the control group. While the mean body weights were 4.7 ± 0.45& 9± 2.5 Kg respectively. Nine patients of the study group (45%) and in 10 patients (50%) of the control group suffered from Down syndrome.**

Results: **There was no statistical difference in intra-operative and postoperative data between both groups, except for the duration of mechanical ventilation which was longer in the control group (48 ± 20 hours) than in the study group (36 ± 15 hours) and the incidence of recurrent postoperative pulmonary hypertensive crises which was higher in the control group (8 patients) than in the study group (4 patients).On the other hand the durations of ICU & hospital stay were higher in the study group (5±1 &10± 1.5) days respectively than in the control group (4±0.88 & 9±1.27) days respectively.**

Conclusion: **We have found no difference in operative mortality &morbidity between patients undergoing surgical repair of CAVSD at 6 months of age or younger. we believe that with modern techniques, the current risk factors for CAVSD repair in patients younger than 6 months and in those older than 6 months are equal. CAVCD should be repaired between 4 - 6 months of age.**

Keywords: **Complete atrioventricular canal defect, early primary repair, 6 months of age.**

The ideal timing for repair of CAVC remains controversial. Some authors advocate primary repair at the age of six months or earlier. Others suggest two-stage repair consisting of pulmonary artery banding as a first stage followed by complete repair thereafter. (1)

Improved surgical results after repair of CAVSD have been reported owing to refinements in surgical technique, improved myocardial protection, and a better understanding of the surgical anatomy. (2)

Also palliation with pulmonary artery banding is now seldom indicated and has been abandoned for a single-stage definitive surgical repair. Tight banding can cause

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severe pulmonary stenosis with myocardial hypertrophy, and loose banding can result in irreversible PVOD. [3]

CAVSDs are associated with high-flow systemic pressure in the pulmonary vasculature leading to fibrosis and intimal hyperplasia. This eventually leads to a reduction in the total cross-sectional area of the pulmonary vascular bed and development of pulmonary vascular obstructive disease (PVOD). [1]

The pulmonary vascular resistances along with the amount of AV valve regurgitation determine the onset of symptoms. If the peripheral vascular resistance is low, as it is normally at 6 weeks of Life, large left-to-right shunts develop through the septal defects. This in turn leads to signs and symptoms of congestive heart failure, which can also develop in the setting of severe AV valve regurgitation. About half of these patients, if left untreated, will die within the first year of life, usually from heart failure or respiratory tract infections. In those who survive, irreversible pulmonary hypertension develops and patients start developing cyanosis from advanced pulmonary vascular disease, even with mild AV valve regurgitation. [4]

Our hypothesis is that CAVSD should be repaired before the onset of irreversible pulmonary hypertension especially in the presence of Down syndrome. This is preferably scheduled before the sixth month of life especially with improvements in anesthetic and intensive care as well as surgical techniques. [5]

Aim of work

The aim of this study was to evaluate early results of primary repair of complete AV canal malformations in the first 6 months of life.

Patients and Methods

Twenty patients below 6 months of age with complete AV canal defects (**study group**) that undergone primary total repair were included. Another group of twenty patients with complete AV canal who undergone primary total repair above the age of 6 months were also selected for comparison (**control group**) ,in the period between November 2009 and August 2011, at Cairo university hospitals.

No patient in this series had previously undergone palliative pulmonary artery banding, and all repairs were done electively.

Preoperative Parameters

All patients were subjected preoperatively to complete history taking & full clinical examination. Routine preoperative investigations were done with special emphasis on Echo cardiography (cardiac dimensions, contractility, Cardiac valves, pulmonary artery pressure and the Rastelli type). Cardiac catheterization & angiography were performed when pulmonary artery pressure was systemic or near systemic to determine operability.

Intraoperative Parameters

Surgical technique

All patients were submitted to complete AV canal repair through complete (standard) median sternotomy. After heparanization, routine aorto-bicaval cannulation was done.

After going on bypass, and aorta was crossclamped, the RA was opened along the anterior aspect of the AV groove. The right Atrial wall was then suspended by 4/0 prolene stay sutures for better exposure.

From that step, three techniques were used for repair as follows:

(1) Single-patch technique: (Figure 1)

For detection of superior and inferior bridging leaflet with respect to the crest of the inter-ventricular septum, filling of the LV with cold saline was first done**.**

The common posterior and anterior leaflets of the AV valve were surgically divided to near the annulus (if were naturally not partitioned). The mitral portions of the common anterior and posterior leaflets were then approximated at their extremes by a marking suture. The cleft in mitral leaflets was then closed with simple interrupted sutures.

To close the VSD, mattress sutures were placed on the right ventricular surface of the upper rim of the ventricular septum. Theses sutures were passed through the lower rim of a pericardial patch, cut to conform to the size and shape of the VSD and primum ASD, and then theses sutures were tied.

Then, another mattress sutures were placed in the base of the new mitral leaflet and passed through the pericardial patch at an appropriate level to the position of the mitral valve during ventricular systole. These valve-fixing sutures were passed also through the adjacent tricuspid leaflets on the right ventricular surface of the patch. Testing of the mitral valve by saline was then done to ensure adequate repair.

While rewarming, the upper part of the pericardial patch was stitched to the atrial septum with a continuous suture to the right of the coronary sinus orifice, leaving the coronary sinus draining into the left atrium to avoid injury to the conduction tissue.

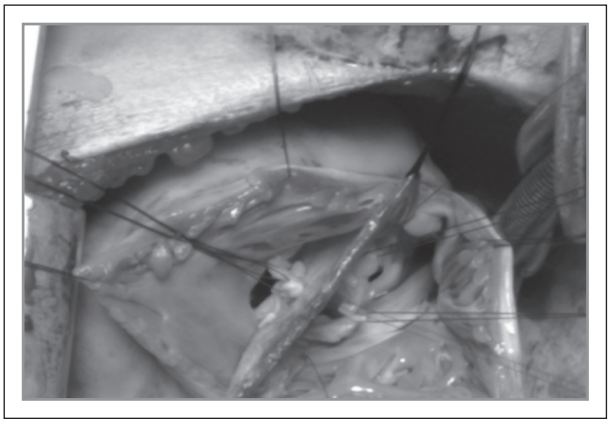

Fig 1. Single patch technique.

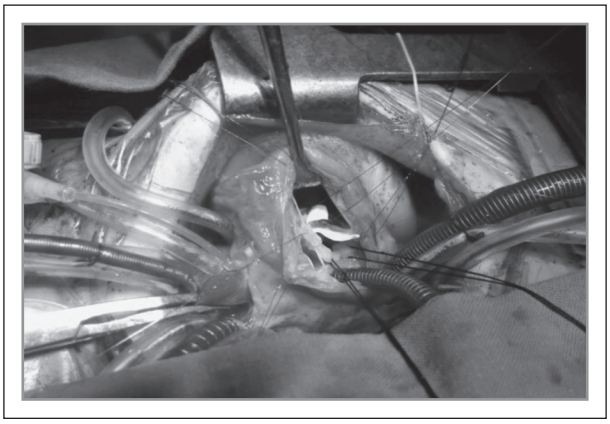

Fig 2. Double patch technique

(2) Double-patch technique (Figure2)

Stay sutures were placed in the common anterior and common posterior valve leaflets for optimum exposure. Both valve leaflets were then inspected in order to identify the point where the common anterior and common posterior leaflets meet to form the new anterior mitral leaflet and a marking suture is placed to bring these points together. This was facilitated by injection of saline under pressure in the ventricular chambers. A crescent-shaped *Gor-tex* patch was cut to the size of the VSD whose height corresponds to the point of leaflet coaptation, and its width corresponds to the distance between the two junction-points of the interventricular septum and the AV valve annulus, at the aortic valve cephalic and AV node caudal. Running sutures were placed along the right ventricular surface of the upper margin of the ventricular septal crest and passed through the patch. Posteriorly, these sutures were placed more superficially and somewhat remotely from the rim of the VSD in order to avoid the bundle of His.

A running horizontal suture line was performed at the upper rim of the VSD patch to sandwich the AV valve leaflets over the VSD. These stitches were passed through the common anterior leaflet, the VSD patch and then the common posterior valve leaflets, respectively with the aid of the previously placed marking sutures.

At that moment interrupted sutures were used to close the cleft in the new anterior mitral leaflet and testing of the mitral valve by saline was then done to ensure adequate repair.

A second patch of pericardium was used to close the primum ASD with continuous running sutures passing through the upper rim of the VSD patch then the atrial septum, leaving the coronary sinus draining into the right atrium.

A crescent-shaped Gor-tex patch was used to close the VSD

(3) Modified single-patch technique (Figure 3)

Testing, as before, was done for the detection of the borders of the cleft and the delineation of the point of coaptation of the left superior and inferior bridging leaflets.

Felted mattress sutures were placed across the top of the ventricular septum on the right ventricular surface for the VSD repair. These VSD repair stitches were passed through the AV valve leaflets in order to separate them into tricuspid and mitral components and then through the lower rim of a pericardial patch cut to the size of the ASD and finally were tied.

Multiple simple sutures were then used to close the cleft in the new anterior mitral leaflet. Then testing of the mitral valve was done by injecting saline into the left ventricle.

To complete the repair, the upper rim of a pericardial patch was attached to the atrial septum with a continuous suture leaving the coronary sinus draining into the left or right atrium.

Felted mattress sutures were placed across the top of the ventricular septum on the right ventricular surface for the VSD closure.

Fig 3. Modified single patch technique

In all techniques after finishing the AV canal repair, closure of right atriotomy was performed by running 6/0 prolene sutures. Weaning from the CPB, decannulation, homeostasis and routine closure of chest were done.

Intra-Operative Parameters:

a) Cross-clamp time, total bypass time and total operative time

b) Technique used for repair: whether single, double, or modified single-patch technique.

c) Use of inotropes after weaning from cardiopulmonary bypass.

d) Patient rhythm on going off bypass and on discharge from the operating theatre.

Postoperative Parameters:

1- Postoperative Mechanical Ventilation time.

2- Incidence of pulmonary hypertensive crisis.

3- Chest tube drainage & re-exploration for bleeding.

4- Total intensive care unit stay & total hospital stay.

5- Postoperative morbidities and in-hospital mortality (Defined as death within 30 days of the operation)

Statistical Analysis

All analyses were done using the statistical software SPSS (SPSS Inc, Chicago, IL).In addition, Univariate statistics using either a $\alpha 2$ analysis or a Fisher exact test were obtained comparing the variables: age, reoperation, mortality, Down syndrome, and gender. A significant difference was indicated at $p < 0.05$.

Data were statistically described in terms of frequencies (number of cases), relative frequencies (percentages), mean and standard deviation values (SD). All statistical calculations were done using Microsoft excel 7 computer program (Microsoft cooperation, NY, USA).

Results

Preoperative results

In the study group, the **age** ranged from 4.5 to 6 months with a mean of 5.3±0.49 months and the **body weight** ranged from 4 to 5.5 Kg with a mean of 4.7 ± 0.45Kg.

While in the control group, the **age** ranged from 8 to 36 months with a mean of 12± 8.5months and the **body weight** ranged from 7 to 15 Kg with of mean of 9± 2.5 Kg.

The rest of the demographic data of the patients, as well as the preoperative echocardiograph findings are shown in Table (1).

Preoperative data	Study group	Control group	P Value
Demographic data			
Age(Mean)	5.3±0.49m	12± 8.5m	
Weight(Mean)	4.7 ± 0.45Kg	9± 2.5 Kg	
Sex			
Male	9 (45%)	8 (40%)	Non significant
Female	11 (55%)	12 (60%)	
Down syndrome	9 (45%)	10 (50%)	Non significant
Preoperative Echo			
Rastelli type			
A	11(5%)	13 (6%)	Non significant
B	2 (10%)	1 (5%)	
C	7 (35%)	6 (30%)	
VSD size(Mean)	6 ± 1mm	5±1mm	Non significant
Common AV valve regurge			
Trivial-mild	14 (70%)	13 (65%)	Non significan
Mod.-severe	6 (30%)	7 (35%)	
Mean PAP	60± 9 mmHg	65± 9 mmHg	Non significant

There was no statistical difference between both groups as regards the preoperative echocardiographic findings. (P value > .05).

Table (1) Demographic data & preoperative echocardiograph data of the Patients.

Intraoperative results

The intra-operative surgical data were collected in both groups and represented as Table (2)

Intra-operative data	Study group	Control group	P value
Time parameters			
Total operative time	182.5+ 8min.	190+ 8.5min.	Non significant
CPB time	122 +12min.	125 +10min.	Non significant
Cross-clamp time	88+ 7.5min.	82+ 8min	Non significant
Techniques of repair			
Double-patch	8(40%)	18 (90%)	
Single-patch	4 (20%)	2 (10%)	
Modified single-patch	8 (40%)	-	
2nd degree HB	2 (10%)	1 (5%)	Non significant

Gradual **weaning from cardiopulmonary bypass** was done in all patients. **Inotropic support** in the form of Adrenaline infusion (100-200µgm/kg/h) was used in 18 patients (90%) of cases of the study group and in19 patients (95%) of cases of the control group (no statistical difference).

All patients received variable doses of **vasodilators,** in the form of Nitroglycerine infusion. Milrinone infusion (0.5 µg/kg/min) was used in 11

Patients (55%) of cases of the study group, and in 15 patients of cases of the control group. There was no significant statistical difference between the two groups.

After weaning from the cardiopulmonary bypass, the patients› rhythms were recorded in all patients: In cases of the study group, sinus rhythm was restored in 18 (90%) patients, while 2 patients (10%) showed 2nd degree heart block. In cases of the control group, sinus rhythm was restored in 19 patients (95%), while 1 patients (5%) developed 2nd degree heart block. There was no statistical difference between the two groups. In all patients who developed 2nd degree heart block, pacing using temporary pace makers was done at this stage and the pace makers were transferred with the patients to the ICU.

There was no statistical difference between the two groups as regards intraoperative parameters.

Postoperative results

All patients required postoperative mechanical ventilation. No patient was extubated in the operating theatre. The mechanical ventilation (Extubation) time in the study group ranged from 20-72 hours with a mean of 36 ± 15 hours. While in the control group, the ventilation time ranged from 24-96 hours with a mean of 48 ± 20 hours. There was statistically significant difference between the two groups (P value =.03).

Recurrent attacks of pulmonary hypertensive crises developed in 4 patients (20%) in the study group, while these attacks occurred in 8 patients (40%) in the control group. This was of statistically significant difference between the two groups (P value =.01). These attacks were managed by hyperventilation with higher positive airways pressures, sedatives using IV shots of Fentanyl at a dose of 3 - 5 µcg/kg or Dormicum (Midazolam) at a dose of 0.2 mg/kg and sometimes muscle relaxants using IV boluses **of Pancuronium** at a dose of 0.1mg/kg.

The total intensive care unit (ICU) stay in the study group ranged from 4-8 days with a mean of 6+1 days, while the total hospital stay ranged from 15-25 days with a mean of 20+ 2.8 days. In the control group, the total intensive care unit (ICU) stay ranged from 3-6 days with a mean of 4+0.88 days, while the total hospital stay ranged from14-22 days with a mean of 18.5+ 2.31 days. The ICU stay &the total hospital stay were statistically significantly lower in the control group than in patients of the study group (P value = .02and .015 respectively). These data are shown in table (3).

Postoperative complications

In the study group: one patient (5%) developed mild to moderate (1cm) posterior pericardial collection with no

hemodynamic effects and was managed conservatively by diuretics for 3 days, then follow up echocardiography showed a decrease in its amount.

Three patients (15%) developed superficial wound infections which were managed also conservatively by frequent dressings and antibiotics according to culture and sensitivity. No other major complications occurred in the remaining patients of the study group.

In the control group: four patients (20%) developed superficial wound infections and were managed in the same way described in the other group. No statistical difference was detected between the two groups of patients.

In hospital mortality

No hospital mortality was reported among the 20 patients of the study group. While in the control group, one patient died after a severe pulmonary hypertensive crisis during which all measures failed to restore adequate O2 saturation to keep the patient alive.

Summary of postoperative results are shown in Table (3).

Postoperative data	Study group	Control group	P value
ICU			
Mechanical ventilation (mean)	36 ± 15 hours	48 ± 20 hours	Significant (.03)
Pulm. hypertensive crises	4 (20%)	8 (40%)	Significant (.01)
Chest tube drainage	60±29cc	80± 35 cc	
Re-exploration	-	1	
ICU stay	5±1 days	4±0.88 days	Significant(.02)
Hospital stay	10± 1.5 days	9± 1.27days	Significant(.015)
In-hospital mortality	-	1	

Table 3. Summary of postoperative results.

Discussion

Surgical repair is the standard of care that is now offered for all patients with of CAVSD and can be performed in infancy. However, in a subset of patients, early congestive heart failure develops within the first few weeks of life that might be not controlled with medical therapy alone. It is in these patients that controversy exists about the ideal timing and strategy of surgery. [2]

The two stage repair although was carried out to reduce in-hospital mortality and technical difficulty from operating on smaller hearts with delicate tissues, yet this approach turned out to bear all long-term complications of pulmonary artery banding .

In addition, repair of AV canal defects beyond 6 months of age has been recently shown to be an incremental risk factor for death. The chronic volume overload from left-to-right shunting increases common AV valve annular dilatation resulting in increased left AV valve regurgitation due to the difficulty in achieving good co-aptation after repair and promotes secondary pathological changes in the AV valve tissue including the cleft area as well. It is not uncommon to hear surgeons make the comment that there is 'inadequate AV valve tissue to perform valve repair'. [1]

Another sequel of delaying surgery is the development of pulmonary hypertension with elevated pulmonary vascular resistance, predisposing to postoperative pulmonary hypertensive crises. Irreversible PVOD, Heath–Edwards grade III and higher pathological changes in the lungs can occur within the first year of life, especially in the presence of Down syndrome. [6]

In Singh et al, 2006[7], study, the mean age was 2.14 months in group (A) who underwent repair on or before 3 months of age (26 patients) and 16.76 months in group (B) who underwent repair after 3 months of age (39 patients).

In another study done by Stellin and colleagues, 2003, 119 consecutive patients underwent repair of CAVCD from January 1985 to March 2001. 58 patients (49%) underwent correction before 3 months of age group (A), and 61 patients (51%) after 3 months group (B).[8]

The lower mean age in Group (A) in the studies of Singh et al [7] as well as Stellin et al[8] than the mean age in our study group reflects the earlier tendency to repair complete AV canal defects, especially in the presence of intractable heart failure. While the higher mean age in group (B) than our control group may be attributed to the presence of more cases in group (B) in those studies with restrictive left to right shunts (in whom definitive repairs could be postponed).

In our study the age of 6 months was considered to be the division point between the two groups since pulmonary hypertension usually occurs at this age, while Singh and colleagues[7] as well as Stellin and colleagues[8] believed that pulmonary hypertension can occur as early as age of 3 months especially in patients with Down syndrome.

The mechanical ventilation time was longer in the control group than the study group, and the incidence of pulmonary hypertensive crises was more in control group patient's .The trend towards earlier intervention has decreased the incidence of pulmonary hypertensive crises. Although earlier reports consistently described postoperative pulmonary hypertension as a major risk factor of death, yet recent long-term results as well as our study demonstrate that early surgical intervention before

the development of pulmonary vascular obstructive disease is the optimal approach.[9] In the study done by Kobayashi and colleagues, the median duration of mechanical ventilation was 11.6 hours which is much less than that in our study .This is due to the lack of Nitric Oxide gas and Extra-corporial Membrane Oxygenation (ECMO) in our intensive care units. Therefore patients are kept sedated and mechanically ventilated for longer time for fear of the occurrence of fatal pulmonary hypertensive crises [9]

Most surgeons currently prefer to perform definitive repair before age 6 months. Reddy and colleagues propose that earlier definitive repairs do not result in an increase in the incidence of AV valve incompetence and recommend elective repair at age 2 to 3 months. In fact, early correction could partially eliminate the incidence of left AV valve regurgitation in the postoperative period as well as reoperation in older patients. This is because degenerative changes or annular dilation of the common AV valve, or both, may progress as the patient ages. *[10]*

Also Reported mortalities resulting from early primary repair without intervening palliative procedures are generally lower than those reported after two staged repair. [11] In this context, tight banding can cause severe pulmonary stenosis with myocardial hypertrophy, and loose banding can result in irreversible PVOD. Yamaki and colleagues [12] have reported a patient with VSD who died of PVOD after PAB and subsequent total correction. Therefore, patients who have received PAB should be followed strictly and carefully. The later decision to perform a complete repair is guided by repeat catheterization after PAB and/or lung biopsy.

By contrast, Prifti and colleagues demonstrated that definitive repairs for small infants who weighed less than 5 kg resulted in an increased risk for late reoperations for residual left AV valve regurgitation.[13]

In all our patients, the choice of the technique used in the repair was based on the surgeon's preference. As a whole in both groups, the Double-patch technique was the most commonly used technique (26 cases, 65%), then the Modified single-patch technique comes next (8 cases, 20%) and finally comes the Single-patch technique (6cases, 15%).

There has been a recent tendency of many centers to switch from the classic one-patch to the two-patch or the modified one patch techniques. Each technique has its advantage and disadvantages. Surgeon preference and experience with a specific technique will remain the main predictor of choosing the technique. All these techniques seem to be equally efficacious and the ability of the surgeon to adapt to the highly variable pathologic abnormalities of the CAVSD is probably more important than just the technique itself.

The Single-patch technique was the initial technique used for the repair of CAVC defects but was abandoned by many centers due to the difficulty in calculating the height where to attach the divided leaflets to the single patch. Too high or too low level of the left AV valve leaflets create a restricted leaflet motion resulting in a small area of coaptation and subsequent incompetence.[11]

The Two-patch technique has been the technique of choice until recently for most centers .However, the height of the VSD patch should be precisely determined to avoid placing the new left AV valve too high restricting the anterior leaflet in systole. The advantage of the two patches over the classic one patch might be that it avoids division of the valve leaflets, limiting the secondary sequestration of tissue for valve division and reconstruction. Also there is no danger of detachment of the mitral component sutured to the pericardial patch when not dividing the leaflets.[14] [15]

The Modified single-patch technique (the so-called Australian technique) is now becoming more and more popular as an attempt to preserve spatial relationship during repair of common atrioventricular valve by simply attaching the common leaflets to the crest of the septum. The main advantage of not using a VSD patch is that by lowering the level of the left AV valve implantation at the crest of the septum, the area of coaptation is increased resulting in better competence. Another advantage is that it simplifies the procedure reducing both ischemic and total pump times. Wilcox and colleagues [16] reintroduced this method of repair for patients with small VSDs. Nicholson and colleagues [17] advocated that the VSD patch could be avoided in most cases of complete AV canal with moderate and large VSD.

Now progression is going from direct suture of the VSD component, to avoiding the Atrial patch as well, aiming at reducing operating time more and getting normal sized atria that were dilated preoperatively which may help in preventing the occurrence of postoperative arrhythmias, the so-called No-patch technique. One concern with this technique is the risk of applying too much tension on the tissues and subsequent tearing due to the fact of not using any patch .*[18]*

Conclusion

In conclusion, we have found no difference in operative mortality between patients undergoing surgical repair of CAVSD at 6 months of age or younger. It is true that a difference may not have been surfaced owing to the low statistical power of this study. However, we believe that with modern techniques, the current risk factors for CAVSD repair in patients younger than 6 months and in those older than 6 months are equal. These factors include the severity of preoperative common AV valve regurgitation, the presence of associated cardiac anomalies, and the degree of functional disability. Therefore we consider early repair of CAVSD is safe and effective.

As an intermediate strategy that might suit more our circumstances in postoperative care, we propose a policy for the management of CAVCD that is: repair should be done at

any age when symptoms of congestive heart failure cannot be managed by medical therapy, while elective repairs for CAVSD are best performed at age 4 to 6 months. In selected cases, as in too low-birth-weight patients, patients with poor clinical condition or with co-morbidities, or in patients in who complete repair is not feasible due to systemic or higher pulmonary artery pressure initial palliation with pulmonary artery banding may be tried.

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Multicentre Experience For Treatment of Moderate Ischemic Mitral Regurgitation During Performance of Cabg

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Objectives: **The best line of treatment of patients with moderate ischemic mitral regurgitation is still a matter of debate. It is not totally clear whether adjunctive mitral valve repair at the time of coronary artery bypass grafting is beneficial. The aim of our multicenter retrospective study is to evaluate the outcome of the patients of our centres who had moderate ischemic mitral regurgitation who underwent either CABG alone or combined with mitral valve repair.**

Materials and Methods: **a total of 43 patients had moderate ischemic mitral regurgitation, LV dysfunction (LVEF<0.50) underwent CABG alone (28 patients) and CABG+MV repair(15 patients) from February 2008 through December 2011 in three centres –Cairo University-Egypt-, King Fahd University hospital Al khobar-KSA-, Al Mouwasat hospital Ad Dammam –KSA-. Data regarding NYHA functional class, LVEF, changes in degree of MR were compared in both groups.**

Results: **Reduction of MR by 2 grades was found in 75% of CABG+MV repair versus 10% in CABG alone after 1 year and 50% versus 10% after 4 years respectively, one and four years survival rates in both groups were almostly similar 94%±2% versus 94±4% and 90%±4% versus 87%±3% respectively, both groups show improved NYHA functional class and LVEF. At late follow up (4 years) recurrence of mitral regurgitation (+3, +4) was found to be 23% in CABG+MV repair group and 50% in CABG alone group.**

Conclusion: **Patients with moderate ischemic MR whether treated by CABG alone or combined with MV repair show improved NYHA functional class, low early and intermediate mortality, however tendency for late recurrent mitral regurgitation was reported in CABG+MV repair patients.**

Key words: **Moderate ischemic MR • mitral valve repair • CABG • CABG+ MV repair.**

Introduction

Ischemic mitral regurgitation is defined as mitral regurgitation that complicates manifestations of CAD in the absence of primary leaflet or chordal pathology .[1]

The pathophysiology of ischemic mitral regurgitation is complicated , several underlying processes are related to its presence and often difficult to separate in a given patient .[2] Most surgeons agree that severe MR should be corrected at the same time of CABG whereas trace to mild MR can be left alone. However the big debate lies in the category of moderate ischemic MR.

Those who support the conservative approach have many reasons which include: 1- CABG improves regional wall motion and correct MR.[3,4] 2- several studies suggest that performing CABG alone does not affect long term survival or functional status. 3-concomitant MV surgery with CABG increases operative mortality that reached in most series more than 10%.[5-10] 4-patients with ischemic MR have small left atria which makes mitral valve surgery difficult .

On the other hand many surgeons advocate mitral valve repair in combination with CABG for the following reasons: 1- Chronic ischemic MR is a dynamic condition which depends on preload and afterload so that preoperative echocardiography may cause underestimation of the severity of MR.

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2- CABG alone is not sufficient to correct ischemic MR if this MR is due to scarring of myocardial infarction or annular and ventricular dilatation.[11] 3-Significant residual MR can result in late symptoms and affect long term survival.[12,13] 4- Mitral valve annuloplasty is usually sufficient in the majority of ischemic MR to correct MR making mitral valve replacement almost never required.[14] 5- In the presence of significant residual MR the reoperation for correction of MR in the presence of patent grafts carries a significant high operative risk .[15]

There is now a strong evidence of improved survival in patients who have severe or moderate to severe ischemic MR who are subjected to MV repair in combination with CABG , but is there a role for combined CABG and MV surgery before regurgitation progresses to severe degree?, this matter is still the subject of much controversy .

In this study we reviewed the outcome of patients with moderate ischemic MR in three centres of cardiac surgery dividing patients into two groups (CABG alone, CABG+MV repair) comparing them in relation to changes in NYHA functional class ,post operative MR, LV function and survival.

Patients and Methods

From Feb 2008 until December 2011 a total number of 43 patients with moderate ischemic functional MR on preoperative echocardiography were treated with either CABG alone (28 patients) or CABG combined with MV repair(15 patients) with the decision to perform MV repair or not at the discretion of the surgeon .

Inclusion criteria of ischemic patients included in this study were moderate ischemic MR which was adopted from Aklog and colleagues [16]but modifying degree of mitral regurgitation from grade 3+ to grade 2+ (table 1), LV dysfunction (LVEF<0.50)

Exclusion criteria included patients with unstable clinical conditions, acute coronary syndrome in the previous 3 months, heart failure in the previous months before surgery, organic mitral valve lesions and significant aortic valve disease.

Significant symptomatic multivessel coronary artery disease, with or without documented prior myocardial infarction
Grade 3+ MR on a scale of 0 to 4+
Documented on preoperative echocardiogram or vetriculogram while patient is not actively ischemic
Regurgitant jet to posterior wall of left atrium without reversal or blunting of pulmonary venous flow
No mitral stenosis
Type I or IIIb by Carpentier functional classification
Annular dilatation with normal leaflet motion (type I) OR
Restricted leaflet motion during systole (type IIIb)
No leaflet prolapse (type II) or other leaflet pathology

TABLE 1. *Definition of Moderate Ischemic MR Aklog et al*

Preoperative assessment of MR grade : a) **left ventriculography**: by contrast injection during coronary angiography in 9 patients 21% of the total number of patients b) **echocardiographic assessment** : using ACUSON sequoia color Doppler system (Siemens Medical solutions USA) or HP Sonos ,a Philips / ATL 5000 (Philips Medical Systems Co.) by Real –time 2-dimentional echocardiographic imaging.

Echocardiography was performed in 100% of our patients (43 patients) within one month before surgery. Assessment of severity of mitral regurge was based on colour Doppler jet characteristics including jet area and width. All patients were graded on a four grade scale.

Patients who were included in our study were of grade 2+ MR and showed a continuous wave Doppler signal with an intermediate intensity, normal pulmonary vein flow pattern without marked increase in the mitral inflow velocity.

Follow up of MR grade was defined semi-quantitatively by visual estimation of the regurgitant jet area in relation to LA area (moderate MR when the regurgitant jet area/LA area equals 20-40%)[17]

Surgical techniques

All patients underwent conventional multi-vessel CABG through a full midline sternotomy on CPB. Myocardial protection was achieved in all patients using antegrade intermittent cardioplegia .

The decision to perform mitral valve repair was taken preoperatively depending on echo data and patient clinical status. For those who received combined CABG and MV repair bicaval cannulation was performed.

Repair of ischemic MR was done by several annuloplasty techniques with no specific criteria for selection of a particular annuloplasty technique for a certain patient but this was according to the surgeon preference (10 patients underwent MV repair using a complete rigid undersized ring—Carpentier Edwards Classic__ and this represents 66.6% of the repair group and 5 patients by Dacron or pericardial posterior annuloplasty technique and this represents 33.3% of the repair group) but no other techniques used like chordal shortening , chordal transfer or artificial chordae.

Post operative follow up

Echocardiographic examination was done every 6 months. An improvement in the MR was defined as decrease in the severity by one or more grades i.e ≥1 and functional recovery of LV was defined as an increase in the ejection fraction ≥5% associated with an improvement in the regional wall motion score, functional status was assessed according to New York Heart Association criteria during follow up visits. Data were collected during patient visits to the department. Operative

mortality was defined as death within 30 days of the operative procedure or before hospital discharge.

Statistical analysis

Numerical values were expressed as mean ±SD. Continuous variables were compared between 2 groups using the Student's unpaired t test. The frequency ratios were compared between groups using the x^2 test. LV remodeling was analyzed using the paired t test and Wilcoxon signed rank test. The Kaplan-Meier analysis was used to determine actuarial survival rates, and differences in survival rates between the 2 groups were examined by the log-rank test.

The variables included in the analysis were age, gender, baseline NYHA class, extent of coronary artery disease, LVEF, and surgical procedure. A probability value <0.05 was considered statistically significant.

Results

The base line preoperative characteristics of both groups of patients who underwent CABG alone or CABG with MV repair are presented in (table 2) and postoperative characteristics are presented in (table3)

	CABG only 28 patients	CABG + MV repair 15 patients	P value
Mean age (years)	62±9	60±8	0.6
Gender (male)	20 (70%)	11 (75%)	0.3
Mean LVEF	36±0.12	34±0.12	0.2
Mean number of diseased vessels	2.8±0.5	2.8±0.8	0.7
Mean preoperative NYHA functional class	3.1±0.8	3.1±0.7	0.1
NYHA functional class III or IV	20 (70%)	13 (90%)	0.1
3-vessel disease	22 (80%)	12 (85%)	0.9
Smoking history	17 (60%)	9 (63%)	0.8
Angina	21 (75%)	9 (60%)	0.07

Table 2. Base line preoperative patient characteristics

As shown in (table2) the mean age of the entire study was 60±9 years and 72% were males. Most patients had angina pectoris 69% with a high prevalence of 3-vessel disease 79% of the total number of patients

All patients had impaired LV function with a mean LVEF (35±0.12) and this explains the high prevalence of patients who had NYHA class III, IV (79%). The mean duration of follow up was 2.2±1.6 years (range 0.6-3.8 years).

There was no significant difference in pre-operative characteristics of the two groups of patients of our study –P value<0.05 was considered statistically significant- However the group of patients who underwent CABG+MV repair showed a higher percentage of patients who had symptoms of heart failure (NYHA III or IV)90% of the repair group.

As shown in (table 3) the CABG+MV repair group of patients shows a significantly long bypass and cross clamp times with (P value<0.001)

The early deaths within 30 days of the surgical procedure were similar in both groups with statistically insignificant difference (P value>1). One and 4-year survival rates between CABG+MV repair Vs CABG alone group was 94%±2% Vs 94%±4% after one year and 90%±4% Vs 87%±3% after 4 years respectively.

	CABG only group	CABG+MV repair	P value
Number of graft vessels	3.2±0.8	3.1±1	0.6
LIMA utilisation	25 (90%)	14(94%)	0.3
Bypass time(minutes)	150±40	183±75	<0.001
Cross clamp time(minutes)	70±62	110±54	<0.001
Hospital length of stay(days)	10±8	10±13	0.2
Early deaths	4%	7%	>1

Table 3. Post-operative characteristics and early mortality

Changes in NYHA functional status, LVEF, degree of mitral regurgitation post operatively:-

As shown in (table4)

A) Change in mitral regurgitation degree :- A significant early improvement in the mitral regurgitation grade (decrease by 1 or more grades) after one year is noticed in patients who had underwent CABG+MV repair as compared to CABG alone group.75% Vs 10% after one year respectively (P value <0.001) which is considered to be statistically significant, however at follow up after 4 years this decline in mitral regurgitation grade is changed to be 50% Vs 10% respectively (P value >0.7) which is considered to be statistically insignificant and this is may be explained by the decrease in the number of patients who continued late echocardiographic follow up.

Variables	CABG+MV repair group	CABG only group	P value
Mitral incompetence	Pre-operative → 2+	Pre-operative → 2+	--
	Change after 1 year → -1.9 ± 0.4	Change after 1 year → -0.3 ± 0.5	<0.001
	Change after 4 years → -1.0 ± 0.2	Change after 4 years → -0.8 ± 0.9	>0.7
LVEF	Pre-operative ----- → 34 ± 0.12	Pre-operative ----- → 36 ± 0.12	0.2
	Change after 1 year → +3.5 ±10	Change after 1 year → +2.6 ± 12	>0.9
	Change after 4 years → -4 ± 11	Change after 4 years → 3.1 ± 13	>0.7
NYHA functional class	Pre-operative ----- → 3.1 ± 0.7	Pre-operative ----- → 3.1 ± 0.8	0.1
	Change after 1 year → -1.2 ± 1.3	Change after 1 year → -2.0 ± 0.9	0.08
	Change after 4 years → -1.2 ± 1.0	Change after 4 years →-2.3 ± 0.5	0.1

Table 4. Changes in NYHA functional class, LVEF, degree of mitral regurgitation.

B) Change in NYHA functional class :- A significant improvement in the NYHA functional class was found in both groups after one year which remained stable until the end of our study after 4 years but there was no statistically significant difference regarding the improvement of the NYHA functional class between both groups(P value was 0.08 after one year and 0.1 after 4 years).

C) Change in LVEF :- A significant improvement in the LVEF was observed in both groups after one year. However after 4 years the improvement remains stable in CABG alone group but not in CABG+MV repair group , although the group differences in LVEF were not statistically significant (P value was> 0.9 after one year and >0.7 after 4 years)

Discussion

Ischemic mitral regurgitation is found in up to 20% of patients who have CAD, and its presence after myocardial infarction and revascularization is associated with a worse prognosis [18-20]

Survival rate in patients with ischemic MR is inversely proportional to the degree of ischemic MR[21].

Patients with mild or mild-moderate ischemic MR are usually considered candidates for CABG alone. However, several recent studies have shown progression of mild ischemic MR to moderate or even severe MR over time in up to 30% of CABG only patients[16,22,23].

Regarding the survival rate :- In our study there was no statistically significant difference in the early death rate (within 30 days of the procedure) between CABG alone and CABG+MV repair groups 4% Vs 7% respectively with a P value >1.

One and four year survival rates for CABG+MV repair Vs CABG alone were 94% ± 2% Vs 94% ± 4% after one year and 90% ± 4% Vs 87% ± 3% after four years respectively, the difference in the survival rate between the two groups was statistically insignificant.

This finding is similar to that found by Diodato MD and his group[24], and similar to the study made by Tina Ryden and his co-workers[25].

In a study published by KimYH and his colleagues [26], they reported a high 30 day mortality rate and a lower survival rate at 5 and 8 years in the CABG + MV repair patients as compared to the CABG alone patients but the difference may be attributed to their larger number of patients and longer follow up period as compared to our study.

Calafiore and co-investigators performed mitral valve surgery in case of chronic ischemic MR grade 2+ patients having low LVEF and LV dilatation and reported a long term survival without any significant increase in the early hospital mortality and with 30 day mortality rate 3.9% [27].

Improvement of the functional status

A significant improvement in the NYHA functional class was found in both groups after one year which remained stable until the end of our study after 4 years but there was no statistically significant difference regarding the improvement of the NYHA functional class between both groups.

Our results are similar to those studies that showed that CABG alone in chronic ischemic MR patients improves the NYHA functional class[24,28,29]

Change of degree of MR

In our study the recurrence of mitral regurgitation (3+ or 4+) was found to be up to 23% after 4 years in the CABG + MV repair group. In a study reported by ,Hung J etal and Mc Gee EC etal [30,31]up to 1/3 of patients experienced recurrence of moderate or even progression to severe MR.

Changes in LVEF

A significant improvement in the LVEF was observed in both groups after one year. However after 4 years the improvement remains stable in CABG alone group but not in CABG+MV repair group.

Prifti E and co-investigators [32]reported a significant improvement in the LVEF in the group who received CABG+MV repair with only mild improvement in group 2 who received only CABG and this was carried out after 6 months of surgery and they concluded that surgical correction of mild-moderate or moderate ischemic MR in patients with impaired LV function should be taken into consideration since it yields better survival and improved LV function.

We can conclude from our study that ischemic patients with an associated moderate MR and low LVEF can be treated safely by mitral valve repair in combination with CABG with an accepted low early mortality rate, improved post operative NYHA functional class, and a significant early post operative decrease in the degree of MR but there is a high incidence of late recurrence of the MR.

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Adjustment of Tricuspid Annular Diameter During repair of Functional Tricuspid Regurgitation

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Background: **Understanding the role of the right ventricle in the maintenance of normal cardiac function has changed dramatically and it has been shown right ventricular function is a major determinant of cardiac symptoms. The aim of this work is to evaluate the surgery of tricuspid valve repair (during mitral valve procedures) as a predictive of right ventricular dysfunction following mitral valve surgery.**

Materials and Methods: **It is a prospective study which included forty four patients with mitral valve disease necessitating surgical replacement /repair, with/ without clinical evidence of right ventricular failure. The following data are included in this study: Complete history and physical examination, resting 12-lead electrocardiogram (ECG), and echocardiogram.**

Results: **When postoperative tricuspid annular diameter (TAD) (3.0 cm) was used as a cut point, no improvement of TR could be expected with a sensitivity of 76% and a specificity of 60%.**

Conclusions: **The decrease in tricuspid annular dilatation after surgery can predict improvement of right ventricular function and tricuspid regurgitation. The technique of tricuspid annular reduction should be precise to ensure adequate right ventricular function after surgery. Intraoperative TEE can be helpful to assess the results of tricuspid valve repair.**

Key words: ***Tricuspid-Mitral-Annular diameter-Right ventricle-Function- Surgery.***

Historically, the right heart was viewed as less important the left heart in the maintenance of normal overall hemodynamic performance. The role of the right ventricle (RV) has been underestimated in the past, especially its role as a determinant of cardiac symptoms, exercise tolerance, and survival in patients with valvular disease of the left heart [1]. The last decade has seen increased recognition of the importance of right ventricular function. Understanding the role of the right ventricle in the maintenance of normal cardiac function has changed dramatically and it has been shown right ventricular function is a major determinant of cardiac symptoms [2, 3]. In valvular heart disease right ventricular dysfunction is now accepted as being pivotal to the natural history of the disease [4]. Normalization of right ventricular ejection fraction is reported in most patients after mitral valve operations[5].

Tricuspid regurgitation (TR) is frequently present in patients with mitral valve disease and more than one–third of patients with mitral stenosis have at least moderate tricuspid regurgitation[6,7]. Approximately 30% of patients with severe mitral regurgitation may have severe TR, and up to 53% of patients undergoing mitral valve surgery have associated TR[8,9]. Clinically severe TR has been reported in 23% to 37% of patients after mitral valve replacement (MVR) for rheumatic heart disease [10, 11]. In 14%, TR occurred in the absence significant left heart disease, pulmonary hypertension, or obvious organic tricuspid valve (TV) disease [10]. The incidence of echcardiographically moderate or severe late TR in rheumatic patients is even higher (68%) [11]. In most cases TR is diagnosed late after MVR, 10 years on average, but can appear as late as 24 years after the initial surgery [10,11]. Residual tricuspid regurgitation following mitral valve surgery was found to be 16% in female valve clinic in Cairo University [12].

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The mechanism by which functional tricuspid valve regurgitation occurs is as following; dilatation of the right ventricle results in dilatation of the tricuspid annulus with subsequent failure of leaflet coaptation[13,14]. Finally the papillary muscles of the tricuspid valve (being attached to the free wall of the right ventricle) get further away from each other[15]. The aim of this work is to evaluate the surgery of tricuspid valve repair (during mitral valve procedures) as a predictive of right ventricular dysfunction following mitral valve surgery.

Materials and Methods

The study included forty four patients with mitral valve disease necessitating surgical replacement /repair, with/ without clinical evidence of right ventricular failure. Among the patients nineteen had mitral incompetence, seven patients had mitral stenosis, and eighteen patients had double valve lesion. As regards tricuspid regurgitation ,8 patients had no TR preoperatively,23 patients had mild TR,8 P patients had moderate TR ,and 5 patients with severe TR.

Exclusion criteria:

1. Left ventricular dysfunction defined as left ventricular ejection fraction (LVEF) <50 % pre/post mitral valve surgery.
2. More than mild aortic incompetence (pre/post operative).
3. Pulmonary stenosis.
4. Poor echocardiographic window.
5. Inadequate correction of mitral valve lesions (e.g. placement of undersized valves).

It is a prospective study of one group that was all subjected to echocardiographic examination, which was done twice , the first is within the week preceding the mitral valve surgery, the second within the week following it.

The following data are included in this study:

1. Complete history and physical examination.
2. Resting 12-lead electrocardiogram (ECG).
3. Echocardiogram to measure left ventricular volumes and ejection fraction, and to provide precise evaluation of mitral, aortic, and tricuspid valve diseases. It also measured the pre, and postoperative tricuspid annular diameter (TAD) using the apical 4-chamber view, and RV inflow views. TAD is defined as the distance between the insertion points of the tricuspid valve into the ventricular septum, and lateral atrioventricular junction.

Results

As regards postoperative TR the patients were classified into no (15 patients), mild (25 patients), moderate (2 patients), and severe TR (2 patients). Preoperatively the mean tricuspid annular diameter was 3.4 +/- 0.7 cm. postoperatively the mean tricuspid annular diameter was 3.1 +/- 0.6 cm.

The ROC curve analysis was used to show postoperative improvement of TR When postoperative tricuspid annular diameter (3.0 cm) was used as a cut point, no improvement of TR could be expected with a sensitivity of 76% and a specificity of 60% Fig. (1) Table (1).

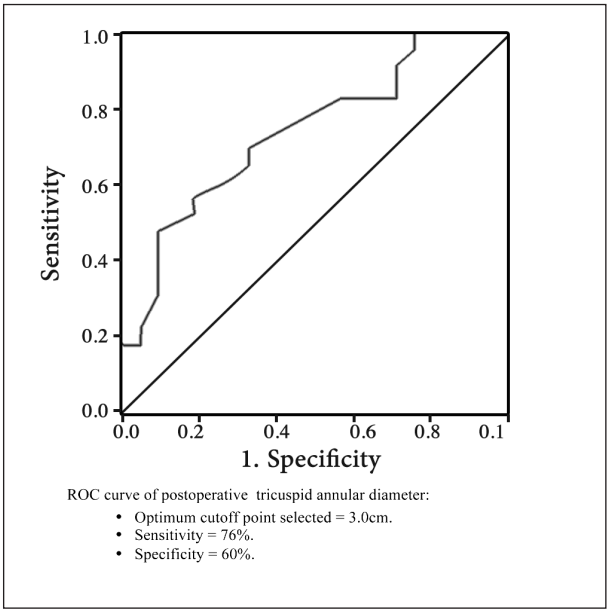

Fig. 1. ROC curve analysis of postoperative tricuspid annular diameter

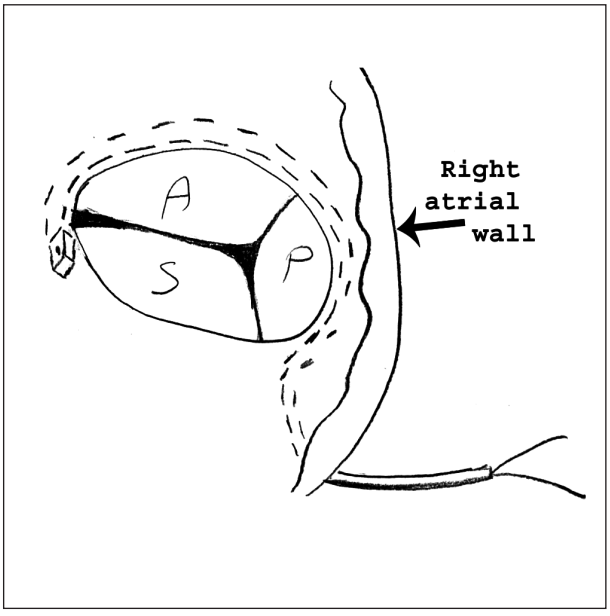

Fig. 2. Adjustable tricuspid valve annuloplasty.

	Preoperative TR	Postoperative TR
No TR	8	15
Mild TR	23	25
Moderate TR	8	2
Severe TR	5	2

Table 1. Preoperative ,and postoperative tricuspid valve regurgitation.

Discussion

The tricuspid annulus has a complex 3- dimensional structure, which differs from the more symmetric (saddle shaped) mitral annulus. As mentioned by Fuduka et al. healthy subjects had a nonpolar, elliptical-shaped tricuspid annulus, with the posterolateral portion being lowest (toward the right ventricular apex) and the anteroseptal portion the highest. Patients with functional TR generally had a more planar annulus, which was dilated primarily in the septal lateral direction, resulting in more circular shape as compared with the elliptical shape in healthy subjects [16]. Based on the importance of tricuspid annular dilatation in the development of TR, some studies recommended that prophylactic TV repair should be performed in patients undergoing MVR regardless of TR severity whenever the TV annulus is equal to or less than 3.5 cm, especially in rheumatic TR [17, 18].

It is well known that reduction of tricuspid annular diameter after mitral valve surgery helps to decrease the volume overload on the right ventricle during the postoperative period which will subsequently improve the ejection fraction of the right ventricle. This study is based on the fact that assessment of RV function remains challenging, and the degree of postoperative tricuspid regurgitation could be a predictor of right ventricular function after surgery. While the prolate ellipsoid of the left ventricle lends itself to geometric assumptions and mathematical interpretations, the shape, geometry, and anatomical location of the right ventricle all conspire against precise assessment. The normal ejection fraction for the left ventricle is greater than or equal to 0.55. The right ventricle has the same stroke volume as the left ventricle, but a slightly greater end-diastolic volume and so has a smaller ejection fraction [19].

There is difficulty in the measurement of RV function by two dimensional (2D) echocardiography because of its complex geometry, its asynchronous contraction pattern, and its mechanical interaction with the left ventricle [20]. Actually adequate assessment of RV performance is more difficult than that of its left ventricular counterpart.

Under reduction of the tricuspid annulus produces residual annular dilatation, and subsequently residual tricuspid incompetence. The same occurs with over correction of annular dilatation because it makes the leaflets crowded over each other. Different techniques had been described to adjust the tricuspid annulus during the procedure of tricuspid valve repair. Kirklin and his colleagues used to tighten the suture of De Vega annuloplasty if the orifice can admit three fingers snugly [21]. Cooley D.A. used to place the ring and middle fingers into the tricuspid orifice to insure that a suitable diameter is achieved[22]. Kaiser and his colleagues used to tighten down the sutures of DeVega annuloplasty over ring sizer No. 29 [23]. Sarraj, and his colleagues used a Carpentier tricuspid ring sizer No. 32, or 34 (to represent the distance between the anteroseptal , and the postroseptal commissures) as a guide to adjust tricuspid annuloplasty [24].

By using intraoperative transoesophageal echocardiograohy (TEE) to show the four chamber view we can measure the TAD after tricuspid valve repair during surgery, especially when the adjustable tricuspid valve annuloplasty technique described by Frater and his colleagues is applied to repair the tricuspid valve. During this technique the surgeon adjusts the tricuspid valve annuloplasty by bringing the two ends of the suture annuloplasty through the right atrial wall, and through another pledget. Then, they are tightened, judging the orifice area under direct vision with appropriate sized tricuspid valve obturator. The suture is clamped atraumatically, the atrium is closed, and bypass discontinued. Assessment of the effectiveness of the annuloplasty can then be carried out, and further adjustment made. The suture is then tied [25]. Tightening the sutures could be done using a rubber tourniquet and the final assessment of tricuspid valve annulus- before tying the suture-could be carried out by intraoperative TEE.

Limitations of the study

The small number of the patients is an important limitation of this study. A further study is needed to evaluate the technique of Frater, and its modification.

Conclusions

Tricuspid regurgitation and right ventricular dysfunction are common complications of mitral valve disease. Tricuspid annular dilatation is an important cause of TR in mitral valve surgery. The reduction in tricuspid annular dilatation after surgery can predict improvement of right ventricular function and tricuspid regurgitation. The technique of tricuspid annular reduction should be precise to ensure adequate right ventricular function after surgery. Intraoperative TEE can be useful to adjust the repair of the tricuspid valve.

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Role of Amlodipine In Decreasing Myocardial Stunning After Aortic Valve Replacement

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An increasing evidence suggests that amlodipine therapy is beneficial to cardiac muscle of patients undergoing aortic valve replacement.

Aim of the work: **Evaluation of preoperative use of amlodipine in myocardial stunning in patients undergoing aortic valve replecement .**

Patients and Method: **60 patients have (AVR) enrolled in this non-randomized prospective study divided into 2 groups: Group I: 21 males and 9 females with mean age (41.73 ± 14.49) receiving amlodipine. Group II: 18 males and 12 females with mean age (40.6 ± 13.97) not receiving amlodipine. Preoperative risk factors, operative data and postoperative details (including ICU stay, postoperative complications and troponine I level, need for inotropic support and postoperative echocardiography) were recorded.**

Results: **There was significant difference between the two groups in the following: The heart started to beat after 4.77 ± 1.59 while in group II after 6.03 ± 2.23(P value=0.014). No support was needed during come off bypass in 17(56.6%) patients, while in 8(26%)patients in group II(P value=0.018). Inotropic support in ICU which was used in 13 (43.3%) patients in Group I and in 22 (73.3%) patients in Group II (P value =0.05) The ejection fraction and fractional shortening after 3 days and two weeks postoperatively (P value <0.01). After 24 hours troponin I in Group I was 2.029±0.287ug/lwhile in group II was 2.671 ±0.387ug/l (P value<0.01). After 48 hours in Group I,troponin I was 0.294±0.121ug/l while in Group II was 0.733±0.248ug/l(P value<0.01). There was no significant difference regarding preoperative data,other intraoperative findings and other postoperative data (P value >0.05).**

Conclusion: **The calcium antagonist amlodipine, given 5 to 7 days preoperatively at a dose of 5 mg orally, can be recommended for patients undergoing open-heart surgery for isolated aortic valve disease with LV hypertrophy.**

Myocardial stunning is a form of contractile dysfunction of viable myocardium caused by a brief period of ischaemia followed by restoration of perfusion[1] .Though intracellular calcium is vital for excitation contraction coupling. It has been suggested that an increase in transient calcium during ischaemia and early reperfusion could be a mechanism for myocardial stunning [2]. Despite much improvement in surgical procedures the benefits of cardiac surgery are delayed due to postoperative left ventricular dysfunction. It is believed that postoperative dysfunction is due to global myocardial stunning since the heart is rendered globally ischaemic during the surgery procedure[3] .Pretreatment with calcium Antagonists before ischaemia attenuates myocardial stunning. This effect probably related to a lessened myocardial calcium overload during early ischaemia

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Patients and Methods

This is a prospective study designed to study the effect of amlodipine in decreasing myocardial stunning and documenting the potential improvement of clinical outcomes in patient undergoing isolated aortic valve replacement for patients with aortic valve

disease (aortic stenosis, aortic regurge and mixed aortic valve disease).

GROUP I: This group include 30 patients received 5mg amlodipine 7 days before aortic valve replacement once daily.

GROUP II: This group contains 30 patients; who did not receive amlodipine before operation. All patients in the 2 groups had full clinical history and risk factors analysis including: age, sex, smoking, angina (CCS), dyspnea (NYHA), hypertension. All patients were submitted for routine tests. Routine ECG and PA chest x-ray was done preoperatively. Echocardiography was done preoperatively for evaluating the systolic function of the left ventricle, measuring end-systolic, end-diastolic diameters , the ejection fraction and fraction shortening.

The anesthetic management, myocardial protection, perfusion data, surgical techniques,and intraoperative events were recorded.

Surgical Technique

Surgical access to the heart was through median sternotomy in all cases. All incisions and closure techniques were the same for both groups. Myocardial protection consisted of repeated infusions of Antegrade Cold blood cardioplegia solution every 25-30 minutes (4˚C; potassium chloride=28mEq/L) supplemented with mild hypothermia (32˚C) and topical cold saline lavage at 4˚C.

All mechanicl valves were implanted using interrupted with pledgeted 2/0 ethibond stitches, aortotomy was closed with prolene stitches. Stratigies taken during removal of aortic cross clamp to decrease myocardial stunning:

1- Controlled reperfusion at low pressure for minimizing dysfunctional capillaries and cell membranes this increases spontaneous recovery of sinus rhythm, decreases arrythmias and decreases the amount of inotropic support.

2- Combination of oxygen delivery,substrate enhancement ,energy repletion and buffering capacities.

3- No IV calcium for at least 20 minutes after clamp removal.

After successful separation from cardiopulmonary bypass, reversal of heparin action is achieved by giving protamine sulphate. After obtaining medical and surgical homeostasis, drains are inserted, the sternum is closed and patients are transported to the intensive care unit (ICU);

Postoperative Data

ICU events were recorded including the need for support, the need for transfusion, ICU stay in hours and hospital stay in days, any postoperative complications were included as re-exploration, acute renal failure, cerebral stroke, arrhythmia, superficial and deep infection and mortality. All patients were submitted postoperatively for routine laboratory tests including complete blood count, liver function tests, kidney function tests, coagulation profile, serum proteins and blood sugar levels. A blood samples were obtained and measured in both groups at 6,24 and 48 hours postoperatively for measuring troponin I level and data was compared in both Groups. Routine ECG was done postoperatively at the 1CU, morning following surgery, at discharge and whenever indicated and compared with the preoperative one.Routine PA chest x-ray was done postoperatively after admission to ICU, daily in the ICU, and at discharge from hospital.

This is done for evaluating the systolic function of the left ventricle with M-mode, measuring end-systolic, end-diastolic diameters and the ejection fraction. Each patient had 2-serial postoperative echocardiograms, done at 3rd day and after 2 weeks of the operation respectively and compared with the preoperative one.

Statistics

The data were collected and analyzed using the statistics analysis program ***SPSS 15***. The data presented are the actual number of occurrences in a group and the mean plus or minus the standard deviations. The Chi square analysis and Fisher exact two-sided test were used to compare occurrence between both groups. ANOVA test was used to compare measured data between both groups.Data were considered significant if *P* value is less than 0.05

Results

During the study, 60 patients were eligible for the study; all of them were enrolled in the study and completed the protocol, thirty patients in each group. The data of both groups were compared and results were obtained by using statistical analysis program **SPSS 15**.

Patients' profiles and preoperative data

There was no significant statistical difference between the two groups in most of the risk factors.Table (2) and Figure (7) show the comparison between the two groups regarding the patients' profile and risk factors. **Group I** had a minimum age of 22 years and a maximum age *of* 67 years with a mean of 41.73 ± 14.49 years, while **Group II** had a minimum age of 19 years and a maximum age of 61 years with mean of 40.6 ± 13.97 years(P value =0.44). There were 9 (30%) females in **Group I**, while **Group II** had 12(40%) females (P value =0.42). **Group I** had 6(20%) of patients with **NYHA** functional class **III** or **IV** while **Group II** had 6(20%) patients with **NYHA** functional class **III** or **IV** (P value =1).**Group I** had 20 (66.6%) hypertensive patients, while **Group II** had 21(70%) patients (P value =0.78). The incidence of smoking was 20(66.6%) patients and 16 (53.3%) patients for **Groups I** and **II** respectively (P value =0.

Most of the preoperative aortic valve lesions showed no significant statistical difference between the two groups .Group 1 had 9 (30%)patients with aortic stenosis while 7(23%)in group 2(P value=0.56).Aortic regurge had been showed in group 1 by 11(36.6%)and in group 2 by 13(43.3%)(P value=0.791). Group 1 had 10(33%)patients with mixed aortic valve lesion while 10(33%) in group 2(P value=1).

Most of the preoperative etiological factors showed no significant statistical difference between the two groups .Group 1 had 27(90%)patients with rheumatic valve lesions,2(6.6%) patients with infective endocarditis and 1(3.3%) case with bicuspid aortic valve.Group 2 had 27(90%)patients with rheumatic valve lesions,2(6.6%)patients with infective endocarditis and 1(3.3%)case with marfan disease.

Most of the preoperative laboratory findings showed no significant statistical difference (P value >0.05) between the two groups. The Creatinine levels were 1.04 ± 0.22 mg% and 1.02 ± 0.29 mg% in **Groups I** and **II** respectively (P value =0.73).The **AST** in **Group I** were 33.33 ± 8.10 u/l, while in **Group II** were 33.30 ± 7.01 u/l respectively (P value =0.98). The **ALT** in **Group I** 30.26 ± 9.30 u/l, while in **Group II** were 29.73 ± 9.12 u/l respectively (P value =0.82). The bilirubin levels were 0.58 ± 0.18 mg% and 0.64 ± 0.29 mg% in **Groups I** and **II** respectively (P value =0.33). There was no significant difference in the ECG changes for both groups.• *There was no **AF** preoperatively*. There was no statistical significant difference between the two groups in all findings (P value >0.05). There was no statistical significant difference between the two groups regarding the mean preoperative ejection fraction which was 51.7 ± 5.1% and 50.9±3.5% for **Groups I** and **II** respectively (P value =0.48).

Operative Results

Prosthetic, Saint Jude (St. Jude) and carbomedics mechanical bileaflet valves were used for replacement. Out of thirty patients in **group I**, one patient (3.3%) received 19mm,10 patients (33%) received 21mm,16patients(53.3%) received 23mm while 3 patients (10 %)received 25mm.In **group II** ,2 patients (6.6%) received 19mm,9 patients (30%) received 21mm,16patients(53.3%) received 23mm while 3 patients (10 %)received 25mm.

In **Group I,** maximumCPB time was 75minutes , minimum was 45minutes and mean time 58.1±8.5 minutes while in **Group II** maximumCPB time was 75minutes,minimum was 48minutes and mean time was59.37±7.5 minutes, with insignificant statistical difference (P value =0.54).

In Group I,the heart started to beat after 4.77 ± 1.59 min while in group II after 6.03 ± 2.23 min that showing significant difference between two groups(P value=0.014).

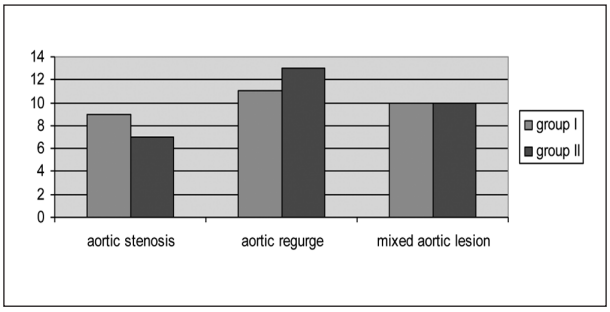

Fig 1. Distribution of cases by type of lesions

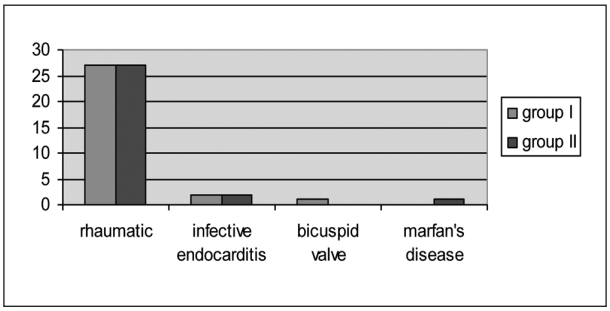

Fig 2. Etiological distribution of the two groups

Groups	Group I N = 30	Group II N = 30	P value	Significance
Variables	Mean ± SD (or N + %)	Mean ± SD (or N + %)		
CPB TIME	58.1±8.5	59.37±7.5	0.54	NS
Time of heart to beat	4.77±1.59	6.03 ± 2.23	0.014	S
Stony Myocardium	3(10%)	4(13.3%)	0.69	NS

S: significant (p <0.05).

Table (1): Operative data of the two groups.

In Group I ,3(10%)patients showing stony myocardium once the aortic clamp was removed while in group II ,4(13.3%) patients showing stony myocardium that showing insignificant difference between two groups(P=0.69).

There was no statistical significant difference between the two groups regarding rhythm of the heart ,sinus rhythm was represented in group I in 20(73.3%)patients while 15(50%) patients in group II(P value=0.19).In group I return of the heart showing atrial fibrillation in 3(10%)patients,while in group II 4(13.3%) patients that required cardioversion either by shock or by cordarone (P value=0.694).

Ventricular fibrillation that required DC shock had occurred in 2(6.6%)in group I while in 3(10%)in group II(P value=0.647). In group I 5(16.6%)patients showing complete A-V block that required temporary pacemaker (up to 30 minutes) while in group II complete A-V block in 8(26%)(P value=0.356).

In Group I,no inotropic support was needed during coming off bypass in 17(56.6%)patients,while in 8(26%)patients in group II that showing significant difference between two groups(P value=0.018).while There was no statistical significant difference between the two groups regarding the need of the heart to high inotropic support ,in group I 5(16.6%) and 9(30%) in group II (P value=0.229).

Groups	Group I N = 30	Group II N = 30	P value	Significance
Variables	Mean ± SD	Mean ± SD		
No Support	17(56.6%)	8(26%)	0.018	S
High inotropic ssupport	5(16.6%)	9(30%)	0.229	NS

S:significant (P <0.05).

Table 2. Come off bypass of the two groups.

Postoperative Results

There was significant difference between both groups regarding inotropic support required in ICU either started during coming off bypass or started in ICU which was used in 13(43.3%) patients in **Group I** and in 22 (73.3%) patients in **Group II** (P value =0.05). There was no significant difference regarding the blood product and plasma transfusion in ICU which was used in 8 (26.6%) patients in **Group I** and in 7 (23.3%) patients in **Group II** (P value =0.77).There was no significant difference between both groups regarding ICU stay (**Group I** : 1.46±0.97 days versus **Group II** : 1.16 ±0.37 days P value = 0.12).All findings in chest X-rays were statistically insignificant between the two groups (P value >0.05).

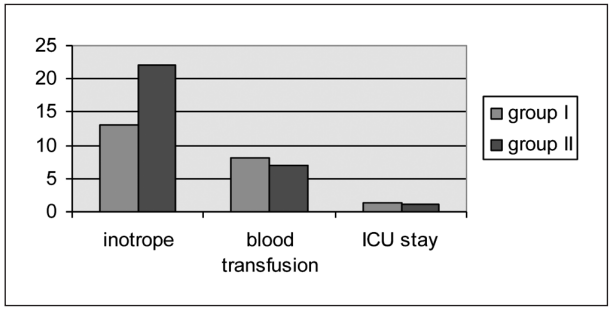

Fig 3. Comparison of outcome of group I and II.

All findings in ECG were statistically insignificant between the two groups, ST segment changes in Group I was 8(26%) patients, while in Group II was 12(40%) patients (P value=0.28). Both Group I and Group II showing one patient of left bundle branch block while right bundle branch block was shown in Group I by 2(6.6%)patients and in Group II by 4(13.3%) patients (P value=0.398).

Pacemaker was off in ICU in all cases in group I while continued in one case in group II(3.3%)and needed perminant pacemaker(P value=0.598).

Echocardiography

After 3 Days

There was significant difference between both groups regarding the ejection fraction after 3 days postoperatively (EF1). The ejection fraction in **Group I** was 43.73± 2.28 % versus 40.70 ± 2.351% in **Group II** (P value <0.01).

There was significant difference between both groups regarding the fraction shortening after 3 days (FS1). The fraction shortening in **Group I** was 32.17 ±2.214% versus 29.60 ±2.372% in **Group II** (P value <0.01).

After 2 Weeks

There was significant difference between both groups regarding the ejection fraction after 2 weeks postoperatively (EF2). The ejection fraction in **Group I** was 45±1.80 % versus 41.07±2.518 % in **Group II** (P value <0.01).

There was no significant difference between both groups regarding the fraction shortening after 2 weeks (FS2). The fraction shortening in **Group I** was 32.90±2.26 % versus 30.17±2.086 % in **Group II** (P value <0.01). Table (12) and figure (14) summarize these results.

Postopera-tive date	Groups	Group I N = 30	Group II N = 30	P value	Significance
	Variables	Mean ± SD	Mean ± SD		
3days	EF	43.73± 2.28	40.70 ± 2.351	<0.01	S
2weeks	EF	45±1.80	41.07±2.518	<0.01	S
3days	FS	32.17 ±2.214	29.60 ±2.372	<0.01	S
2weeks	FS	32.90±2.26	30.17±2.086	<0.01	S

S: significant, EF = Ejection Fraction, FS = Fraction Shortening.

Table 3. Comparison of echocardiography of group I and II.

Laboratory Findings

Preoperative level of troponin I showing no significant changes between Group I 0.227±0.276 ug/l and Group II 0.139±0.183 ug/l(P value=0.151).After 6 hours no significant changes were occurred between Group I 0.972 ± 0.221 ug/l and Group II 1.09 ± 0.255 ug/l(P value=0.051).

The significant changes were started after 24 hours as in Group I was 2.029±0.287 ug/lwhile in group II was 2.671 ±0.387 ug/l(P value<0.01).After 48 hours in Group I,troponin I was 0.294±0.121 ug/l while in Group II was 0.733±0.248 ug/l that showing significant difference between two groups(P value<0.01)

Postoperative Complications

There is no significant difference regarding the postoperative re-exploration due to bleeding in the 1st 24 hours postoperatively. Re-exploration was done in 4(13.3%) patients in **Group I** versus 3(10%) patients in **Group II** (P value = 0.77). No major neurological complication (stroke) occurred in any patients.

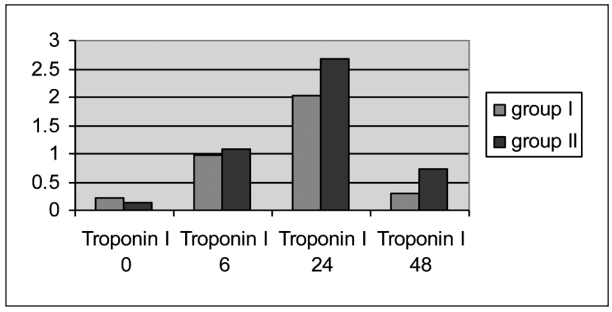

Fig 4. Comparison of Laboratory findings of group I and II.

One patient in **Group I** had renal impairment (Creatinine up to 2.7 mg/dl) but this patient needs no dialysis.Group II , one developed acute renal failure(Creatinine up to 4.5) and required dialysis post operatively 3 times(P value=1).Two patients had superficial wound infection in **Group I** and only one patient had superficial wound infection in **Group II** (P value =0.56). Two patients (6.6%)in Group II died; one developed acute renal failure and required dialysis post operatively and was died after 3 days and the other developed low cardiac output syndrome and multiple organ failure and was died after one week .

Discussion

In this study involving 60 patients undergoing AVR, they were prospectively followed and divided on two groups: 30 patients receiving amlodipine and 30 patients not receiving amlodipine. This was comparable to various studies done on cases of aortic valve replacement. The mean age *in this study* (41.73 ±14.49years and 40.6 ± 13.97 years for groups I and II respectively) was lower than the mean age group of ***A,Tschirkov et al.*** [4] in 1992 was 48.5±.12.88 and 44.7±.14.64 years for deltiazem users and non-deltiazem users group respectively.The low age in this study may be due to prevelance of rheumatic aortic valve diseases.The more high age increase sensitivity to stunning , impaired ability to maintain Ca^{2+} homeostasis and impair the synthesis of new contractile proteins to repair damaged myofilaments during the recovery phase of stunning. *In this study;* the female population, (30%) in group I and (40%) in group II with no statistical difference (P value=0.42) that was small in comparison to other studies. ***R Ascione et al.*** [5]. in 2001 the female gender was 55% for group I versus 47% for group II also non significant showing no difference in the results of both studies between female and male population and the considered variables had essentially the same effects in men and women.*In this study;* history of NYHA class III or IV was (20%) in group I and (20%) in group II while in ***R Ascione et al.***[5] in 2001 history of NYHA class III or IV was 19 % for group I versus 21 % for group II and showing the extent of left ventricular dysfunction as predictor of postoperative myocardial stunning . *In this study;* Group I had 27(90%)patients with rheumatic valve lesions,2(6.6%)patients with infective endocarditis and 1(3.3%) case with bicuspid aortic valve.Group II had 27(90%)patients with rheumatic valve lesions,2(6.6%) patients with infective endocarditis and 1(3.3%)case with marfan disease that showed no statistical difference between the two groups .While **in Hikmet et al.** [6] **in 2007**Group I had 21(57%)patients with rheumatic valve lesions,4(11%)patients with infective endocarditis ,11(30%) case with bicuspid aortic valve and 1(3%) case with myocotic infection.Group II had 23(59%)patients with rheumatic valve lesions,3(8%) patients with infective endocarditis , 1(3%)case with myoctic infection,6(15%)patients with biscupid aorta and 6(15%) cases with marfan disease. This is showing the prevalence of rheumatic heart disease in our study. *In this study;* Group I had 9(30%) with aortic stenosis,11(36.6%)with aortic regurge and 10(33%) with mixed aortic disease.Group II had 7(23%) with aortic stenosis,13(43.3%)with aortic regurge and 10(33%) cases with mixed aortic disease with no statistical difference between the two groups.While in **Ye. et al.**[17]**,Naseem et al.**[7] **in 2007**Group I had 10(33%) with aortic stenosis,11(36.6%) with aortic regurge and 9(33%) with mixed aortic disease. Group II had 9(30%) with aortic stenosis,13(43.3%)with aortic regurge and 8(26.6%) cases with mixed aortic disease with no statistical difference between the two groups and concided with data in our study **.**The data reported where aortic stenosis and aortic insufficiency had a similar postoperative prognosis, indicate that preoperative myocardial injury can be expected to be similar with respect to two conditions: left ventricular hypertrophy and dilation.There was no statistical significance in other risk factors between the two groups which provide equal chances for comparing both groups.

In this study, **Group I** mean CPB time was 58.1±8.5 minutes , In **Group II** mean CPB time was 59.37±7.5 minutes

with insignificant statistical difference (P value =0.54) ,that was lower than in **Selvendiran et al.**[18] **,Hikmet et al.** [6]**in 2007** that for aortic stenosis and aortic regurge groups were 74 ± 7.5 and 76 ± 9.4 min, respectively and also insignificant.These results concided with higher age in the other studies and more calcific degeneration of the valves that required prolonged time on bypass . In this study, **In Group** I,the heart started to beat whatever the rythm after 4.77 ± 1.59 min while in **group II** after 6.03 ± 2.23 min that showing significant difference between two group (p value=0.014).*In this study,* there was no significant difference regarding the rhythm of heart after removing the cross clamp as group I showing 20(73.3%) patients of sinus rhythm,3(10%)patients of AF,2(6.6%)patients of VF and 5(16.6%)patients with transient A-V block.While group II showing 15(50%)patients with sinus rhythm,4(13.3%) patients with AF,3(10%)patients with VF and 8(26%)patients with transient A-V block.Adversely to this study **Hafize Yaliniz et al.** [8]**in2004** Seven patients in the control group(not receiving deltiazem) needed defibrillation 2.50 to 7.00 minutes (mean, 4.60 ± 2.40 minutes) after the cross-clamp was removed, but all recovered sinus rhythm after defibrillation. In this group, spontaneous AV-node function was regained within 7.30 to 21.00 minutes (mean, 13.25 ± 6.00 minutes). In the diltiazem group, 3 patients went into ventricular fibrillation 4.20 to 7.30 minutes (mean, 6.00 ± 2.80 minutes) after the cross-clamp was removed. Fibrillation terminated in asystole and spontaneous sinus rhythm after defibrillation. In all 20 patients in this group, complete AV block lasted for 14.15 to 27.20 minutes (mean AV-node recovery time, 22.72 ± 7.40 minutes). One of these patients needed ventricular pacing for 52 minutes because of bradycardia during supportive cardiopulmonary bypass. The difference in the mean AV-node recovery time for the diltiazem group was statistically significant with respect to that of the control group ($P < .05$). This different results between this study and diltiazem study can be explained by cardiodepressive effect of diltiazem and the risk of temporary AV block that is not present in amlodipine effect. There was no significance difference between the two groups regardless stony myocardium Group I showing 3(10%)patients while in group II ,4(13.3%) patients.This met with ***A Tschirkov et al.*** [4] , in 1992 as the histological findings showed well recognizable signs of ischaemia,ultrastructural changes ,they discovered minimal changes in diltiazem receiving groups which was slight and reversible.Recovery to the normal cell structure was complete and quick in this group.Edema of the mitochondria was present to a minor degree and the crista were intact and fewer ischaemic injuries in this group.There were statistically significant differences in the histological samples obtained 10min. and 30min.after reperfusion with P value=0.01. *In this study,* Group I,no inotropic support was needed during come off bypass in 17(56.6%)patients,while in 8(26%)patients in group II that showing significant difference between two groups(P value=0.018). while There was no statistical significant difference between the two groups regarding the need of the heart to high inotropic support in group I 5(16.6%)patients and 9(30%)patients in group II. **Hafize Yaliniz et al.** [8]**in2004** did not study the need for inotropic support during come off bypass but recorded the time of cardiopulmonary bypass support, none of the patients in the diltiazem group needed supportive cardiopulmonary bypass for more than 30 minutes owing to prolonged AV-node recovery time . The differences between the deltiazem and control group regarding the need of for mechanical support were not significant,this is showing the superior cardioprotective effect of amlodipine. *In this study,* there was significant difference between both groups regarding inotropic support in ICU which was used in 13 (43.3%) patients in **Group I** and in 22 (73.3%) patients in **Group II** (P value =0.05).In the study of **Hafize Yaliniz et al.** [8]**, Egrabe et al.**[10]**,** three patients in the control group and two patients in the diltiazem group needed postoperative inotropic support that is not significan. Also,there was no significant difference between both groups regarding blood transfusion which was used ,ICU stay and radiological findings. These results met with ***A Tschirkov et al.*** [4]**in 1992**,**Testuhiro et al.**[11]**,** where there was no significant differences between all groups regarding the same parameters. All patients survived the operation and were discharged from the hospital in good general condition. No myocardial infarction or other major complications occurred and there were no hospital deaths. Two patients (groups 1 and 2) showed low cardiac output syndrome (NS***P =*** 0.494) requiring inotropic support by dopamine infusion of more than 4.5 mg body weight/min. In this study,All electrocardiographic findings were statistically insignificant between the two groups ,ST segment changes in Group I was 8(26%)patients ,while in Group II was 12(40%)patients(P value=0.28).Both Group I and Group II showing one patient of left bundle branch block while right bundle branch block was shown in Group I by 2(6.6%) patients and in Group II by 4(13.3%)patients(P value=0.398). The same results by ***A Tschirkov et al.*** [4]**in 1992**,**Stanly et al.**[12]**,**as non specific ECG changes in 13 patients(14.4%) and were randomly disturbed among both groups(P value=0.674). In this study, There was significant difference between both groups regarding the ejection fraction after 3 days in **Group I** was 43.73± 2.28 % versus 40.70 ± 2.351% in **Group II** (P value <0.01). and 2weeks postoperatively in **Group I** was 45±1.80 % versus 41.07±2.518 % in **Group II** (P value<0.01),also the fractional shortening showed significant difference between both groups after 3 days in **Group I** was 32.17 ±2.214% versus 29.60 ±2.372% in **Group II** (P value <0.01). And 2 weeks postoperatively **Group I** was 32.90±2.26% versus 30.17±2.086% in **Group II** (P value<0.01).**Christopher et al.** in1998[9] showed that post exercise stunning was defined as a new wall motion abnormality (change in ejection fraction and fractional shortening >20%from baseline) present after exercise in myocardial segments that had matched perfusion defects at peak stress. Overall, fewer patients exhibited stunning during amlodipine treatment than while receiving isosorbid mononitrate (48% versus 82%, P=0.028) that met with our study. In this study, preoperative level of troponin I showing no significant changes between Group I 0.227±0.276 ug/l and

Group II 0.139±0.183 ug/l(P value=0.151).After 6 hours no significant changes were occurred between Group I 0.972 ± 0.221 ug/l and Group II 1.09 ± 0.255 ug/l(P value=0.051). The significant changes were started after 24 hours as in Group I was 2.029±0.287 ug/l while in group II was 2.671 ±0.387 ug/l(P value<0.01).After 48 hours in Group I,troponin I was 0.294±0.121 ug/l while in Group II was 0.733±0.248 ug/l that showing significant difference between two groups(P value<0.01). This met with **Hafize Yaliniz et al. [8] Mathew et al.[13], Jones et al.[14],** where highest mean of CK-MB ug/l in control group was 52.56±22.90 ug/l while in group that received deltiazem was 35.11±11.60 ug/l (P value<0.05).According to ***A Tschirkov et al.*** **[4]in 1992** the peak level of CK-MB appeared around 12 hours after the operation and showed a tendency to decrease during the next 24 hours,At every time period measured ,the release of CK-MB showed a statistically different level (p value<0.01)in deltiazem receiving group versus non receiving group. In this study,neurological,renal ,surgical complications did not show statistical difference between the two groups that concided with ***A Tschirkov et al .*** **[4],Hikmet et al. in 2007** [6] and ***R Ascione et al.*** [5] that showed no differences between the group. Four patients in **group I** with normal coagulation profile were re-explored for bleeding two cases due to injury of branches of internal thoracic artery, one case re explored due to thymic vein injury and the last one large amount of clots was found with no source of bleeding found and three patients in **group II** patients were re-explored for bleeding one case due to injury of branch of internal thoracic artery,the second case was due to oozing from pulmonary vent site and the last one was left open chest due to uncontrollable bleeding from aortotomy suture line (P value = 0.77), these results not confirm the concept claiming amlodipine causing thrombocytopenia in contrast with ***E Garbe et al. in 2004***[10],**Gottlieb et al.** [15], **Ferguson et al.** [16] that found amlodipine dependant antibodies against platelets in serum of patients and recovered after stopping the drug and with several studies report rectal bleeding with prolonged amlodipine therapy . Two patients only had superficial wound infection in **Group I** and only one patient had superficial wound infection in **Group II** (P value =0.56). One patient in **Group I** had renal impairment (creatinine up to 2.7 mg/dl) but this patient needs no dialysis (spontaneous recovery) this may due to attenuation of mitochondrial injury and apoptosis in hypoxic renal tubular cells,and one patient in Group II had severe renal impairement (creatinine up to4.5 mg/dl) that required dialysis and died after 3 days.This met with ***Tetsuhiro et al. in 2004***[11] showed evidence that administration of azelnidipine, a calcium antagonist, protects tubular cells from apoptosis subsequent to hypoxic injury, by stabilizing cellular and mitochondrial Ca2+ homeostasis and inhibiting the mitochondrial permeability transition, cytochrome c release, and the downstream cascade .That benefit was confirmed by no need for dialysis for patient under amlodipine therapy. *In this study* there was no statistical significant difference between both groups in mortality rate. Only Two patients (6.6%)in Group II died,one developed acute renal failure and required dialysis post operatively and the other developed low cardiac output syndrome and multiple organ failure. That concided with other studies of calcium antagonism effect in myocardial stunning as in **Naseem et al.** [7] two patients (4%) died, one developed acute renal failure, post operatively and the other dead intraoperative. and no cases died in **A Tschirkov et al**[4]**.**

Conclusion

The contribution of amlodipine therapy to the improvement of myocardial protection in patients with aortic valve disease and left ventricle hypertrophy undergoing isolated aortic valve replacement should be interpreted as follows:

1. Improvement and favorable modification of preischemic factors of hypertrophied myocardium by decreasing peripheral vascular resistance, pulmonary artery pressure, and coronary vasodilation.

2. Preischemic administration of amlodipine prevents a higher calcium burden during aortic cross-clamping resulting from wide opening of the small calcium channel thus reducing oxygen radical production .

3. Maintaining low SVR and PVR during the rewarming and early postoperative period, thus minimizing the afterload and burden to the left ventricle. The recovery of left ventricular function is rapid and stable.

The lower incidence of ventricular arrhythmia and systemic hypertension in the early postoperative period, rapid recovery of cardiac performance without the need for inotropic support, the low level of troponin I release and significantly less of ultrastructural damage to the myocardium , appear to be acceptable arguments to support the favorable effect of amlodipine for patients undergoing open-heart surgery.

The calcium antagonist amlodipine, given 5 to 7 days preoperatively at a dose of 5 mg orally , can be recommended for patients undergoing open-heart surgery for isolated aortic valve diseases with LV hypertrophy.

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Surgery and Early Outcome Result of Ascending Aortic Aneurysm

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Background: **Ascending aortic aneurysm disease (AAAD) shows a low frequency, heterogeneous behavior, high risk of rupture, dissection and mortality, making elective surgery necessary. Several procedures have been developed, and the Bentall technique is considered as the reference standard. So, the aim of the present study was to investigate the early surgical outcome (first year post operative) in patients with ascending aortic aneurysm treated using the Bentall procedure.**

Methods: **30 patients with AAA underwent surgery between January 2008 and December 2011. The supracoronary repair with tube graft was used for dissection aortic aneurysm and total circulatory arrest with retrograde cerebral perfusion, while Bentall repair was used for aortic aneurysm and aortic regurge.**

Results: **There was insignificant difference in durations of hospital stay, laboratory data of patients on discharge, and postoperative complications. The only significant predictor of death in all studied patients was the second operation sequence. In each group, age, sex, dyspnea status, aortic dissection, diabetes mellitus, hypercholesterolemia, hypertension, smoking, fair ejection fraction (30-49%), operative priority (elective, emergant or urgent) and operative sequence had no influence on mortality rate.**

Conclusion: **Bentall's operation is most appropriate for younger patients, those with the Marfan syndrome, and others with marked pathological involvement of the sinuses.**

Ascending aortic aneurysm (AAA) is defined as a dilatation of the ascending aorta producing a cross sectional diameter more than 1.5 times its normal value; values between 1.1 and 1.5 are considered dilated or ectatic ascending aorta (1).

The decision for surgical treatment is multifactorial and is established by the anatomic features of the aorta, underlying disease, risk of anticoagulation, age of the patient and presence of active infection, among others. Various surgical techniques have been developed that reflect the evolution in the management of AAA, each with advantages, limitations and specific risks (2).

The Bentall operation has been considered the gold standard for treatment of combined ascending aortic aneurysm disease and aortic valve pathology (3). While patients who have significant dilation of the aortic root in addition to an aneurysm of the ascending aorta or patients with Marfan syndrome should undergo replacement of the ascending aorta and root. This is usually done with a composite graft consisting of a mechanical valve inserted into a collagen- or gelatin-impregnated Dacron graft that comes preassembled. The coronary arteries are reimplanted as buttons (4).

Patients and methods

This study included 30 patients with Ascending Aortic Aneurysm underwent surgery between January 2008 and December 2011. Identification of Ascending Aortic Aneurysm was based on preoperative Echocardiography and Computed Tomography assessment performed by an independent cardiologist.

The type of repair that was performed depended on the etiology of aneurysm. The supracoronary repair with tube graft was used for dissection aortic aneurysm and total

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circulatory arrest with retrograde cerebral perfusion, while Bentall repair was used for aortic aneurysm and aortic regurge.

The patients were divided into 2 groups according to type of repair: group A and group B. In group (A) 19 patients underwent aortic valve replacement with supra coronary conduit, while in group (B) 11 patients underwent replacement of the ascendine aorta and aortic root with a composite valve graft conduit (Bentall Operation).

Preoperative Data

Data characterizing patients and perioperative clinical outcomes were entered prospectively into the PATS database. The following data of the studied patients were selected:

I- Demographic data and patient characteristic: including age at surgery, sex difference, height (cm), weight (kg), body mass index, BMI (kg/m^2), body surface area (BSA) (m^2).

II- Preoperative history of systemic diseases: including history of congestive cardiac failure, previous PTCA/stent, diabetes, hypercholesterolaemia, hypertension, smoking, GIT, respiratory, cerebrovascular diseases, atrial fibrillation/flutter, aortic regurgitation and Marfan disease.

III- Preoperative clinical data: including reason for operation, ejection fraction, operative priority and sequence.

IV- Preoperative laboratory data:

1. Complete laboratory investigations were done including C.B.C, renal function test and liver function test.
2. EuroScore (European System for Cardiac Operative Risk Evaluation) was used as a risk model which allows the calculation of the risk of death after a heart operation. The model asks for 17 items of information about the patient, the state of the heart and the proposed operation (5).
3. Parsonnet Score was used to predict risk of undertaking cardiac surgery. The elements of this score include: female gender = 1, obesity (>1.5 x ideal weight) = 3, diabetes = 3, hypertension (>140mmHg) = 3, ejection fraction >50% = 0, ejection fraction 30-49% = 2, ejection fraction <30% = 4, age: 70-74 years = 7, age: 75-79 years = 12, first reoperation= 5, second =10, dialysis dependent = 10, catheter lab emergency = 10, catastrophic states = 10-50 (6).

Operative Data

I- Anesthesia and CPB

Anaesthesia consisted of propofol (3 rug/kg/h) combined with remifentanyl (0.5 to 1 g/kg/min). Femoral arterial cannulation and brachiocphalic artery cannulation were profiled in 8 patients with aortic dissection, ascending aorta aneurysm extending to aortic arch, and emergency status.

In patients with severe atherosclerotic disease of the abdominal aorta or femoral arteries, the axillary cannulation was employed. In other patients, the CPB was instituted using ascending aortic cannulation and a two-stage venous cannulation in the right atrium. Systemic temperature was kept between 28°C and 30°C. In cases of Bental repair, while in cases which need total circulatory arrest and Retrograd cerebral perfusing the temperature as kept at 18°C.

Cold blood hyperkalemic cardioplegia (4°C) was given antegrade into the aortic root at a rate of 300 mL/min for 2 minutes and then retrograde at a rate of 200 mL/min for an additional 2 minutes. A cooling jacket was used to facilitate this process. If the aortic valve was grossly incompetent, and prompt arrest was not achieved with retrograde cardioplegia, the aorta was opened and the coronary ostia were cannulated directly. During the procedure, retrograde cardioplegia was administered every 20 minutes.

II-Surgical techniques

1- Aortic valve replacement with supra coronary conduit

After the institution of cardiopulmonary bypass, the ascending aorta was cross-clamped and the heart was arrested with cold blood hyperkalemic cardioplegia. A longitudinal aortotomy was made and extended into the non-coronary sinus of Valsalva, well away from the right coronary ostium.

The valve was excised and aortic valve was replaced. The ascending aorta was then replaced with a woven Dacron conduit, in a supracoronary position. In some of these cases the posterior segment of the proximal anastomosis was constructed first with the graft inverted and tucked into the left ventricle through the aortic annulus.

The graft was everted out of the ventricle and the aortic valve prosthesis sutured to the annulus in the usual way. Then, the anterior half of the proximal anastomosis was completed. With this technique a more accurate and therefore haemostatic suture line was constructed. The risk of hemorrhage from the inaccessible posterior aspect of the anastomosis was minimized.

In all cases the distal anastomosis was constructed with a double everting continuous suture of 4/0 prolene, buttressed with a strip of Teflon felt. In no case was the Dacron conduit preclotted. In a few cases the aneurysm wall was closed over the conduit after resection of excess tissue.

Particular attention was directed to making a watertight anastomosis. If the aneurysm was limited to the ascending aorta and there was no associated dissection, the graft was tailored and the distal anastomosis completed with the aortic cross-clamp in.

Rewarming was begun while the distal anastomosis was being sewn. The cross-clamp was removed, and the air in

the ascending aorta and heart was removed. The patient was weaned from cardiopulmonary bypass, and the cannulas were removed.

2- Replacement of the ascending aorta and aortic root with a composite valve graft conduit (Bentall Operation):

Replacement of the ascending aorta and aortic root with a composite valve graft conduit was perforemed as prescribed by Bentall and de Bono, 1968.

After establishing cardiopulmonary bypass, the aorta was clamped proximal to the innominate artery and the heart was arrested with cold blood cardioplegia. The aorta was transected beneath the clamp, ensuring an adequate cuff of aortic tissue. Proximally the aortic root was excised leaving only buttons of aortic tissue surrounding each of the coronary arteries.

The coronaries were mobilized for 1 to 2 cm to prevent tension during reimplantation. A composite graft was selected based on the size of the aortic annulus. The sewing ring of the composite graft was sutured to the annulus with 2-0 pledgeted polyester mattress sutures placed immediately adjacent to each other. The adjacent placement of sutures and the selection of a conduit that snugly fits within the annulus help to ensure hemostasis. A second suture line with a 4-0 running polypropylene suture could be used to approximate the aortic remnant to the newly secured valved conduit sewing ring to aid in hemostasis.

Openings for coronary reimplantation were made in the appropriate position in the Dacron graft with an ophthalmic cautery. First the left and then the right coronary arteries were attached using 4-0 or 5-0 polypropylene suture in continuous fashion incorporating a thin strip of felt.

The distal anastomosis was then performed with a continuous 3-0 or 4-0 polypropylene suture also incorporating a strip of felt. The graft was vented with a needle and the left atrium and ventricle were de-aired. After the patient was decannulated and protamine has been administered, suture line hemostasis was scrutinized.

III- Collected Intraoperative Data

Including the number of used procedures, cumulative bypass Time (in minutes), cumulative cross-clamp (XC) time (in minutes), minimum core temperature, minimum pressure, maximum pressure, minimum flow, maximum flow, minimum PO2, maximum PO2, vascular pathology (aneurysm, aneurysm with dissection, aneurysm with Marfan, and dissection), blood transfusion, blood units, blood products transfused, and comming off bypass and inotropic support

Postoperative Data

At the end of surgery patients were transferred to the intensive care unit (ICU) and managed according to unit protocol. Patients were extubated as soon as they met the following criteria: hemodynamic stability, no excessive bleeding (< 80 mL/h), normothermia, and consciousness with pain control. Fluid management postoperatively consisted of 5% dextrose infused at 1 mL/kg/hour, with additional colloid or blood to maintain normovolemia and hematocrit more than 24%. Potassium and magnesium deficiencies were promptly treated as necessary to maintain electrolyte balance within the normal range.

The collected postoperative data included:

I- Hospital stay: including duration of ventilation (in days and in hours), stay on ITU (in nights and in hours), preoperative stay (in days), postoperative stay (in days), and total hospital stay (in days).

II- Laboratory data of patients on discharge: hemoglobin, creatinine, and bilirubin on discharge.

III- Postoperative complications: low cardiac output, arrhythmia, reoperation for bleeding/tamponade, sternal resuturing, pulmonary complications, neurological complications, renal complications and multisystem failure.

IV- Patient Survival and Mortality.

Statistical analysis

Statistical data were presented as mean ± SD or number (percentage) as appropriate. T-student used or Chi-square test was used to compare independent data. Predictors of mortality were tested using univariate and multivarite regression. P-value was considered significant if it was < 0.05.

Results

Preoperative Parameters

Group A included 19 patients, 17(89.5%) of them were males and 2(10.5%) were females, with mean age was 51±11.7 years. Group B included 11 patients, 8(72.7%) of them were males and 3(17.3%) were females, with mean age of 46.18±8.78 years, with insignificant difference between both groups regarding comparison of age and sex difference (p-value > 0.05). The mean height (cm) was 172.16±5.37 cm in group A and 174.6±9 cm in group B, with insignificant difference between both groups (p-value > 0.05). The mean weight (kg) was 79.44±11.5 kg in group A and 84.6±16.6 kg in group B, with insignificant difference between both groups (p-value > 0.05). The mean BMI (kg/m2) was 26.78±3.46 kg/m2 in

group A and 27.64±4.49 kg/m2 in group B, with insignificant difference between both groups (p-value > 0.05). The mean BSA (m^2) was 1.91±0.14 m^2 in group A and 1.99±0.21 m^2 in group B, with insignificant difference between both groups (p-value > 0.05).

The mean Hb (gm/dl) was 13.12±1.77 in group A and 11.64±1.12 in group B. The mean creatinine (mg/dl) was 1.04±0.28 in group A and 0.83±0.18 in group B. The mean bilirubin (mg/dl) was 0.85±0.54 in group A and 1.16±0.71 in group B. The mean Euroscore was 2.84±1.3 in group A and 3.18±1.77 in group B. The mean Parsonnet Score (PATS) was 8.68±2.74 in group A and 7.63±3.98 in group B. There was insignificant difference in preoperative laboratory data between both groups (p-value > 0.05). Preoperative clinical data and risk scoring in the studied patients summarized in (table, 1).

Operative Parameters

The mean total number of procedures was 2.42±1 in group A and 2±0.77 in group B. The mean cumulative bypass Time (min) was 186.57±48.4 in group A and 184.18±106.7 in group B. The mean cumulative cross-clamp time (min) was 135.15±34.6 in group A and 109.27±4 in group B. The mean minimum core temperature was 25.84±4.47 in group A and 26±6.16 in group B. The mean minimum pressure was 49.88±11.7 in group A and 48.90±14.8 in group B. The mean maximum pressure was 81.77±8.49 in group A and 79.81±0.40 in group B. The mean minimum flow was 3.25±1.25 in group A and 3.83±0.26 in group B. The mean maximum flow was 4.84±0.38 in group A and 5.04±0.55 in group B. The mean minimum PO2 was 289.1±83.6 in group A and 283.14±69.8 in group B. The mean maximum PO2 was 460.5±102.9 in group A and 405.7±72.2 in group B.

The vascular pathology included: Aneurysm in 13(68.4%) in group A and 7(63.6%) in group B, aneurysm and dissection in 2(10.5%) in group A and no patients in group B, aneurysm and Marfan in 1(5.3%) in group A and no patients in group B, and dissection in 3(15.8%) in group A and 4(36.4%) in group B.

Perioperative blood transfusion was done in 6(31.6%) in group A and 4(36.4%) in group B. Two or more blood units were used in 4(21.1%) in group A and 1(9.1%) in group B. Blood products transfused in 2(10.5%) in group A and no patients in group B.

Failed to come off bypass was reported in 1(5.3%) in group A and 1(9.1%) in group B. High inotropic support was used in 2(10.5%) in group A and no patients in group B. Minimal support was used in 7(36.8%) in group A and 8(72.7%) in group B. No support was used in 9(47.4%) in group A and 2(18.2%) in group B.

Parameters	Group A AVR+Supracornary prosthesis, (n=19)	Group B Bantall's procedure, (n=11)	P-value
Age (years)	51±11.7	46.18±8.78	0.24
Sex: Male Female	17(89.5%) 2(10.5%)	8(72.7%) 3(17.3%)	0.23
Height (cm)	172.16±5.37	174.6±9	0.36
Weight (kg)	79.44±11.5	84.6±16.6	0.33
BMI (kg/m^2)	26.78±3.46	27.64±4.49	0.56
BSA (m^2)	1.91±0.14	1.99±0.21	0.29
Hb (gm/dl)	13.12±1.77	11.64±1.12	0.3
Creatinine (mg/dl)	1.04±0.28	0.83±0.18	0.051
Bilirubin (mg/dl)	0.85±0.54	1.16±0.71	0.21
Reason for operation:			
Anatomical	10(52.6%)	3(27.3%)	0.38
Angina	2(10.5%)	2(18.2%)	
Aortic aneurysm	2(10.5%)	0(0%)	
Aortic dissection	2(10.5%)	3(27.3%)	
Severe valve pathology	3(15.8%)	3(27.3%)	
Dyspnea status:			
NYHA 2	10(52.6%)	4(36.4%)	0.45
NYHA 3	8(42.1%)	5(45.5%)	
NYHA 4	1(5.3%)	2(18.2%)	
Ejection fraction:			
Fair (30-49%)	3(15.8%)	5(45.5%)	0.07
Good	16(84.2%)	6(54.5%)	
Operative priority:			
Elective	16(84.2%)	8(72.7%)	0.52
Emergent	1(5.3%)	2(18.2%)	
Urgent	2(10.5%)	1(9.1%)	
Operative sequence:			
First operation	18(94.7%)	10(90.9%)	0.68
Second operation	1(5.3%)	1(9.1%)	
EuroScore	2.84±1.3	3.18±1.77	0.55
PATS	8.68±2.74	7.63±3.98	0.40

BMI: Body mass index, BSA: Body Surface Area, NYHA: New York Heart Association PATS: Parsonnet Score.

Table (1): Preoperative data in the studied patients.

Parameters	Group A AVR+Supracornary prosthesis, (n=19)	Group B Bantall's procedure, (n=11)	P-value
Total number of procedures	2.42±1	2±0.77	0.24
Cumulative bypass Time (min)	186.57±48.4	184.18±106.7	0.93
Cumulative cross-clamp time (min)	135.15±34.6	109.27±44	0.08
Minimum core temperature	25.84±4.47	26±6.16	0.93
Minimum pressure	49.88±11.7	48.90±14.8	0.84
Maximum pressure	81.77±8.49	79.81±0.40	0.45
Minimum flow	3.25±1.25	3.83±0.26	0.14
Maximum flow	4.84±0.38	5.04±0.55	0.26
Minimum PO2	289.1±83.6	283.14±69.8	0.87
Maximum PO2	460.5±102.9	405.7±72.2	0.21
Vascular pathology:			
Aneurysm	13(68.4%)	7(63.6%)	0.38
Aneurysm+dissection	2(10.5%)	0(0%)	0.26
Aneurysm+Marfan	1(5.3%)	0(0%)	0.43
Dissection	3(15.8%)	4(36.4%)	0.07
Blood transfusion	6(31.6%)	4(36.4%)	0.78
Blood units: 2 or more	4(21.1%)	1(9.1%)	0.08
Blood products transfused	2(10.5%)	0(0%)	0.26
Comming off bypass:			
Failed to come off bypass	1(5.3%)	1(9.1%)	0.19
High inotropic support	2(10.5%)	0(0%)	0.26
Minimal support	7(36.8%)	8(72.7%)	0.09

Table 2. Operative parameters of the studied patients.

Postoperative Parameters

The mean duration of ventilation was 1.40±1 days and 28.26±23.4 hours in group A, 1.60±1.8 days and 27.40±38.7 hours in group B. The mean stay on ITU was 2.93±2.81 nights and 64.14±66.7 hours in group A, 2.1±1.79 nights and 48.20±36 hours in group B. The mean preoperative stay was 1.47±1.71 days in group A and 1.09±0.70 days in group B. The mean postoperative stay was 11.05±7.94 days in group A and 16.54±10.6 days in group B. The mean total hospital stay was 12.52±7.75 days in group A and 17.63±11.1 days in group B. There was insignificant difference in durations of hospital stay of the studied patients (p-value > 0.05).

The number of patients discharged to home was 14(73.4%) in group A and 8(72.7%) in group B. The mean Hb (gm/dl) on discharge was 11.52±1.68 in group A and 11.50±1.64 in group B. The mean creatinine (mg/dl) was 1.04±0.32 in group A and 0.95±0.19 in group B. The mean bilirubin (mg/dl) was 0.76±0.36 in group A and 0.92±0.33 in group B. There was insignificant difference in laboratory data of patients on discharge (p-value > 0.05).

Low cardiac output occurred in 7(36.9%) of group A and 7(63.6%) of group B. Arrhythmia occurred in 3(15.8%) of group A and no patients of group B. Reoperation for bleeding/tamponade was indicated in 8(42.1%) of group A and 3(27.3%) of group B. Sternal resuturing was done in 3(15.8%) of group A and 3(27.3%) of group B. Pulmonary complications occurred in 1(5.3%) of group A and no patients of group B. Neurological complications occurred in no patients of group A and 1(9.1%) of group B. Renal complications occurred in 1(5.3%) of group A and no patients of group B. Multisystem failure occurred in 1(5.3%) of group A and no patients of group B.

Parameters	Group A AVR+Supracornary prosthesis, (n=19)	Group B Bantall's procedure, (n=11)	P-value
Ventilation (days)	1.40±1	1.60±1.8	0.73
Ventilation (hours)	28.26±23.4	27.40±38.7	0.94
Stay on ITU (Nights)	2.93±2.81	2.1±1.79	0.41
Stay on ITU (Hours)	64.14±66.7	48.20±36	0.50
Preoperative stay (days)	1.47±1.71	1.09±0.70	0.48
Postoperative stay (days)	11.05±7.94	16.54±10.6	0.11
Total hospital stay (days)	12.52±7.75	17.63±11.1	0.14
Discharge to home	14(73.4%)	8(72.7%)	0.95
Hb (gm/dl)	11.52±1.68	11.50±1.64	0.97
Creatinine (mg/dl)	1.04±0.32	0.95±0.19	0.46
Bilirubin (mg/dl)	0.76±0.36	0.92±0.33	0.33

Table 3. Duration of hospital stay and Laboratory data of patients on discharge.

As regard to preoperative data in survivor and died patients underwent AVR and supra-coronary conduit operation, age, sex, dyspnea status, aortic dissection, diabetes mellitus, hypercholesterolemia, hypertension, smoking, fair ejection fraction (30-49%), operative priority (elective, emergant or

Parameters	AVR and supracoronary conduit			Bentall's operation		
	Survivors (n=14)	Died (n=5)	P-value	Survivors (n=8)	Died (n=3)	P-value
Age (years)	48.6±11.8	57.6±9.7	0.14	45.2±7.6	48.6±13	0.59
Sex:						
Male	13 (92.9%)	4 (80%)	0.42	6 (75%)	2 (66.7%)	0.78
Female	1 (7.1%)	1 (20%)		2 (25%)	1 (33.3%)	
Dyspnea status:						
NYHA 2	7 (50%)	3 (60%)	0.16	2 (25%)	2 (66.7%)	0.38
NYHA 3	7 (50%)	1 (20%)		4 (50%)	1 (33.3%)	
NYHA 4	0 (0%)	1 (20%)		2 (25%)	0 (0%)	
Aortic dissection	1 (7.1%)	1 (20%)	0.42	2 (25%)	1 (33.3%)	0.78
Diabetes mellitus	1 (7.1%)	1 (20%)	0.42	0 (0%)	0 (0%)	1
Hypercholestrolemia	3 (21.4%)	1 (20%)	0.94	0 (0%)	1 (33.3%)	0.08
Hypertension	9 (64.3%)	4 (80%)	0.51	4 (50%)	2 (66.7%)	0.62
Smokers	1 (7.1%)	0 (0%)	0.53	2 (25%)	0 (0%)	0.33
Fair Ejection fraction (30-49%)	2 (14.3%)	1 (20%)	0.76	4 (50%)	1 (33.3%)	0.62
Operative priority:						
Elective	13 (92.9%)	3 (60%)	0.14	6 (75%)	2 (66.7%)	0.17
Emergent	0 (0%)	1 (20%)		2 (25%)	0 (0%)	
Urgent	1 (7.1%)	1 (20%)		0 (0%)	1 (33.3%)	
Operative sequence:						
First operation	14 (100%)	4 (80%)	0.08	8 (100%)	2 (66.7%)	0.08
Second operation	0 (0%)	1 (20%)		0 (0%)	1 (33.3%)	

Table 4. Preoperative data in survivor and died patients as predictors for mortality.

urgent) and operative sequence had no influence on mortality rate, with insignificant difference between survivors and died patients regarding comparison of these factors. While in patients underwent Bentall's operation as predictors for mortality. Age, sex, dyspnea status, aortic dissection, diabetes mellitus, hypercholesterolemia, hypertension, smoking, fair ejection fraction (30-49%), operative priority (elective, emergant or urgent) and operative sequence had no influence on mortality rate, with insignificant difference between survivors and died patients regarding comparison of these factors.

Discussion

Aortic aneurysm is a well-known surgical entity that most commonly involves the ascending part of the aorta and, to a lesser extent, the aortic arch and the descending part or the abdominal aorta (7).

Ascending thoracic aortic aneurysm is defined as a dilatation of the ascending aorta producing a cross sectional diameter more than 1.5 times its normal value; values between

Parameters	Group A AVR+Supracornary prosthesis, (n=19)	Group B Bantall's procedure, (n=11)	P-value
Low cardiac output	7(36.9%)	7(63.6%)	0.36
Arrhythmia	3(15.8%)	0(0%)	0.16
Reoperation for bleeding/tamponade	8(42.1%)	3(27.3%)	0.33
Sternal resuturing	3(15.8%)	3(27.3%)	0.44
Pulmonary complications	1(5.3%)	0(0%)	0.43
Neurological complications	0(0%)	1(9.1%)	0.18
Renal complications	1(5.3%)	0(0%)	0.43
Multisystem failure	1(5.3%)	0(0%)	0.43
Mortality rate	5(26.4%)	3(27.3%)	0.95

Table 5. Postoperative complications and mortality rate in the studied patients.

1.1 and 1.5 are considered dilated or ectatic ascending aorta. The incidence of thoracic aneurysms has been classically estimated to be 2–5 cases per 100000/year (8).

Composite graft replacement of the aortic valve and ascending aorta, as originally described by Bentall and De Bono or the modified button method, has become the accepted surgical treatment for a variety of proximal aortic conditions including ascending aortic aneurysm with aortic valve incompetence, aortic dissection, and infective endocarditis (9).

The Bentall operation is more appropriate for patients with aortic root abnormality and a dilated ascending aorta, whereas aortic valve replacement and supracoronary replacement of the ascending aorta is a perfectly acceptable operation for patients with aortic valve disease, normal or mildly dilated aortic sinuses, and a dilated ascending aorta (10).

Previous conservative methods of aortic root repair, such as aneurysm banding, plication, and supracoronary aortic replacement, were characterized by partial removal of diseased aortic tissue. The conservative surgery remains the best alternative procedure since the native aortic valve is not removed, however, it should not be employed in cases when the disease involves the aortic valve, annulus and sinuses of Valsalva.

Various studies evaluated the Bentall's technique and conservative methods for surgical treatment of ascending aortic aneurysm with comparable results of early and late outcome, also, the predictors for early outcome are not well defined (2,11,12,13,14-18). Therefore, the aim of the current study is to investigate the early surgical outcome (first year post operative) in 30 patients with ascending aortic aneurysm using Bentall's operation or aortic valve replacement with supracoronary conduit.

In our study, the specific procedure that was performed depended on the distal extent of aortic involvement, condition of the aortic root and the aortic valve, underlying pathology, desired anticoagulation status, and surgeon preference.

In our study, the patients with ascending aortic aneurysm were relatively young (mean age, 49.23±10.8 years) compared to other reports, and there was a male predominance (83.3%); others have reported a male-to-female ratio of 2:1 to 4:1.6 (19-21).

In our study, a careful preoperative evaluation of the patient was important to minimize the risks of surgery. Nearly one-third of patients undergoing surgery for thoracic aortic disease have chronic obstructive pulmonary disease (22). Patients with suspect pulmonary function should have spirometery and room air arterial blood gases. Smoking cessation, antibiotic treatment of chronic bronchitis, and chest physiotherapy may prove beneficial in elective situations. Normal renal function should be ensured with the appropriate blood work, and abnormal results should prompt further investigation.

Because unaddressed severe carotid disease is a risk factor for stroke during ascending aortic operations, patients over the age of 65 had duplex imaging of their carotids (23).

Younger patients with peripheral vascular disease, extensive coronary artery disease, carotid bruits, or history suspicious for cerebral ischemia was investigated as well (24).

Abdominal aortic aneurysms occur in 10 to 20% of patients with ascending aortic aneurysms. Patients with "atherosclerotic aneurysms" that extend into the aortic arch have a greater than 50% probability of having distal thoracic or abdominal aortic aneurysms (25,26). Thus, in our elective preoperative workup, CT or MRI of the abdominal aorta was indicated if disease is suspected.

Traditional risk factors have included smoking, hypertension, atherosclerosis, and well-defined genetic disorders such as Marfan syndrome and Ehlers-Danlos syndrome (27-29). In our study, the associated preoperative risk factors for ascending aortic aneurysm include hypertension in 63.3%, smoking in 46.7%, and Marfan disease in 3.3%.

The aortic wall is a biologically active environment. Smooth muscle cells synthesize and degrade elastin, collagen, and proteoglycans. In the media of a typical ascending aortic aneurysm there is fragmentation of elastic fibers, and loss of smooth muscle cells or alteration in smooth muscle cell function. The resulting pathologic entity is referred to as cystic medial degeneration or cystic medial necrosis. In advanced forms there is a dramatic loss of elastic fibers and smooth muscle cells with the accumulation of a basophilic amorphous material giving the media a true cystic appearance (30, 31). Subtler degrees of elastic fiber fragmentation are normal, and the diameter of the ascending aorta typically increases with age. Smoking has been associated with increased concentrations of elastolytic enzymes within the aortic wall, possibly hastening this process (32).

Marfan syndrome is an autosomal dominant connective tissue disorder, with potentially life-threatening cardiovascular manifestations. Fibrillin is one of the major structural components of the elastic fiber. The resulting abnormal elastic fibers are prone to disruption and result in histologic findings consistent with cystic medial degeneration of the smooth muscle layer at an early age leading to aortic aneurysm (30, 33, 34).

In our study, reoperation for bleeding/tamponade was performed in 11(36.7%) of all patients underwent surgery, 8 out of 19 patients (42.1%) underwent AVR with supracornary prosthesis and 3 out of 11 patients (27.3%) underwent Bentall's procedure.

As published in other series, postoperative bleeding requiring reoperation ranges from 2.4 to 11.1% (16,35,36). The use of the exclusion technique of graft insertion and blood-impervious grafts has resulted in lower bleeding rates.

In a recent study by van Putte and colleagues, to evaluate short-term and long-term outcomes of aortic root replacement with mechanical valve prosthesis, the incidence of resternotomy for bleeding or tamponade was 19% (37).

In our study, postoperative neurological complications occurred in one patient (3.3%) who underwent Bentall's procedure.

Neurological complications particularly stroke had been reported in 1.8 to 5.9% of patients in various series (34,36,38,39). Antegrade reperfusion following completion of the distal aortic anastomosis and the use of retrograde cerebral perfusion1may lower the risk of stroke in patients requiring circulatory arrest (36,40).

In our study, the overall early mortality rate (in theatre and postoperatively in hospital) for ascending aortic aneurysm was 26.7% of all cases, 27.3% for Bentall's procedure and 26.4% for AVR with supracornary prosthesis.

The reported early mortality of surgery for ascending aortic aneurysm in literature varies from 2% to 13% (2,9,16,18,20,37).

The higher mortality rate in our study as compared to other studies might be related mainly to few number of the studied patients. In addition, some of these series did not include dissection, and the proportion of emergent operations, reoperations, and arch replacements is highly variable (20,35,38,41, 42).

Our results are gratifying given the high mortality and morbidity attending untreated ascending aortic aneurysm, dissection and root infection which is as high as 20% at 24 hours and 90% at 3 months (21).

The most common cause of early death is clearly cardiac failure. Other frequent causes of early death include stroke, bleeding, and pulmonary insufficiency (35,38,41,42).

Cohn and colleagues noted the risk of mortality to be low, regardless of whether chronic ascending aortic dissection or aneurysm was present; however, acute aortic dissection poses a greater risk of early and late mortality (20,42). Due to improved techniques, the surgical mortality rate for patients with acute type A dissections has been significantly reduced (43).

In the study by Bhan and colleagues, Bentall's operation was performed using a composite aortic valve and prosthetic graft in 82 patients, there were 6 early deaths (7.3%) (16).

In the study by Sioris and colleagues, operative mortality was 5% for patients undergoing aortic valve replacement and supracoronary replacement of the ascending aorta and 4% for patients undergoing the Bentall operation (18).

Galicia-Tornell and colleagues reported the hospital mortality of ascending aortic aneurysm (AAAD) surgically treated using the Bentall procedure in three out of 23 (13%) patients due to septic shock and ventricular fibrillation. Those authors found that surgical mortality with the Bentall procedure was similar to published results by other specialized centers and they concluded that events related to the basic aortic pathology, surgical technique, aortic valve prosthesis and left ventricular dysfunction encourage long-term studies with follow-up (2).

A recent study by van Putte and colleagues revealed that overall 30-day mortality was 3.2% to 2.5% for elective surgery and 6.5% for urgent surgery (37).

The type of surgery did not seem to influence early or late mortality, whether composite graft replacement or separate aortic valve replacement/repair and supracoronary replacement or only ascending aortic replacement. However, separate replacement of the ascending aorta and aortic valve carries a higher complication rate for the remaining ascending aorta on long-term follow-up, compared with the Bentall procedure (44). Ehrlich and colleagues found concomitant procedures, hypothermic circulatory arrest time 30 min, and contained rupture to be risk factors for an adverse outcome (43).

In our study, the only significant predictor of early mortality in all patients was the second operation sequence. In each procedures (AVR with supracotronary conduit or Bentall's procedure), age, sex, dyspnea status, aortic dissection, diabetes mellitus, hyper-cholesterolemia, hypertension, smoking, fair ejection fraction (30-49%), operative priority (elective, emergent or urgent) and operative sequence had no influence on mortality rate.

There is a controversy regarding factors affecting outcome after surgical treatment of ascending aortic aneurysm that might be related to number of studied patients, difference in the follow-up period, difference in preoperative characteristics of the patients (low or high number of patients with co-morbidities) and difference in indication of surgery (elective or emergent, for aneurysm only or for aneurysm or dissection). In our study, absence of predictors for mortality in each procedure might be related to few numbers of the studied patients enrolled in this study.

The study by Prifti and colleagues revealed the aortic dissection, age >65 years, associated coronary artery disease, NYHA functional class 3, LVEF <35% and total arch reconstruction as strong predictors for poor overall survival in patients undergoing aortic root replacement (17).

In the study by Sioris and colleagues, older age, moderate or severe left ventricular dysfunction, active endocarditis, previous cardiac surgery, and coronary artery disease were independent predictors of death (18).

Meharwal and colleagues found left ventricular ejection fraction 30% and contained rupture were the only factors associated with early mortality on multivariate logistic regression, but as the regression analysis was performed on a very small number of incidents, it should be interpreted as

indicative (21). Bachet and colleagues reported a 3% incidence of low cardiac output and 1.95% incidence of permanent stroke(19).

The study of 597 patients by Etz and colleagues highlighted the excellent short- and long-term outcomes with the Bentall procedure for a multitude of aortic diseases. The strength of the operation lies in its wide applicability and reproducibility. The choice of valve type does not affect early or late outcomes, as shown in the 50- to 70-year age group. However, the data clearly indicate that emergency operation and clot have a negative impact on in-hospital and long-term outcome. A carefully orchestrated aortic aneurysm surveillance program and timely elective surgery can circumvent the higher mortality and complication rates associated with emergency operations(45).

In conclusion, for treatment of ascending aortic aneurysms, the use Bentall's operation or a separate graft and valve provided similar clinical outcomes and the type of operation had no effect on operative and short-term survival. This finding reflects the proper selection of patients with ascending aortic aneurysm for surgery.

Progress in preoperative and postoperative patient management, in conduct of cardio-pulmonary bypass and myocardial protection, and in techniques and materials used for root replacement must be credited for the low mortality and morbidity of elective procedures for surgical management of ascending aortic aneurysm.

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Effect of Immediate Preoperative Oral Sildenafil Administration for Pulmonary Hypertension in Patients undergoing Valve Replacement

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Objectives: **We tried to assess the role of oral sildenafil given preoperatively in reduction of pulmonary artery systolic pressure and also evaluate its effects on haemodynamics.**

Methods: **60 patients who had valvular heart disease with valve lesions indicative for mitral valve replacement were enrolled in the study. They were randomly divided into two goups; group (A) and group (B). Group (A) had oral sildenafil immediately preoperatively. All patients were subjected to transthoracic echocardiography and haemodynamic data collection was done.**

Results: **Mean PASP were 75.3, 39.4 and 35.1 mm/Hg pre-op, intra op and post- op respectively. The administration of sildenafil has markedly affected the pulmonary artery systolic pressure (PASP). The mean PASP was reduced from 75.3 mmHg to 35.1 mmHg (P value 0.001). Moreover, there is stepwise reduction of PASP after administration of sildenafil pre-operatively, as detected by intra-operative PASP assessment, (P value 0.001 and 0.003 respectively). There was no significant effect on other haemodynamic variables; systemic blood pressure and central venous pressure, P value (0.5 and 0.1 respectively).**

Conclusion: **The results showed a dramatic effect of orally administered sildenafil on pulmonary artery pressure measured either directly intraoperative or postoperatively.**

Key Words: **Pulmonary hypertension, sildenafil, mitral valve disease.**

The first report of the circulation of blood through the lungs has been attributed to Ibn Nafis (1210–1288) [1]. Over the past 50 years it has become clear that pulmonary hypertension is largely a disease of the pulmonary circulation, and the pathology is focused in the small pulmonary arteries, which are characterized by intimal fibrosis, medial hypertrophy, adventitial proliferation, obliteration of small arteries, and, on occasion, vasculitis or changes in the walls of the pulmonary veins [2].

Pulmonary hypertension is a condition defined as an increase of the mean pulmonary artery pressure to more than 25 mm Hg at rest or 30 mm Hg with exercise. This definition was used in the National Institutes of Health (NIH) registry of patients with primary pulmonary hypertension [3].

Available therapeutic possibilities for pulmonary hypertension are anticoagulants, calcium channel blockers, prostacycline, and endothelin receptor antagonist [4-5]. However, these are either much overpriced, have limited benefits or have poor acceptability among patients because of complex delivery systems.

The pharmacological agent Sildenafil belongs to a class of drugs called phosphodiesterase (PDE) inhibitors. Phosphodiesterases are enzymes which catalyse the hydrolysis of cyclic nucleoside monophosphates (cAMP and cGMP). To date at least 11 isoforms are identified from this enzyme [6].

Sildenafil and related compounds are selective inhibitors of the cGMP hydrolyzing enzyme phosphodiesterase 5 [7]. Sildenafil is the drug which has been most often

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studied in many clinical trials. Its clinically relevant effects have been noticed on pulmonary vasculature and the smooth muscle corpus cavernosum [8].

Several studies have documented a relaxant effect of sildenafil on the pulmonary vascular smooth muscle with lowering of the pulmonary artery pressure and pulmonary vascular resistance in patients with various forms of pulmonary hypertension [9-10].

With reviewing literature, there are few randomized trials on the use of sildenafil and related drugs in postoperative pulmonary hypertension after cardiac surgery. Most of these trials were carried out on postoperative pulmonary hypertension following surgical correction of a congenital defect. The effect of oral sildenafil administration in patients with pulmonary hypertension secondary to valvular heart disease immediately preoperatively is yet to be addressed.

Patients and Methods

60 patients who had valvular heart disease with mitral valve lesions indicative for mitral valve replacement were enrolled in the study. A written consent was taken from every participant. The participants were randomly assigned into two groups:

(1) Group (A) or Patient group: It includes 30 patients. They were given sildenafil 25-50 mg orally (according to weight) immediately preoperatively (60 minutes before induction of anaesthesia).

(2) Group (B) or Control group: It includes 30 patients. They underwent the operative procedure directly without sildenafil therapy.

Both groups were subjected to the following:

(A) Transthoracic Echocardiography:

All patients had a detailed preoperative echocardiography to assess the cardiac valves and verify the indication of surgical intervention, also to assess preoperative pulmonary artery systolic pressure.

(B) Haemodynamic data:

* Central venous pressure: A central venous line through the internal jugular vein was inserted preoperatively to assess the central venous pressure preoperative (30 minutes before induction of anaesthesia) and postoperative (60 minutes after operation).

* Systemic blood pressure: It was assessed preoperative (30 minutes before induction of anaesthesia), intraoperative (after the placement of the prosthetic valve) and postoperative (60 minutes after operation).

* Pulmonary artery systolic pressure: It was assessed during the routine preoperative 2D trans-thoracic echocardiography, directly intraoperative (after the placement of the prosthetic valve) and 60 minutes postoperative by trans-thoracic echocardiography.

Patients with hepatic or renal impairment, chronic lung parenchymal disease or on regular nitrate therapy were excluded from the study.

(C) Surgical technique

Standardized surgical technique for valve replacement via median sternotomy was done to all patients. Total cardiopulmonary bypass is established with standard bicaval cannulation techniques using the ascending aorta as the site of cannulation for arterial inflow. The patient is cooled to an esophageal temperature of 28°C. The aorta is cross clamped and cardiac arrest induced by infusion of cold potassium cardioplegic solution into the aortic root. The left atrium is opened just posterior to the interatrial groove. Bi-leaflet mechanical valves were used in all cases for replacement of the mitral valve, after the prosthesis is tied in place, the aortic clamp is removed and as the patient is being rewarmed, the left atriotomy is closed. Care must be taken to avoid air embolization as the patient is being weaned from cardiopulmonary bypass.

(D) Statistical Analysis

Data analysis was conducted using SPSS statistical package version 16. Continuous data were displayed using mean, minimum and maximum values and were compared using Student t test, analysis of variance (ANOVA test), Pillai's trace and correlation coefficient when appropriate. Categorical data were displayed using frequency and were compared using Chi square test.

Results

(A) Study population data

The present study is conducted on 60 patients who underwent open heart surgery for mitral valve replacement. Table (1) shows the demographic and echocardiographic characteristics of the two study groups.

(B) Haemodynamic data

The obtained haemodynamic data include central venous pressure, systemic blood pressure and pulmonary artery systolic pressure. The central venous pressure was obtained pre- and post-operatively. The pulmonary artery systolic pressure and systemic blood pressure were measured pre-operative, intra-operative and 60 minutes post-operatively. Table (2) shows these haemodynamic data.

Variable	Group (A)	Group (B)	P value
Sex (males %)	33.3	43.3	0.3
Age	31.7±10.4	32.4±10.5	0.7
Echocardiographic parameters			
Aorta (mm)	2.45±0.5	2.53±0.5	0.5
LA (mm)	6.66±1.1	6.47±1.1	0.5
MVA (Cm^2)	1.55±0.7	1.50±0.7	0.8
RV (mm)	1.93±0.7	2.01±0.7	0.6
IVSD (mm)	0.90±0.09	0.92±0.09	0.5
EDD (mm)	5.74±0.7	5.75±0.7	0.9
ESD (mm)	3.65±0.5	3.64±0.5	0.9
PWD (mm)	0.86±0.09	0.88±0.09	0.3
FS (%)	35.16±5.7	34.96±5.8	0.9
EF (%)	64.0±7.3	63.8±7.1	0.9

LA: left atrial AP diameter, MVA: mitral valve area, RV: right ventricular diastolic diameter, IVSD: interventricular septal diastolic dimension, EDD: left ventricular end-diastolic diameter, ESD: left ventricular end-systolic diameter, PWD: posterior wall diastolic diameter, FS: fractional shortening, EF: ejection fraction.

Table (1) shows the demographic and echocardiographic parameters of the study patients.

Variable	Group (A)	Group (B)	P value
CVP-Pre.	11.9±1.8	11.8±1.6	0.7
CVP-Post.	11.1±0.9	10.6±1.2	0.1
Systolic BP-Pre.	132±15	135±12	0.8
Systolic BP-Intra.	120±13	127±11	0.5
Systolic BP-Post.	124±14	125±10	0.3
PASP-Pre.	75.3±18.2	74.5±16.5	0.8
PASP-Intra.	39.4±7.4	56.3±8.2	0.001
PASP-Post.	35.1±8.4	54.7±8.8	0.001
Difference in PASP	40.2±14.9	19.8±13.9	0.001

Table (2): Mean values of haemodynamic parameters of the study population. CVP: central venous pressure, PASP: pulmonary artery systolic pressure.

(C) Sildenafil effect

(1) In group (A): The administration of sildenafil has noticeably affected the pulmonary artery systolic pressure (PASP). After administration of sildenafil pre-operatively, the mean PASP was reduced from 75.3 mmHg to 39.4 mmHg (P value 0.001). Moreover, there was maintained reduction of PASP extended in the post-operative period, as detected by post-operative PASP assessment, (P value 0.003), figure (1).

Moreover, there was no significant effect on other haemodynamic variables; systemic blood pressure and central venous pressure, P value (0.5 and 0.1 respectively).

(2) In group (B): The mean PASP was reduced from 74.5 mmHg to 56.3 mmHg (P value 0.001). However, this reduction wasn't maintained in the post-operative period as in the patient group, (P value 0.2). Moreover, the extent of the reduction in PASP in the control group (19.8 mmHg) is much less that observed in the patient group (40.2 mmHg), (P value 0.001), figure (1).

(3) On comparing between the two groups: There was statistically significant reduction in the mean PASP measured intra-operatively and post-operatively (P value 0.001). However, there was no statistically significant difference in other haemodynamic variables such as central venous pressure or systolic blood pressure.

(D) Factors associated with sildenafil effect

Using Pearson correlation coefficient for parameteric data, the change in pulmonary artery systolic pressure is not related to patient age (P value 0.1) nor left atrial diameter (P value 0.9). It has also no relation to the patient sex (P value 0.6 using either independent sample T test or Kendall's tau test).

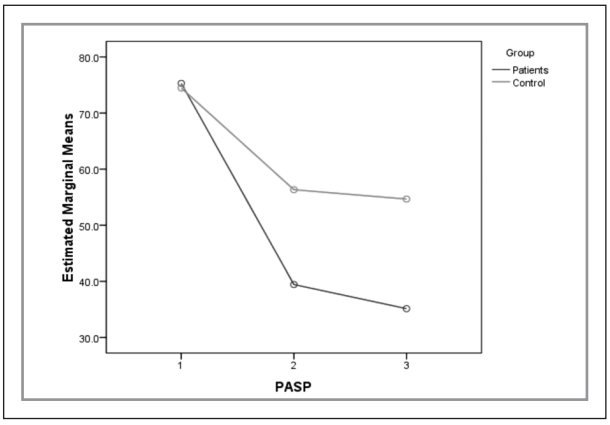

Fig 1. Effect of sildenafil administration on pulmonary artery systolic pressure among group (A) compared with group (B). 1: Pre-operative, 2: Intra-operative, 3: Post-operative.

However, there is statistically significant negative correlation between the extent of PASP reduction and cardiac function, (P value 0.03), and the mitral valve area (P value 0.001), figure (2).

There is also a significant positive correlation between the reduction in PASP and the right ventricular dimensions (P value 0.001). The change in PASP was positively correlated to the level of pulmonary artery pressure immediately before the operation (P value 0.001), figure (3).

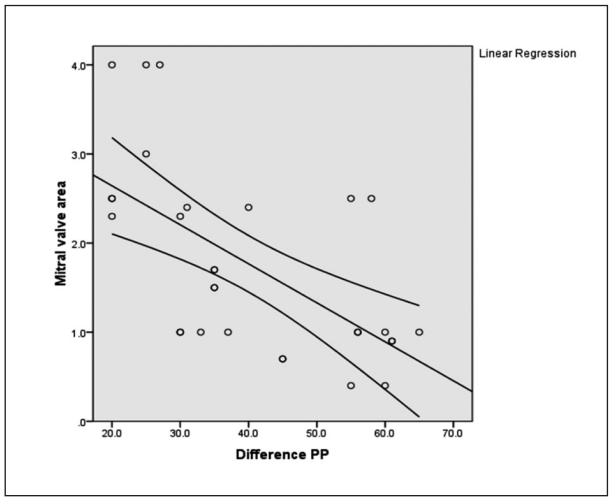

Fig 2. Scatterplot graph shows the linear regression between the mitral valve area and the change in pulmonary artery pressure, P value 0.001. PP: pulmonary pressure

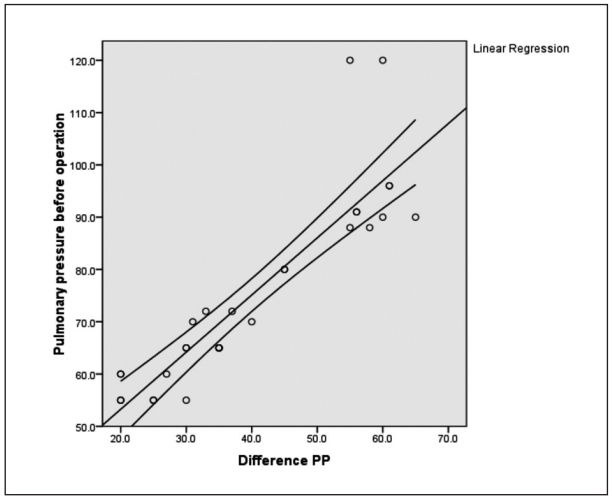

Fig 3. Scatterplot graph shows the linear regression between the change in pulmonary artery pressure and the baseline level of the pressure before operation, P value 0.001.

Discussion

Pulmonary arterial hypertension is a progressive disease with a poor prognosis. If not treated, it eventually leads to right ventricular failure and death. Moreover, with the recent advances in cardiac surgery, still the preoperative pulmonary artery systolic pressure is a powerful predictor of early and late mortality after surgery.

In a recent study carried out on 873 consecutive patients who underwent mitral valve operation. They stated that both operative mortality and long-term survival were correlated with the degree of preoperative pulmonary hypertension. Hence, preoperative pulmonary artery systolic pressure is a powerful predictor of early and late survival after mitral valve operation [11].

The therapeutic options for pulmonary hypertension continue to advance, however, the resent therapeutic applications have limitations including the delivery mechanism (e.g., IV epoprostenol), short half-life (e.g., inhaled iloprost), and cost [12]. There has been recent interest in the potential role of novel therapies including sildenafil, a selective inhibitor of phosphodiesterase type 5. In our study, we tried to assess the role of oral sildenafil given preoperatively in reduction of pulmonary artery systolic pressure and also evaluate its effects on haemodynamics. The results showed a dramatic effect of orally administered sildenafil on pulmonary artery pressure measured either directly intraoperative or by echocardiography postoperatively. It showed that sildenafil administration is safe with tolerable haemodynamic effects as well.

Mikhail et al., reported that oral or even IV administration of sildenafil is safe and effective in reducing mean pulmonary artery pressure. Moreover, it improved the clinical status of patients with pulmonary hypertension as evidenced by 6 minutes walk test [13].

The present study has enrolled a control limb in order to prove the significant pulmonary vasodilator effect of oral sildenafil. In group (B), there was significant reduction in PASP intraoperatively. However, this may be attributed to the effect of anaesthesia and/or the mechanical effect of valve replacement itself, as the intraoperative measurement was obtained after the prosthetic valve placement. The reduction in PASP continued till the post-operative period only in those patients who received Sildenafil. Moreover, the extent of reduction in PASP (preoperatively versus postoperatively) was much greater in group (A) than in group (B), which emphasizes the potent vasodilatory effect of the tested drug. Michelakis et al. demonstrated that oral sildenafil as a single dose acts as a potent pulmonary vasodilator in patients with both primary and secondary pulmonary hypertension [10].

In our study, oral sildenafil has no significant haemodynamic effect on central venous pressure or systemic blood pressure. In a controlled, prospective, randomized, double-blind study, a single dose of oral sildenafil immediately before induction of anesthesia produced significant pulmonary vasodilatation

without eliciting systemic effects [14]. This could be attributed to the fact that among the various phosphodiesterases, isoform 5 is the predominant type in the normal pulmonary vasculature. Therefore, inhibition of this enzyme is a logical step to increase the bioavailability of cGMP and support endogenous vasodilatation in patients with pulmonary arterial hypertension. Sildenafil is a phosphodiesterase inhibitor that potently and selectively acts on pulmonary vascular tree [15].

There has been little experience with the use of oral sildenafil in adult cardiac surgical patients with pulmonary hypertension, mostly limited to the postoperative period. Shim et al., drew a randomized prospective double blind study on the effect of oral sildenafil on the pulmonary artery systolic pressure in patients undergoing cardiac surgery [14]. Trachte et al., also reported a beneficial effect of oral sildenafil in patients with pulmonary hypertension in the perioperative period. Although, they reported a statistically significant effect on mean systemic arterial blood pressure, it was clinically insignificant [16].

Our study confirmed the pulmonary vascular vasodilator effect of oral sildenafil and this effect was not associated with neither clinically nor statistically significant effects on the systemic blood pressure. Moreover, we studied the associated variables with sildenafil effects. The reported sildenafil effect was not associated with patient's age or sex. The results described a profound vasodilator effect of sildenafil in patients with mitral stenosis, impaired left ventricular function and those with high baseline pulmonary artery systolic pressure. Furthermore, there was an inverse relationship between the reduction in pulmonary artery systolic pressure following sildenafil administration and mitral valve area. This is quite logic as early in the natural history of both cases of tight mitral stenosis and left ventricular failure, there is a backward heart failure resulting in pulmonary congestion with variable degree of pulmonary hypertension. This finding leads us to recommend the routine use of oral sildenafil in candidates of valvular replacement especially those with mitral stenosis, impaired left ventricular function or severe pulmonary hypertension.

The present study has a limitation that we enrolled a relatively small number of patients; however the used statistical tests could overcome this limitation. Moreover, this could be considered a pilot study secondary to a larger double blind study.

In conclusion, this study states that immediate preoprerative oral sildenafil administration is definitely effective in reducing the pulmonary artery systolic pressure with no effects on other systemic haemodynamic parameters. We recommend further studies with larger patient population to prove our results.

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Outcome After Surgical Treatment of Isolated Native Tricuspid Valve Endocarditis: Six Years Single Institution Experience

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Background: **Different surgical options have been advocated for the management of patients with tricuspid valve endocarditis (TVE). In this study we audit our surgical experience in patients with isolated native TVE focusing on predictors of in hospital mortality and mid-term outcome.**

Methods: **Between April 2004 and December 2010, thirty patients underwent tricuspid valve surgery for TVE, there were 17 males and 13 females with mean age of 28.3 ± 7.1. The main indications for surgery in this series were severe tricuspid regurge that was present in all patients and recurrent septic pulmonary embolisation in 11/30 (36.6 %), and/ or congestive heart failure not responding to medical treatment in 8/30 (26.6 %).**

Results: **Thirty patients with native TVE had tricuspid valve surgery. 10/30 (33.3 %) of patients were drug addict, while another 9/30 (30 %) had indwelling IV catheter. The main causative organisms in this series were fungal infections (aspergillus and candida) in 10/30 (33.3 %) of patients, while in 8/30 (26.6 %) of them staphylococcus aureus was the cause. In this study only seven patients (23.3 %) underwent tricuspid valve reconst ruction, while 23 patients (76.6 %) underwent tricuspid valve replacement utilizing a bioprosthetic valve. Postoperative complications occurred in 8/30 (26.6 %) of patients and mortality in 6 patients (20 %). In this series the predictors of in hospital mortality were recurrent septic pulmonary embolisation (p-value 0.002 and OR 0.4), congestive heart failure (p-value 0.001 and OR 0.3) and the presence of pericardial effusion (p-value 0.001 and OR 0.3). During the follow up period that extended from 6 month to 68 months there was no recurrence of infection or valve related events.**

Conclusion: **Tricuspid valve surgery for TVE can be performed with acceptable levels of early mortality. In hospital mortality was linked to recurrent septic pulmonary embolisation, congestive heart failure and the presence of pericardial effusion, mid-term follow up showed no recurrence or valve related events.**

Right sided infective endocarditis (RSIE) represents 5-10% of all cases of endocarditis [1]. Isolated native tricuspid valve endocarditis (TVE) is even less common. In this subset of special group of infective endocarditis (IE) the primary approach for management is essentially medical due to relative benign course and low in hospital mortality, with surgical referral being necessary in only small minority of patients [2]. However, in the past few years there has been a continuing increase in referral for surgical management, though still considered infrequent in operative lists [3]. RSIE has been linked with IV-drug addicts, but there are other predisposing factors including, permanent pace maker, IV- catheters, congenital heart disease and patients with chronic renal failure [4]. The indications for surgical treatment have been well defined by the European Society of Cardiology in their latest version 2009 [5]. Although tricuspid valve repair utilizing annuloplasty ring is the method of choice compared to tricuspid valve replacement, this may be true for most of chronic organic tricuspid lesions. Tricuspid valve pathology following infective endocarditis (IE) may be difficult to repair particularly when extensive valve destruction and/or the need for extended debridement to eradicate infection is needed. In this report we prospectively evaluated our surgical experience in the last six years in patients who presented with isolated native TVE, ocusing on in hospital mortality and mid-term outcome.

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Methods

Between April 2004 and December 2010, two hundred and thirty patients with IE were operated upon at the department of cardiothoracic surgery, Cairo University Hospitals among this group thirty patients with isolated native tricuspid valve endocarditis were prospectively studied. Pre-operative characteristics, operative data and follow up were all collected and analyzed.

Our hospital is one of referral hospital in Egypt dedicated for the management of patients with IE and lately one of the centers recognized by the international collaboration on endocarditis (ICE). Through a dedicated multi-disciplinary team (Cardiologists, Bacteriologists, Anesthesiologist, Intesivests and Cardiothoracic Surgeons) the management of these patients takes place. All patients are admitted to the cardiology department where diagnosis and medical management occurs. Patients who are surgical candidates are referred after being evaluated in a multi-disciplinary approach. Our surgical strategy entails extensive debridement of infected material, followed by irrigation with saline and swabbing of infected area with povidone-iodine. All excised tissues are sent for bacteriological and pathological evaluation. Valve repair is our first priority whenever possible (vegetectomy and the use of autologous pericardium) and the limited use of artificial material. But in many cases extensive valve pathology deems valve reconstruction impossible.

In these cases valve replacement is unavoidable and it is our policy to use biological valves as a substitute. Carpentier-Edwards Perimount mitral heart valves, classic and lately the MC3 tricuspid annuloplasty ring are the prosthesis of choice that we use for endocarditis in our center.

It is our policy that all patients are referred back to the cardiology department when they are surgically free to complete their antibiotic course in the hospital. Upon discharge all patients are followed up on monthly bases for the first 6 months, then every 2 months for the next 6 months, then every 3 to 6 months. In this study there were 10 patients with fungal tricuspid endocarditis, for those who survived strict follow up and life-long antifungal treatment was provided.

Statistical Analysis

Data was analyzed using SPSSwin statistical package version 15 (SPSS Inc., Chicago, IL). Numerical data were expressed as mean and standard deviation. Qualitative data were expressed as frequency and percentage. Chi-square test (Fisher's exact test) was used to examine the relation between qualitative variables. For quantitative data, comparison between two groups was done using Mann-Whitney test. Odds ratio (OR) with its 95% confidence interval (CI) were used for risk estimation. A p-value < 0.05 was considered significant.

Results

In this study, thirty patients underwent tricuspid valve surgery for TVE. There were 17 males and 13 females, with mean age of 28.3 ± 7.1. Among the predisposing factors in this series, 10 (33.3 %) of patients were drug addict and 9 (30 %) of patients had IV- indwelling catheter, but in 6 (20 %) of patients no predisposing factor could be detected. Preoperative complication include repeated septic pulmonary emboli in 11/30 patients (36.6 %), were 9 patients presented with hemoptysis, 1 patient with pneumothorax and another with empyema. Congestive heart failure not responding to medical treatment occurred in 8/30 patients (26.6 %). A summary of the patient population is given in Table 1.

Variables	Statistical results
Age	Range (19-48). Mean (28.3 ± 7.1).
Sex	13 F : 17 M
BMI	Mean (21.3 ±3.8)
Preoperative co-morbidities	
Renal Failure	9/30 (30 %).
Diabetes	8/30 (26.6 %).
Liver dysfunction	2/30 (6.6%).
Underlying cardiac lesions	
Rheumatic heart disease	2 patients
Congenital heart disease	1 patient
Hear Block	1 patient
Predisposing factors	
IV-drug addicts	10/30 (33.3 %)
IV-catheter	9/30 (30 %)
Abortion and other operation	4/30 (13.3 %)
Permanent pace maker	1/30 (3.3 %)
Not detected	6/30 (20 %)
Preoperative investigations	
Hb	9.1 ± 2.1
TLC	17316.6 ± 8191.7
ESR	106.1 ± 21.9
Creatinine	2.6 ± 2.9
Preoperative complications	
Recurrent pulmonary emboli	11/30 (36.6 %)
Congestive heart failure	9/30 (30 %)
Pericardial effusion	13/30 (43.3 %)
a) Mild	8/30 (26.6 %)
b) Moderate	5/30 (16.6 %)

Table 1. Patients clinical characteristics.

Twenty (66.6 %) of patients underwent urgent surgery which was defined as surgery within 48 hours of admission due to recurrent pulmonary embolisation in the presence

of vegetation > 20mm in size or congestive heart failure not responding to treatment. Tricuspid valve replacement using bioprosthetic valve was done in 23/30 patients (76.6 %), while in 7 patients tricuspid valve repair using annuloplasty ring was possible. Operative data is summarized in Table 2.

Variables	Patient no. 30
Time of surgery	
Urgent	20 (66.6%)
Elective	10 (33.3 %)
Types of surgery	
Repair with ring	7 (23.3%)
Bioprosthesis	23 (76.6 %)
# 29	3
# 31	4
# 33	23
Ischemic time	18 (60 %) Range (25 – 75 min) Mean 43.1 ± 14.26
On pump beating heart	14 (40 %) Range (40 – 90 min) Mean 56.4 ± 13.4
Operative time	Range 120 – 220 Mean 154.7 ± 33.4

Table 2. Operative data

In this series, the preoperative blood culture was positive in 16/30 patients (53.3 %), staphylococcus aureus was cultured in 8/30 (26.6 %), eight patients in this series had aspergillus fumigatus and 2 patients had candida. All patients had severe tricuspid regurgitation with the pathological affection to the anterior leaflet of the tricuspid valve in 90 % of cases. Both bacteriological and pathological data are gathered in Table 3.

In the postoperative period, 9 patients (30%) needed inotropic support, the mean mechanical ventilation time was 10.3 ± 5.2 hours and ranged from (3 – 22 hours) and the mean ICU stay was 5 ± 2.2 days before transfer to the cardiology department. Eight patients had postoperative complications and table 4 analyzes these data. The in hospital mortality was 6 patients (20 %). Hospital stay ranged from 15 – 90 days with a mean of 55.7 ± 27 days.

The risk factors for in hospital mortality were recurrent septic pulmonary embolisation, congestive heart failure and pericardial effusion. Table 5 shows the univariate analysis for the risk of in hospital mortality. In this series 24 patients who survived were followed up extending from 6 – 68 months with a mean of 25 ± 12.6 months, during this period there was no recurrence of infection (Paravalvular leak, valve regurge, recurrent fever) or valve related deterioration (the need for explantation due to valve regurge or stenosis).

Variables	Patients no. 30
Pathology	
Leaflet affection	
1) Anterior leaflet	27 (90 %)
2) Posterior leaflet	8 (26.6 %)
3) Septal leaflet	1 (3.3 %)
Vegetation	
1) No.	Multiple
2) Size	2 – 34 mm (mean 18.1 x 11.6mm)
3) Freely mobile	10 (30 %)
Periannular extension	5 (16.6 %)
Blood culture	16 (53.3 %)
Tissue culture	17 (56.6 %)
Organisms	
Staphylococcus Aureus	8 (26. 6 %)
Aspergillus Fumigatus	8
Candida	2 (6.6 %)
MRSA	2
Staphylococcus Coagulase –ve	2
Pseudomonous	2
Streptococcus Pneumonea	2
Streptococcus Viridans	1 (3.3 %)
Non detected	4 (13.3 %)

Table 3. Bacterial and pathological data

Variables	Complications	Mortality
Low cardiac output syndrome	3	2
Fungal sepsis	2	2
GIT bleeding	1	1
Stroke	1	1
Exploration for bleeding	1	
Total	8 patients (26.6 %)	6 patients (20 %)

Table 4. Complications and mortality analysis

Risk factors	P-value	Odds ratio (OR)	95% confidence interval
Embolization	0.002	0.4	0.2-0.9
Congestive heart failure	0.001	0.3	0.1-0.8
Pericardial effusion	0.001	0.3	0.1-0.8

Table 5. Univariate analysis for in-hospital mortality

Discussion

Our study presents 30 patients with isolated tricuspid valve endocarditis, and 10 patients (33.3 %) of this series having fungal endocarditis. Our results agree with others (3,6), that surgical treatment of this special group of endocarditis could be performed with good early and mid-term results.

The incidence of TVE is increasing due to growing number of IV drug addicts and patients having long term IV catheters. In our study, this represents 66.6 % of predisposing factors, however in 20 % of cases we could not detect any predisposing factor. Our patient population has a lower mean age compared to other series (7), this can be explained partly by the prevalence of drug addiction in youth and middle age in our community as well as the occurrence of TVE in second and third decades as mentioned in some reports (3,8).

The indications for surgery in this series follow the European cardiology society guidelines (5). In this study more than one indications were present in one patient. As many as 2/3 of our patient underwent urgent surgery which is defined as surgery within 48 hours of admission, this was due to that our hospital is a referral surgical center and many patients were referred late after failure to properly diagnose or treat them in other hospitals.

The optimal surgical treatment of the tricuspid valve is reconstruction and this might be possible for functional tricuspid valve pathology. However, in patients with TVE the principle of management is aggressive and extended debridement aiming at eradication of infection and prevention of future recurrence. In the presence of localized infection repair may be possible and limited excision including vegetectomy and reconstruction utilizing autologous pericardium can be carried out. Repair might not be possible in patients with extensive pathology where multiple vegetations, multiple leaflets affection, subvalvular and /or periannular extension is present. In these patients total valve excision without valve replacement was advocated by some investigators (9), and was met with 20 % of patients cannot tolerate the procedure due to right ventricular failure. Tricuspid valve replacement is hence recommended to correct hemodynamics when valve repair is not possible. The choice between biological and mechanical valve is a matter of ongoing debate. Mechanical valve at the tricuspid position are at high risk for thrombosis compared with valves in the aortic or mitral position, and consequently are at risk for early reoperation. However in long term follow-up mechanical valves are favorable over biological valve as a result of valve degradation in biological valves, and therefore mechanical valves should be chosen in younger patients with good long term prognosis. We as well as other authorities agree that biological valve replacement for tricuspid valve remains a good option even for young patients because of limited life expectancy unrelated to the type of tricuspid prostheses at long term follow up (7). Moreover, IV drug addicts and patients with long term IV catheter have difficult venous access rendering long term manipulation of anticoagulation difficult. In the presence of the previous risk factors as well as in patients with pace maker leads the risk for re-infection is high. In our series, all patients who were impossible to have valve repair received a biological valve based on the previous argument.

In this series, we present 10 patients (30 %) with fungal endocarditis (8 patients with aspergillus and 2 patients with candida). The predisposing factors in this rare subgroup agree with other published data and include IV long term catheter and IV drug abusers. The mortality in patients with fungal endocarditis is near 100 % and relapse reaches 40 %. However, there is no large series to determine this mortality in the tricuspid valve or its relapse after valve replacement. In this study, the mortality in this subgroup include 3/10 patients (30 %) and along the follow up there was no relapse. It is our policy to provide close follow-up as well as life-long antifungal therapy for this subgroup of patients.

In this study, the pathological pattern by the infectious process is similar in spite of the different bacterial and fungal organisms detected. The anterior leaflet was found to be involved in more than 90 % of patients, with posterior and septal leaflets to be least affected. This was observed by other investigators (10). The process involves the leaflet margin, chordea and papillary muscles. However, multiple vegetations were noted in our patients. Periannular extension was present in 16.6 % of patients, this correlates with delayed referral to our hospital as delayed diagnosis and proper management was not achieved in this subgroup of patients who had severe valve destruction and periannular extension. Patients with fungal TVE had friable and larger vegetations as observed by others (8), clinically this reflects a higher rate of multiple and recurrent pulmonary emboli due to loose attachment to the affected leaflet.

The in-hospital mortality in this study was 20 %, in other series with tricuspid valve surgery for managing functional tricuspid valve the mortality ranged from 18 – 26 % (11, 12). However, in a study for right sided infective endocarditis the hospital mortality was 11.7 % (3). The main causes of early death in our series were fungal sepsis and low cardiac output syndrome. Septic multiorgan failure and myocardial failure were the prominent cause of death in other series (3, 11). Our univariate analysis for predictors of in-hospital mortality was recurrent septic pulmonary emboli, congestive heart failure and the presence of pericardial effusion.

In this study to avoid patient incompliance and cost of the post-procedure long term antimicrobial therapy, it is our policy to keep the patients admitted at the department of cardiology until they finish their treatment course. This explains well our long hospital stay which in this study reaches a mean of 55 days. During the follow up period that extended to 68 months and had a mean of 24.6 months, there was no recurrence of infection nor valve related complications. In other report freedom from reoperation due to re-infection at 5 years was 92.2 ± 3.4 % (3).

The Carpentier-Edwards pericardial bioprosthesis is a good option, the freedom rate from tricuspid reoperation averaging 83 % ± 8 % 10 years after operation (7).

Despite our 20 % in-hospital mortality in this series, surgery for TVE can be performed with good early and midterm results. Predictors of mortality including recurrent septic pulmonary emboli, congestive heart failure and pericardial effusion could reflect late referral and calls for earlier surgical intervention for this subgroup of infective endocarditis.

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Ross Procedure Versus Mechanical Aortic Valve Replacement Early and Midterm Results

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Background: **No aortic valve replacement can claim to be perfect. Although mechanical prostheses are durable , they require anticoagulation. The objective of the study was to compare the performance of pulmonary auto-graft with mechanical valves, in the treatment of aortic valve disease.**

Methods: **Forty patients with aortic valve stenosis, and below the age of 40 years were assigned to receive either pulmonary auto-grafts (No 20) or mechanical valves prostheses (No.20). Clinical outcomes, left ventricular mass regression,ejection fraction and mean gradients were evaluated at discharge 3 months, and 6 months after surgery. Follow-up was complete for all patients.**

Results: **Hemodynamic performance was significantly higher in the Ross group (mean gradient 2.6mmHg VS 17.4mmHg, P < 0.0005). Overall a significant decrease in left ventricular mass was found six months postoperatively. However, there was no significant difference in the rate and extent of regression between the two groups. There was one intra-operative mortality in the Ross group and one major bleeding one minor bleeding, one minor valve thrombosis and one case of infective endocarditis in the mechanical valve group.**

Conclusion: **In our randomized cohort of young patients with aortic valve stenosis, the Ross procedure was superior to the mechanical prosthesis with regard to homodynamic performance. However, this did not result in an accelerated left ventricular mass regression. Clinical advantages like reduced valve related complications and lesser myocardial strain will have to be proven in the long term.**

Key words: **Pulmonary auto-graft – Ross procedure, Mechanical valves**

The choice of a particular aortic valve prosthesis is influenced by several inter-related factors such as patient age, concomitant disease (for instance coronary artery disease or mitral valve disease), atria fibrillation, the center experience with implantation of a prosthesis and preferment of the referring cardiologist, attending surgeon and the patient (1). Since the 1959 more than 80 models of pathetic heart valves have been developed and used these prosthetic valves which may be mechanical or bioprosthetic (2) No aortic valve replacement can claim to be perfect. Although mechanical prostheses are durable, they require formal anticoagulation and some show suboptimal homodynamic performance which can result in late left ventricular dysfunction.

Biological valves do not require anticoagulation but show degeneration that accelerates after 7-10 years particularly in the young active people. Recognizing their difficulties, Ross conceived the pulmonary auto-graft procedure, hoping to create an aortic valve replacement closer to the ideal. Initially the operation did not find favor with the cardiac surgical community because of concerns regarding technical complexities, the consequences of creating pulmonary valve disease and the ability of the pulmonary valve to withstand the homodynamic stress of the aortic position (3).

The series by Chambers, and his colleagaes which is the longest reported for any biological valve replacement shows the pulmonary auto-graft to function well in the aortic position over a follow-up period of up to 26 years in terms of both freedom from auto-graft replacement and function of late surviving valves (4).

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The pulmonary auto-graft is a living tissue, and has the potential to grow in relation to the patient (5). Simon et al., showed that other valve replacement prostheses have higher transvalvular gradients in the small patient annular size in 95% of patients (6).

Pregnancy after prosthetic valve replacement exposes the mother and the fetus to a high rate of complications related to thromboembelic or hemorrhagic events. The need for anticoagulants carries a significant risk of fetal and neonatal morbidity. In contrast, bioprostheses (porcine valves) are associated with a decreased risk of thromboembolism or complications related to anticoagulants, but the accelerated rate of tissue value degeneration in young patients especially during pregnancy limits their usefulness (7).

In Dore and Somerville series there was no significant increase in aortic regurgitation or right sided lesions and there were no maternal complications during or after pregnancy (8). The aim of this work is to compare Ross procedure versus mechanical valve replacement.

Material and Methods

A prospective study was curried out at the cardiothoracic surgery department in Cairo University hospital during the period between 2003, and 2006. The study included 40 patients with aortic valve disease undergoing elective aortic value replacement. These patients were equally divided into two groups: Group A: Ross procedure patients Group B: Mechanical aortic valve replacement patients. The patients participating in this study were selected from patients present in the department during the implementation of the study.

Exclusion criteria a) Associated coronary artery disease b) Patients with isolated or predominant aortic regurgitation, c) Patients who required repair or replacement of an additional heart valve, d) Redo patients, e) Patients with infective endocarditis or emergency patients. f) Severe calcification of the aortic root, and those with atypical origin of the coronary ostia, G) Mismatch between the aortic and the pulmonary annulus (up to 3mm).

Study variables

Patients were studied for the following main variable items:

A) Pre-operative variables

1- History and physical examination.
2- Age, and Sex
3- Body surface area
4- Associated medical disease

Echocardiography to assess: posterior wall thickness (PWT), and sepal wall thickness (SWT), gradient across the left ventricular outflow tract (LVOT) and the aortic valve and left ventricular mass index.

B) Intra-operative variables studied

1- Type of operation 2-Valve pathology 3-Type of valve inserted, 4-Prosthetic valve size 5-Aortic cross clamp time. 6- Cardiopulmonary bypass (CPB) time. 7- Need for inotropic support and 8- Intra –operative beading.

C) Post-operative variables

1- During TCU stay:

ii- Ventilatory support iii- Blood loss

iv- Total ICU stay v- Labs. mainly Hb.

2- Before discharge from the hospital echocardiography was done to assess:

Gradient across LVOT, function of the prosthetic valve and LV function and dimensions. Free voluntary written consent was obtained from all patients.

Surgical technique

All patients underwent surgery through a full median sternotomy. All patients in group B received prosthetic valves using interrupted 2/0 ethibond without doing any of the enlargement procedures. All the Ross procedures were done using the full root technique. Our protocol included subcutaneous low molecular heparin for the first day and parallel oral anticoagulation with warfarin (Marivan). As soon as the international normalized ratio (INR) reached the therapeutic target range of 2.5-3.5 heparin was discontinued

Results

This study was conducted on 40 patients having aortic valve disease either stenosis is or double valve lesion (stenosis and regurge). The two groups required aortic valve replacement as defined by preoperative echocardiography. The patients were classified into 2 groups:

Group A: Patients who has aortic valve replacement using the pulmonary auto-graft (Ross procedure).

Group B: Patients who had aortic valve replacement using mechanical prosthesis.

As regards the Demographic Data in group A there were 8 males and 12 females while in group B there were 6 males and 14 females. In group A the age ranged from 6-30 with mean of 21 $\pm$ 7.9 while in group B the age ranged from 15-40 with a mean of 28 $\pm$ 8.5. In group A the BSA was 1.49 $\pm$ 3 while in group B the BSA was 1.65 $\pm$ 3.

The preoperative Data are summarized in table (1,2). As regards the operative data 20 patients in group A had Ross procedure using the full root pulmonary autograft and the right ventricular outflow tract (RVOT) was constructed using pulmonary homograf. For group B 20 patients had aortic valve replacement using a mechanical prosthesis. The types of valve were reduced St. Jude medical 2 cases, standard Carbomedics 7 cases, Onyx supra-annular 6 cases and standard St Jude 5 cases.

	Group (A) (n=20)	Group (B) (n=20)	P-value	Significance
I	0/20 (0%)	0/20 (0%)		
II	0/20 (0%)	0/20 (0%)		
III	6/20 (30%)	8/20 (40%)	P-0.05	N.S
IV	14/20 (70%)	12/20 (60%)		

NS = Not significant

Table 1. Preoperative NYHA classification in the two studied groups

Echo	Group (A) (n=20)	Group (B) (n=20)	p-value	Significance
Mean systolic gradient (mmHg)				
Range	42.69	40-73	P> 0.05	N.S
Mean ± SD	55.9 ± 11.9	58.6 ± 14.3		
SWT				
Range	1.6-2.3	1.5-2.2	P> 0.05	N.S
Mean ± SD	1.98 ± 0.2	1.82 ± 0.4		
PWT				
Range	1.5-2.2	1.4-2.1	P> 0.05	N.S
Mean ± SD	1.95 ± 0.3	1.81 ± 0.4		
Preoperative annular diameter				
Range	17-25	19-25	P> 0.05	N.S
Mean ± SD	21.6 ± 3.1	22.4 ± 3.5		
LVEDD				
Range	4.2-7.7	4.1-7.2	P> 0.05	N.S
Mean ± SD	5.43± 0.7	5.19±0.5		
LVESD				
Range	3.3-6.8	3.1-6.5	P> 0.05	N.S
Mean ± SD	4.12 ± 0.5	3.9 ± 0.4		

Table 2. Preoperative investigations in the two studied groups

During surgery the bypass time and the aortic cross clamp time are shown in tables (3,4). Weaning from CBP was done without difficulty in both groups except for one case in group A.

	Group (A) (n=20)	Group (B) (n=20)	p-value	Significance
Cross clamp time (min)				
Range	93-133	60-100	P< 0.01	Highly
Mean ± SD	115.7 ± 21.5	75.8 ± 19.6		Significant
CPB time (min)				
Range	12.5 -185	90-150	P< 0.01	Highly
Mean ± SD	146.7 ± 37.9	106.9 ± 19.8		Significant
Mean annular valve				
Range	17-27	19-27	P> 0.05	N.S
Mean ± SD	22.2 ± 2.3	22.3 ± 1.9		

NS = Not significant

Table 3. Intraoperative outcome in the two studied groups

	Group (A) (n=20)	Group (B) (n=20)	p-value	Significance
Inotropic support [n (%)]	15/20 (75%)	11/20 (55%)	P< 0.05	Significant

Table 4. Patients requiring inotropic support after completion of the procedure in the two studied groups

The ICU course is shown in table (5). As regards postoperative morbidity, 2 patients suffered from dysrrhythmia in the form of ventricular ectopics and non sustained ventricular tachycardia. The second patient experienced incomplete heart block. In group B two patients had atrial fibrillation. In group B one patient suffered from mediastinitis, and he required debridement and rewiring. He was discharged 2 weeks later. Postoperative follow up was done at a mean follow up interval of 4.5 months (Table 6).

During the 6 months of follow up for both groups one patient (in group B) developed minor valve thrombosis with dysfunction of one of the leaflets after anticoagulant stoppage following a bleeding event. The patient was treated by an antithrombotic, and recovered completely. In group B also two patients suffered from epistaxis and melena, and required hospitalization and INR control. Four patients required hospitalization stoppage of anticoagulants and transfusion of plasma. All of them were in group B. In group B one patient suffered from late prosthetic valve endocarditis, and required reoperation and replacement of the mechanical valve but he didn't survive. In group A one patient required reoperation for pulmonary auto-graft stenosis (Five months after surgery) which was replaced by a larger size valve and he did well. The data of the postoperative echocardiographic examination are listed in table (7-18).

	Group (A) (n=20)	Group (B) (n=20)	P-value	Significance
I	9/20 (45%)	10/20 (50%)	P>0.05	N.S
II	11/20 (55%)	10/20 (50%)		
III	0/20 (0%)	0/20 (0%)		
IV	0/20 (0%)	0/20 (0%)		

NS = not significant

Table 5. Postoperative NYHA classification in the two studied groups

	Group (A) (n=20)	Group (B) (n=20)	p-value	Significance
3 months	3.5 ± 1.7	17.5 ± 5.3	P< 0.001	Very highly Significant
6 months	2.6 ± 1.3	17.4 ± 3.6	P< 0.001	Very highly Significant

Table 6. Postoperative follow up of mean systolic gradient (mmHg) in the two studied group

	Group (A) (n=20)	Group (B) (n=20)
Preoperative	55.9 ± 11.9	58.6 ± 15.3
6 months postoperative	2.6 ± 1.3	17.4 ± 3.6
P-value	P < 0.001	P < 0.001
Significance	Very highly significant	Very highly significant

Table 7. Comparison between pre- and 6 months postoperative mean systolic gradient (mmHg) in the two studied groups

	Group (A) (n = 20)	Group (B) (n = 20)	P-value	Significance
3 months	1.70 + 0.2	1.60 ± 0.2	P > 0.05	N.S
6 months	1.34 + 0.1	1.24 ± 0.1	P < 0.05	Significant

Table 8. Postoperative follow up of septal wall thickness (mm) in the two studied groups

	Group (A) (n = 20)	Group (B) (n = 20)
Preoperative	1.98 ± 0.2	1.82 ± 0.4
Postoperative (6 months)	1.34 ± 0.1	1.24 ± 0.1
P-value	P < 0.001	P-value
Significance	Very highly significant	Very highly significant

Table 9. Comparis on between pre-and 6 months postoperative septal wall thickness (mm) in the two studied groups.

	Group (A) (n = 20)	Group (B) (n = 20)	P-value	Significance
3 months	1.53 + 0.3	1.45 ± 0.1	P > 0.05	N.S
6 months	1.32 + 0.2	1.24 ± 0.2	P > 0.05	N.S

Table 10. Postoperative follow up of posterior wall thickness (mm) in the two studied groups.

	Group (A) (n = 20)	Group (B) (n = 20)
Preoperative	1.95 ± 0.3	1.81 ± 0.4
Postoperative (6 months)	1.32 ± 0.2	1.24 ± 0.2
P-value	P < 0.001	P-value
Significance	Very highly significant	Very highly significant

Table 11. Comparison between pre-and 6 months postoperative posterior wall thickness (mm) in the two studied groups.

	Group (A) (n = 20)	Group (B) (n = 20)	P-value	Significance
3 months	66.4 ± 8.3	65.8 ± 7.8	P > 0.05	N.S
6 months	67.4 ± 8.3	65.0 ± 9.2	P > 0.05	N.S

Table (12) Postoperative follow up of ejections fraction (%) in the two studied groups.

	Group (A) (n = 20)	Group (B) (n = 20)
Preoperative	66.3 ± 7.9	1.81 ± 0.4
Postoperative (6 months)	67.4 ± 8.3	1.24 ± 0.2
P-value	P > 0.05	P-value
Significance	NS	NS

Table 13. Comparison between pre-and 6 months postoperative ejection fraction (%) in the two studied groups.

	Group (A) (n = 20)	Group (B) (n = 20)	P-value	Significance
3 months	5.3 ± 0.6	5.06 ± 0.4	P > 0.05	N.S
6 months	5.22 ± 0.5	4.94 ± 0.5	P > 0.05	N.S

Table 14. Postoperative follow up of LVEDD in the two studied groups.

	Group (A) (n = 20)	Group (B) (n = 20)
Preoperative	5.43 ± 0.7	5.19 ± 0.5
Postoperative (6 months)	5.22 ± 0.5	4.94 ± 0.5
P-value	P > 0.05	P-value
Significance	NS	NS

Table 15. Comparison between pre-and 6 months postoperative LVEDD in the two studied groups.

	Group (A) (n = 20)	Group (B) (n = 20)	P-value	Significance
3 months	4.07 ± 0.4	3.83 ± 0.4	P > 0.05	N.S
6 months	4.01 ± 0.4	3.78 ± 0.4	P > 0.05	N.S

Table 16. Postoperative follow up of LVEDD in the two studied groups.

	Group (A) (n = 20)	Group (B) (n = 20)
Preoperative	4.12 ± 0.5	3. 9 ± 0.4
Postoperative (6 months)	4.01 ± 0.4	3.78 ± 0.4
P-value	P > 0.05	P
Significance	NS	NS

Table 17. Comparison between pre-and 6 months postoperative LVEsD in the two studied groups.

	Group (A) (n = 20)	Group (B) (n = 20)	P-value	Significant
3 months	149 ± 34.1	141 ± 34.4	P > 0.05	N.S
6 months	114 ± 27.2	110 ± 30.2	P > 0.05	N.S

Table 18. Postoperative follow up of LVMI (gm/m2) in the two studied groups.

Discussion

The choice of the best aortic valve replacement for young patients is still troublesome; it depends on the specific characteristics of each prosthesis as well as on factors related to the patient. Such factors include the etiology of the valvular dysfunction, socio-economic status, left ventricular function, cardiac rhythm, dimension of the aortic ring, presence of associated lesions, and others (9).

The use of biologic prosthesis in this group of patients may require future reoperations, whereas with the mechanical prosthesis the chance of thrombo-embolic events is very high, if the difficulties in obtaining a correct anticoagulation are taken into consideration. The use of a pulmonary auto-graft is very attractive, because it is durable and associated with a small incidence of late complications (10).

Even though it is a more complex operation from a technical point of view, our results show that the Ross procedure may be carried out with an acceptable mortality rate, comparable to those reported by other authors and by the International Record of Ross procedures. Likewise, even with longer aortic clamping times and CPB required to carry out this procedure, postoperative morbidity was minimal.

Our study was done in Cairo University hospitals on 40 patients undergoing aortic valve replacement. In this randomized study, 20 patients received the pulmonary auto-graft the others underwent mechanical aortic valve replacement. A comparison will be done between the 2 groups regarding the preoperative criteria the operative course and postoperative clinical and echocardiographic outcome.

Preoperative Evaluation:

In our study the age for the Ross procedure ranged from 6-30 with a mean of 21.7 while in the mechanical group the age ranged from 15-40.The reason for this significance between these groups is the tendency for performing the Ross procedure more in children age (0-18 years) more than young adults age (18-40 years) as growth potentials of the Ross procedure is well documented and there is a tendency to delay aortic valve replacement with mechanical prosthesis to avoid reoperation as the child outgrows his or her mechanical valve size.

In a study by Brown et al., where he compared the outcome for aortic valve rep1acement in 508 patients the pulmonary auto-graft group mean was 7.4±6.1 years and 15±4 years for the mechanical group patients (11).

In our study there were 8 males and 12 females in group A and 9 males and 11 females in group B there were no statistical significance between the two groups.

In a study by Laforest were he compared 132 patients replaced with pulmonary auto-graft with another 311 patients replaced with homograft The number of males were 62%, and females were 38% in group 1 and males 66% and 34% females in group 2 (6).

A higher number of females were present in the pulmonary auto-graft group consistent with the fact that they benefit most from this type of procedure.

In our study the BSA was 1.49±0.03 for group A and the BSA was 1.65±0.4 for group B which was statistically insignificant comparing it to the other studies of (12).

In our study the patients were classified in timing of New York Heart Association (NYHA) classification. In group A, 30% were in class III and 70% in class V, group B 40% were in class III and 60% in class IV.

In a similar study by Doss in 2005 were he compared two different valve substitutes most of the patients in both groups fell into NYHA class III and IV (13).

Preoperative Echocardiographical Assessment

In our study preoperative echocardiographical assessment was done for all the patients in both groups the main aim is to measure the gradient across the valve the dimension and functions.

In group A the mean gradient across the valve was 55.9±11.9 while in group B the mean gradient was 58.6±15.3

In similar study by Doss the mean gradient across the valve was 60±2.3.

In our study there were no statistical difference between the 2 groups preoperatively as regarding the left ventricle dimensions. In group A the mean LVESD was 4.12 ± 0.5, mean LVEDD was 5.43±0.7, mean PWT was 1.95±0.3, and mean SWT was 1.82±0.4. In group B the mean LVESD was 3.9 ± 0.4 LVEDD was 5.19 ± 0.5, mean PWT was 1.81 ± 0.4, and mean SWT was 1.82 ±0.4.

In a similar study done by Doss et al., in the Ross group the LVEDD was 4.9±0.5 LVESD 3.7±0.4, PWT was 1.83±0.2, and SWT was 1.98±0.2, in the mechanical group the mean LVED was 4.7±0.5 and the mean SWT was 1.83±0.4 mean PWT was 1.81±0.2.

Operative Techniques

The technique of aortic valve replacement using an auto-graft was done by the full pulmonary root technique in all of our cases.

Ross current registry also documents, that 96% of the procedures done world wide is through the root technique (14).

Stelzer et al. demonstrated a significant advantage of the full root over the cylinder and the subcoronary techniques . They found an auto-graft reoperation rate of 3.3% (4 of 122 patients) in the root replacement group compared with 6.9% (4 of 58 patients) and 11.5% (3 of 26 patients) in the groups with cylinder and subcoronary implantation, respectively (15).

The cross clamp time in our series mean was for group A 115.7±21.5 and cardiopulmonary bypass time was 146.7±37.5. While for group B 75.8±19.6 CPB 106.9±19.8 which shows that group A was almost double the time or more when compared to group B.

In a study done by Bohm and colleagues in 2006 The zero hospital mortality is gratifyingly low for their series compared with other series with the Ross operation in children. The experienced groups of both Elkins and colleague and Pessotto and colleagues reported an early mortality of 3.5% and 2.7%, respectively (16,17).

The postoperative complications

The postoperative chest tube drainage and blood requirement were high in the Ross procedure group compared to the mechanical aortic valve. Reexploration was higher 10% for the Ross group.

In another study done by Bhatti et.al, where they studied the perioperative complications related to Ross procedure, 9.3% required reexploration (75 patients). The average postoperative bleeding in 24 hours was 254 ml, ranging from 30 ml to 940 ml. Postoperative ICU stay ranged from 2 to 9 days with mean of 2.57 days and hospital stay of 2-20 days with mean of 1 0.8 days and he concluded that long CPB leads to platelet dysfunction, enhanced fibrinolysis and dilution of all the components of the coagulation system (18).

However the result of our study was influenced by the limited No. of cases as compared to the other studies.

Postoperative Morbidity

Arrhythmias in form of ventricular ectopy and heart block occurred after the Ross procedure which included 10% of our study, the incidence of arrhythmia by Bhatti was 16.6% (18).

In Ross' group's early experience, 2 of 18 (11%) patients had SVT and 5 of 18 (27%) patients had "ventricular dysrhythmias". In 3 (17%) of these patients death was attributed to ventricular dysrhythmias. In a more recent report of the 20-year follow-up of Ross's group's surgical experience involving 241 patients [12], there had only been one additional early death and one late death attributed to arrhythmias since the early experience reported in 1971. This dramatic change in arrhythmia- related mortality was most likely caused by therealization of the importance of preserving the first septal branch of the left anterior descending coronary artery when harvesting the pulmonary root (19).

Follow-up

Follow-up was done for all the patients in both groups over a period of six months post-operatively. This included clinical and echocardiographic assessment.

The NYHA functional class improved in all the patients in both groups. 45% of the patients in group A and 50% of the patients in group B were functional class I, 6 months after the operation

Postoperative Valve related Events

In our study there were high incidence of bleeding post mechanical valve (group B) and none in (group A) due to absence of anticoagulation in the Ross group.

Two patients in the mechanical valve group developed gastrointestinal bleeding and epistaxis respectively, they were

treated by fresh frozen plasma and control of the INR to the level of 2.0-3.0.

In a study by Bohm the cumulative follow-up was 205 patient-years, with a mean follow-up of 42-27 months. The period of study was from July 1996 to January 2005. There was no thromboembolic or hemorrhagic events or endocarditis were observed (10).

In a study by Mazzitelli et al, forty-six children, aged 4 years to 16 years where a comparison was done on outcome of aortic valve using different types of valve substitutes, there results where thrombosis of the mechanical valve occurred in two out of 30 patients (6.6%) after AVR with mechanical prostheses after 0.6 and 8.7 years, respectively, and no embolic or hemorrhagic events occurred in the Ross group (20).

Although it is encouraging that the mechanical valve recipients in the present series had low hemorrhagic or thrombo-embolic complications, it would be hazardous to conclude that this group of patients will remain free of these problems over the long term.

In our the study the incidence of operated valve endocarditis occurred in one patient in the mechanical group two months after his original operation and was reoperated upon for re-replacement of his mechanical valve from which he didn't survive.

ACC/AHA guidelines for the management of patients with valvular heart disease stated that the annual risk of PVE in the aortic position is 0.6% to 0.9% per patient-year. The 5-year freedom from PVE reported in many major series is greater than 97%. Mechanical valves have a slightly higher early hazard for PVE than stented bioprostheses invasive paravalvular infection occurs in up to 40% of cases of PVE. Early PVE is associated with 30% to 80% mortality while late PVE is associated with 20% to 40% mortality. Stentless porcine heterografts ,human allografts and autografts are less likely to develop PVE since they have less prosthetic material that may serve as a nidus of infection (1).

Malfunctioning pulmonary allografts, in the right ventricular outflow tract, are also a cause of reoperation. In our study, there was one patient in the auto-graft group who required reoperation within the first 6 months for homograft stenosis. Chambers et al, reported reoperations were performed on 37 of the 113 patients with homografts in the pulmonary position (4).

Post operative echocardiological follow up

Despite excellent perioperative results of mechanical valve replacement for aortic stenosis, the 15-year survival rate is only 44%. Compelling evidence suggests that such poor long-term results may be related to the incomplete regression of left ventricular hypertrophy caused by persistently elevated transvalvular gradients. Mechanical aortic valves are prone to high transvalvular gradients due to the obstructive nature of their pyrolitic carbon housing and sewing rings, especially during exercise. Reduction of transvalvular gradiant is an important predictor of regression of LV hypertrophy after AVR. The pulmonary auto-graft, being a viable biologic substitute with nearly perfect hemodynamic performance and a low valve-related complication rate, could be such an ideal prosthesis.

Many reports on LVM regression after aortic valve replacement with stentless and stented bioprostheses or mechanical valves have been published. In most studies, a significant regression of LVM is reported. According to these reports, LV mass index decreased by 17% to 25% 1 year after prosthetic aortic valve replacement. Some studies on prosthetic aortic valve replacement showed less decrease in LVM, whereas the results of others are comparable to those of our study. There are studies showing that LVM regression is dependent on valve type(21,22).

Pibarot et al. concluded in their study of LVM after bioprosthetic aortic valve replacement that the superior hemodynamic performance of stentless bioprostheses might have some benefits with regard to LVM regression (23).

Our study demonstrated that the pulmonary auto-graft in the aortic position offers physiological pressure gradients that are superior to the hemodynamic performance of mechanical valves. The significance of these benefits in terms of prognosis, however, remains to be determined on a longer follow up studies. The near physiological hemodynamics may establish the auto-graft valve as a reference valve substitute for LVM regression studies after aortic valve replacement.

By means of cardiac echocardiography, it was observed that immediate hemodynamic function of the pulmonary auto-graft in aortic position may eventually be considered "normal". Mean gradients were insignificant, with flow speed similar to the normal aortic valve.

In our study there were significant drop in gradients measured postoperatively when compared to the preoperative measurements but the drop of gradients was significant in group A (Ross group) when compared to group B (mechanical group).

For group A the mean preoperative gradient was 55.9 and the postoperative gradient was 26±1.3.

For group B the mean preoperative gradient was 58.6 while the mean postoperative gradient was 17.4.

As regard to the pattern of regression of the left ventricle when measuring the posterior wall thickness PWT, septal wall thickness SWT and the left ventricle mass index (LVMI) there were no significance in the pattern of regression of both groups. This might be due to the limited number of cases and the short periods of follow-up.

The hemodynamic performances of the current biological and mechanical prostheses are satisfactory; however, all have residual gradients, even at rest (24).

In a few patients having small initial portions of the aorta, the use of smaller prosthesis may be associated with very high residual gradients. Studies reported that Carbomedics prostheses at less than 12 mm/m of body surface are usually highly stenotic, This can be observed with other kinds of prostheses, as reported by several authors (25,26).

Pulmonary auto-grafts allow the substitution of the aortic valve with normalization of the hemodynamic performance (27).

Frazier et al recently showed that left ventricular mass reduction after aortic valve replacement was greater when prostheses with better hemodynamic performance were used. In this study, we also observed a significant reduction of left ventricular mass, with even lower values than those reported by the authors above. Although a direct comparison of the results is not possible, we believe that the greater reduction observed in this study is due to the performance of pulmonary auto-grafts (28).

In a study done by Jin and colleagues where they compared the effect of valve substitute on the left ventricle hypertrophy, they found that the type of valve substitute, the nature of the original valve disease, whether stenotic or regurgitant, and the follow-up time were the major determinants of left ventricular mass index and function over the first 2 to 3 years. Potential influence of age, sex, concomitant coronary artery disease, and intra-operative factors, such as the duration of aortic cross-clamp time and myocardial preservation method proved to be of little significance during this study period (29).

The major intention of this study was to evaluate LVMI change after the Ross procedure. Independent of surgical technique, we found a significant decrease in LVMI 6 months after the Ross procedure but not statistically significant from the mechanical valve group: for group (A) 114.0 ± 27.2, for group (B) 110 ±30.2.

In a study by Doss et al., the results of mechanical aortic valve replacement where compared, the pulmonary auto-grafts had significantly lower transvalvular gradients than the mechanical valves. From our understanding of the pathophysiology of aortic valve stenosis, we would have expected a significant difference in the regression of LV hypertrophy between the two valve substitutes. However, in this randomized group of patients, LV mass regression was similar in both groups at 6 and 12 months, despite the superior hemodynamic performance of the pulmonary autografts (13).

The 6-month postoperative follow-up period also seems to be insufficient to assess the regression of LV hypertrophy. Several authors have demonstrated that no difference in LV mass regression is found between 1 year and 3 years of follow-up (29).

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Early Results of Comparative Study Between PCI and CABG In The Treatment of Coronary Artery Disease

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BACKGROUND: **Both coronary artery bypass surgery (CABG) and percutanuos coronary interventions (PCI) are safe and established treatment modality of invasive revascularization for patients with coronary artery diseases (CAD). However conflicting information exists when comparing the short term efficacy of the two methods. The clinical outcomes after invasive revascularization differ according to the number of diseased vessels, presence or absence of disability, and left ventricular dysfunction. The available data need to be addressed, so that care of patients with CAD can be successfully tailored.**

METHODS: **We randomly assigned 72 patients with multivessels disease, 38 patients underwent PCI, and 34 patients underwent CABG in the period of 2 years from February 2007 to March 2009 in Prince Sultan Cardiac Center in Burida. Both surgical and stent angioplasty groups were followed-up for one year (end point) for recurrent angina, myocardial infarction (MI), cerebrovascular stroke, or death, among survivors the need for second revasculaization was addressed.**

RESULTS: **The preoperative patient's characteristics for both groups were similar. After 12 months of follow up, the rate of death was 5,2%(2/38 patients) in PCI group, and 6%(2/34 patients)in CABG group, the rate of stroke was 2,6%(1/38 patients) in PCI group, and 0%(0/34 patient) in CABG group, the rate of MI was 5,2%(2/38 patients)in PCI group, and 3%(1/34 patient) in CABG group. The rate of repeated revascularization was 13,1%(5/38 patients) in PCI group, and 6%(2/34 patients)in CABG group, this the only significant difference between the two groups.**

CONCLUSIONS: **CABG is associated with lower rate of adverse cardiac and cerebrovascular events as compared with PCI, so CABG remains the superior line of treatment in patients with coronary artery diseases.**

KEY WORDS: **CABG, multivessels disease, percutaneous coronary intervention, drug eluting stent**

Percutanous coronary intervention (PCI) was introduced in 1977. Experience with this approach, coupled with improved technology has made it possible to treat increasingly complex lesions and patients with a history of clinically significant cardiac disease, coexisting condition, or anatomical risk factors. (2-3) Coronary artery bypass grafting (CABG) was introduced in 1968 and rapidly became the standard technique for treating patients with symptomatic coronary artery diseases.(4) Advances in coronary surgery (e.g. off pump CABG, smaller incisions, enhanced myocardial preservation, use of arterial conduits, and improved postoperative care) have reduced morbidity and mortality.(5-6)

Several trials comparing PCI involving bare-metal stents with CABG in patients with multivessels diseases (e.g. Arterial Revascularization Therapies Study 1{ARTS 1}, the Medicine, Angioplasty, or Surgery Study 11{MASS 11}, the Argentine Randomized Study of coronary Angioplasty with stenting versus CABG in patients with multivessels diseases{ERACI 11}, and the Angina With Extremely Serious Operative Mortality Evaluation {AWESOME}, these trials showed similar survival rate in stent and CABG groups and higher revascularization rate in the bare-metal stents group at 5 years.(7)

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Others (e.g. the Stent Or Surgery {SOS} study) have shown significant long-term survival with surgical interventions.(8)

In other randomized, controlled study of comparing drug-eluting stents and bare-metal stents have shown significant reduction in the rate of repeated intervention.(9) These improvements have led to expanded use of PCI in patients with complex coronary anatomical features. According to current guidelines CABG remains the treatment of choice for patients with severe coronary diseases, including left main coronary artery disease and three-vessel disease.(10)

METHODS

Our study was randomized study that required a consensus of the surgeon and interventional cardiologist regarding equivalent treatability of the patient by either technique. Informed consent was obtained from each patient and institutional review board approved the protocol.

Patients with angina or ischemia but no previous bypass surgery or angioplasty were selected after agreement between surgeons and cardiologists, randomly assigned after written informed consent and treated with either surgery or stented angioplasty. Patients were eligible for coronary revascularization if they had at least two de novo lesions (located in different vessels and different territories) potentially amenable to bypass surgery or stent implantation.

In the surgical group, 20 out of 34 patients (59%) had stable angina, and 14 patients (41%) had unstable angina.

In the stent group, 22 out of 38 patients (58%) had stable angina and 16 patients (42%) had unstable angina. (Table 1)

Concomitant risk factor modification was an important aspect of treatment for all patients in our study. Smokers were counseled and assisted with smoking cessation. Patients with hypertension were required to have their blood pressure lowered to less than 130/85 mmHg. Pharmacologic treatment was instituted for patient with hypercholesterolemia according to guidelines protocol.

Exclusion criteria included a left ventricular ejection fraction less than 30%, overt congestive heart failure, diabetes mellitus, a history of previous cerebrovascular accident, myocardial infarction, severe hepatic or renal disease, diseased saphenous vein, and the need for concomitant major surgery (e.g. valve surgery or resection of aortic or left ventricular aneurysm, carotid endarterectomy, abdominal aortic aneurysm surgery), finally patient with neutropenia or thrombocytopenia were also excluded.

All diagnostic angiograms and electrocardiograms were reviewed by staff at independent core laboratory (Cardiolysis, Rotterdam, Netherland). The standard procedure for coronary bypass entailed extracorporeal circulation and cardiac arrest. The internal thoracic artery had to be used for revascularization of the left anterior descending coronary artery or the diagonal branches during the extracorporeal circulation. The use of other arterial conduit material was discouraged. The remaining vessels could be bypassed by use of the greater saphenous vein in whatever configuration the surgeon deemed appropriate. Anesthetic techniques and the type of cardioplegic solution were standardized.

Stenting procedures were done using Taxus Express Paclitaxe eluting stents (Boston Scientific). Patients were treated with intention of achievement of complete revascularization of all vessels at least 1,5 mm in diameter with stenosis of 50% or more as identified by interventional cardiologist or cardiac surgeons.

End Points

The primary end point was defined as the absence of any of the following major adverse cardiac and cerebrovascular events within 12 months after random assignment: death, cerebrovascular event, documented non-fatal myocardial infarction, or repeated revascularization by percutaneous intervention or bypass surgery.

After random assignment, all myocardial infarction were counted as events, whether they occurred spontaneously or in association with coronary artery bypass grafting surgery or angioplasty procedure. Myocardial infarctions were confirmed only after relevant electrocardiogram and cardiac markers. Every subsequent revascularization procedure was recorded, including the reason for the procedure.

Statistical Analysis

Continuous variable were expressed as mean ± SD and compared with the unpaired Student t' test. The Fisher exact test was used for categoric variables. Wilcoxon score were used for categoric variables with an ordinal scale. Discrete variables were expressed as counts and percentages and were compared in terms of relative's risks (for surgery Vs stenting) with 95% confidence intervals calculated by the formula of Greenland and Robins. All statistical tests were 2-tailed. Event-free survivals were estimated according to Kaplan-Meier method, and differences were assessed with the log-rank test.

RESULTS

Between February 2007 to March 2009, a total of 72 patients were randomly assigned to undergo coronary artery bypass grafting surgery (34 patients) or angiography with drug-eluted stent implantation (38 patients) at our institute.

Table (1) shows their baseline demographic and angiographic characteristic

Characteristics	Stented angioplasty	Coronary artery bypass grafting
	(No. 38)	(No. 34)
Male sex	No. 28 (73%)	No. 25 (74%)
Age (year mean ± SD)	61 ± 10 (30-83)	50 ± 10 (41-61)
Body mass index (Kg/ m^2, mean ± SD)	26.2 ± 3.7	27.5 ± 3.7
Previous conditions		
- Hypertension	51%	49%
-Hypercholesterolemia	56%	57%
- Family history	10%	12%
- Current smoker	32%	34%
- Stable angina	57%	60%
- Unstable angina	43%	40%
Ejection fraction	61%± 12%	60% ±13%
Vessel territory		
- Right coronary artery	70.2	71.3
- Left anterior descending artery	88	91%
- Left circumflex artery	69%	71%

Table 1. Baseline characteristics of patients included in the study

In the first 24 hours after intervention, abnormal creatine kinase MB level was observed in 61% of the surgical group and 31% of the stent group. One patient (2.9%) died in the hospital after operation because of cardiogenic shock (2.9%). The hospital mortality rate in stented group was zero %. 33 patients were weaned off the ventilator machine and extubated in the CABG group. The lengths of stay were 7± 9.4 days in surgical group and 2± 4.8 days in PCI group.

In surgical group no patient had cerebrovascular stroke and one patient (2.9%) had myocardial infarction. Two patients (6%) need repeated revascularization, one case (3%) by means of bypass surgery and one case (3%) by angioplasty.

The events in stented group after patients discharged include two patients (5.2%) died, one patient (2.6%) suffered from stroke and two (5.2%) suffered from myocardial infarction.

The rate of repeat revascularization at 12 months was significantly higher among the patients in PCI group than among those in the CABG group (13.1% and 2.6% P< 0.001). Most patients who underwent repeat revascularization were treated with PCI rather than CABG. (4 patients from PCI group and 1 patient from CABG group)

In comparison between the two groups as mentioned above, one out of 38 underwent PCI had stroke and none from the surgical group (2.6% Vs zero % P=0.003), MI occurred in 2 patients in PCI group and 1 patient in CABG group (5.2% Vs 3% P=0.11). Two patients died in PCI group and one patient died in CABG group (5.2% Vs 2.9% P=0.37)

The 12 months rates of symptomatic graft occlusion in the CABG group and stent thrombosis in PCI group were similar (one patient from each group P=0.89) (Table 2)

Variable	PCI	CABG	P Value
Early CK-MB	31%	60%	<0.005*
Repeat vascularization	5/38 (13.1%)	2/33 (6%)	<0.001*
- CABG	1	1	
- PCI	4	1	
Death	2/38 (5.2%)	1/33 (3%)	0.37
Stroke	1/38 (2.6%)	zero/33	0.003*
MI	2/38 (5.2%)	1/33 (3%)	0.11
Symptomatic graft occlusion or stent thrombosis	1/38 (2.6%)	1/33 (3%)	0.89
Length of stay	2± 4.8 d.	7± 9.4 d.	<0.005*

Table 2 . Clinical End Points occurring within 12 months

DISCUSSION

The SYNTAX trial was designed to compare current surgical and percutaneous techniques in patients with multiple vessel disease. For the primary end point, the 12 month rate of major adverse cardiac or cerebrovascular, CABG proved to be superior. Therefore, the findings with regard to component of the primary end point and sub-group analysis can only be considered as hypothesis–generating. Rates of death and myocardial infarction at one year were similar between patients who underwent CABG and those who underwent PCI with drug eluting stents, whereas the rate of stroke was increased in the CABG group and the rate of repeat revascularization was increased in the PCI group. The increase in the rate of repeat revascularization with PCI as compared with CABG did not appear to translate into a significant overall increase in the rate of death or myocardial infarction, although longer-term follow-up is needed.(11) The risk of repeat revascularization after PCI needs to be balanced against the invasiveness of CABG and the risk of stroke, as previously reported in a meta-analysis of 23 studies comparing CABG and PCI, in which procedure-related strokes were found to be more common after CABG in 1.2% of patients Vs 0.6% those undergoing PCI (P< 0.001) without a concomitant decrease in survival[12].

In our result the rate of repeated revascularization was significantly high in PCI rather than CABG group.

In the SYNTAX trial, most cases of stent thrombosis occurred within 30 days after the procedure, and then 12 month rate of stent thrombosis in the PCI group was similar to the rate of symptomatic graft occlusion in the CABG group. However, as described in the literature, stent thrombosis often has more serious consequences for patients (rate of death, approximately 30%, rate of myocardial infarction >60%) than does graft occlusion, which often results only in angina leading to revascularization [13].

In our patients, no significant difference between stent thrombosis and graft occlusion in the two groups during the follow up period.

The use of antiplatelet medication was high among patients in the PCI group (with 71.1% receiving thienopyridine at 12 months).

There was an imbalance between the two groups with regard to general management apart from thienopyridine use. Thienopyridine therapy was not mandated beyond 6 months in the PCI group, since the study was designed to compare current CABG and PCI practices, including medication regimens. The low rate of stroke among patients who underwent PCI may have resulted from the use of highly effective dual-antiplatelet therapy, which prevents thrombo-embolic events; additional treatment with antiplatelet drugs might therefore benefit patients undergoing CABG[14].

In our study, patient underwent PCI received Aspirin, Plavix (Clopidogrel) throughout the period of follow up. On the other hand CABG patients received only aspirin post-operatively.

The SYNTAX score was designed to predict outcomes related to anatomical characteristics and, to a lesser extent, the functional risk of occlusion for any segment of the coronary artery bed [15].

The SYNTAX score was predictive of outcomes in patients who underwent PCI. In PCI group with high SYNTAX score there is significant increase in major adverse cardiac or cerebrovascular event and also the rate of death, stroke and MI was slightly raised. This finding suggests that a percutaneous approach should be avoided in patients with high SYNTAX score. On the other hand outcomes in the surgical group were not influenced by the SYNTAX score[14]. Similar results were reported after stratification of patients with multivessel disease in the ARTS II registry[16].

In our work, we found that the death rate was more in PCI group than in CABG group, also we found that stroke was more higher in PCI group than in CABG group, and finally the MI rate was found also more in PCI group than CABG group although these differences were not significant. The length of stay was less in PCI group than in CABG group with significant differences.

There are some limitations in our study. First, the 12 month follow-up period may not be sufficient to reflect the true long-term effect of CABG as compared with PCI with drug-eluting stents on cardiac related health. However, our early results in term of major adverse cardiac or cerebrovascular events are similar to those of meta-analysis[12]. The second limitation is the small number of patients in our study. Third, the use of different medications between the groups in our study, reflecting variation in standard care of patients between the two treatment group. Fourth, although randomization was conducted in blind manner, with clinicians and participants unaware of future treatment assignments, it was not possible to blind the performance of the treatment.

CONCLUSION

We conclude that as CABG was associated with lower cardiac and cerebrovascular events, it may be considered the treatment of choice for patients with multivessel disease as compared with PCI.

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Surgical Correction of Moderate Ischemic Mitral Regurge In Elderly, Does It Affect on Quality of life?

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Objective: **Moderate ischemic mitral regurgitation is an independent risk factor for reduced long-term survival. This study was designed to assess the results of correction of moderate ischemic mitral regurgitation in elderly and monitor the early outcome in terms of impact on quality of life.**

***Methods*: Between September 2005 and March 2010, 56 patients (65 years of age and older) underwent coronary artery bypass grafting (CABG) with concomitant mitral valve repair with implantation of a prosthetic, flexible or semiflexible remodeling ring , at King Fahad cardiac center, Riyadh, Saudi Arabia. All patients had New York Heart Association (NYHA) class III or IV. Conventional technique with cardiopulmonary bypass was performed in all patients through full sternotomy. Follow-up echocardiography ranged from 6 to 18 months.**

Results: **There were 3 in-hospital (30 day) deaths, 2 patients died from multi-organ failure and one patient from severe heart failure. The mean time of cardiopulmonary bypass was 198±7 min, with a mean aortic cross-clamp time of 136 ±4 min. The average number of grafts was 2.7±0.2 (range, 2 to 5). Three patients (5.36%) required placement of an intra-aortic balloon pump (IARP). Trivial to mild regurgitation in 46 patients (82.14%), and grade 2 regurgitation was found in 2 patients (3.57%). Three patients (5.36%) required mechanical valve replacement, due to residual 2 to 3+ mitral regurgitation. Three patients were returned to the operating room for postoperative bleeding. Follow up echocardiography, there was marked reduction in end-systolic and end-diastolic volumes and diameters with improvement of ejection fraction. All surviving patients have been angina free. The vast majority of patients (46 patients) reported improvement in their functional status. The New York Heart Association (NYHA) and Canadian Cardiovascular Society (CCS) classes significantly decreased from a mean of 3.4±0.2 to 1.8±0.3 and 2.8±0.3 to 1.9±0.1 respectively.**

Conclusions: **Combined mitral valve procedure and myocardial revascularization, as complete as possible, for ischemic moderate mitral regurgitation achieve satisfactory early outcome and improve the quality of life.**

Mitral regurgitation (MR) secondary to myocardial infarction is found in approximately 3% of all patients undergoing coronary angiography. The correct management of ischemic mitral regurgitation (IMR) in patients presenting for coronary artery bypass grafting (CABG) is an ongoing source of debate. Correction of severe IMR at the time of CABG has become widely accepted as standard therapy and is not disputed [1].

Patients with trivial to mild IMR are treated by revascularization alone. However, there is no consensus as to the appropriate treatment for patients with moderate IMR. While some data suggests that revascularization alone in these patients results in improved IMR and has acceptable outcomes other investigators dispute this [2].

Uncorrected moderate mitral regurgitation secondary to myocardial infarction during CABG is an independent risk factor for long-term survival. However, late effects of correction of mitral incompetence concomitant with CABG are less well known and the choice of mitral valve procedure is still debated. Outcomes of these patients represents a challenging problem for both cardiologists and cardiac surgeons [3].

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While surgical correction of mitral valve regurgitation at the time of revascularization could be most beneficial, treatment of elderly patients are problematic as valve replacement distorts ventricular annular geometry and function. Mechanical mitral valve replacement puts this age group at risk from anticoagulant complications, and revascularization alone often results in continued mitral regurgitation, heart failure and poor outcome [4].

The fact that many patients with "moderate" or less MR present with significant symptoms of congestive heart failure or enlarged left atria suggests that, they probably have frequent episodes of more severe MR. CABG alone will not correct moderate ischemic MR in many patients with infarction and annular dilatation [5]. Mitral annuloplasty is technically feasible, and it alone will almost always correct moderate ischemic MR, which makes mitral valve replacement almost never necessary[6].

This present study was designed to assess the results of correction of moderate ischemic mitral regurgitation in elderly and monitor the early outcome in terms of impact on clinical status.

Patients and Methods

Between September 2005 and March 2010, 56 patients corresponding to 3.86% of all CABG patients with 65 years and more (65-83years) were studied at King Fahad cardiac center, King Saud university, Riyadh, Saudi Arabia. All patients had a preoperative diagnosis of moderate ischemic MR. Diagnosis was done by echocardiography, ventriculography or both. Patient believed to have an element of underlying organic/ degenerative mitral disease and patients undergoing all other procedures were excluded from this study. All patients, underwent CABG with concomitant mitral valve repair. To be classified as having moderate ischemic MR, the patient had to fulfill all of the criteria listed in Table 1. Coronary artery disease (CAD) was considered present with significant stenosis ≥70% in at least one vessel with or ≥50% in the left main. All patients had New York Heart Association (NYHA) class III or IV despite receiving maximized medical regimens. All the records of those patients were reviewed, including baseline clinical, echocardiographic, hemodynamic and surgical data. Medical therapy was optimized following the current guidelines.

Echocardiographic Imaging

All preoperative and postoperative echocardiographic imaging was performed using standard transthoracic windows with commercially available equipment. Intraoperative echocardiography was performed using echocardiography (Hewlett-Packard Sonos1500; Hewlett-Packard Co; Waltham, Mass) and biplane transesophageal probe. Transesophageal echocardiogram was used in all patients before MV surgery to characterize the mechanism of MR. The study was performed after induction of general anesthesia and before the surgical incision at the discretion of the surgeon and anesthesiologist. There were no systematic attempts to induce MR by increasing afterload or preload. After MV repair or replacement , transesophageal echocardiogram was repeated to evaluate the adequacy of MV surgery. Analysis was performed by experienced echocardiographers.

Mitral regurgitation was assessed using color flow Doppler; severity was graded as none, trivial, mild, moderate, or severe. Measurements of left ventricle (LV), mitral annular, and outflow tract diameters were made from parasternal long-axis views. LV volumes and ejection fraction (EF) were calculated using Simpson's method with two apical views. Regurgitant volume was calculated as the difference between mitral inflow and forward cardiac output, and the regurgitant fraction as the ratio of the regurgitant volume to mitral inflow volume. Mitral gradients were calculated using continuous-wave Doppler. A postoperative transthoracic echocardiogram (TTE) was performed at our hospital within 6 weeks of surgery and during follow up period. This study was also performed at the discretion of the surgeon.

Operative Techniques

All procedures were performed through full sternotomy. Conventional technique with cardiopulmonary bypass was used in all patients. Dual venous cannulation with moderate hypothermia (26–32°C) and antegrade blood cardioplegia were performed. Coronary artery bypass grafting (CABG) was done before the mitral procedure. The left internal mammary and saphenous veins were used as conduits for most of the patients. The decision to mitral valve repair was at the surgeon's preference and the ischemic pathology of mitral valve.

Implantation of a prosthetic, flexible or semiflexible remodeling ring (Duran Ring; Medtronic Inc; Minneapolis) was performed in all patients because they were believed to have annular dilation. Intra-operative evaluation of the adequacy of the valve repair was made by direct visual inspection of leaflet coaptation by observing any regurgitation when the ventricular chamber was filled. The ventricle was filled by the bulb-flush technique. Intra-operative trans-esophageal Doppler echocardiography was the standard method of repair valve evaluation.

Data Collection and Analysis

All patients underwent clinical follow-up with mean duration was 18±6 months. Preoperative, operative, and postoperative data were collected prospectively in our clinical database and confirmed by review of the actual medical records. Data were tabulated with Microsoft Excel (Microsoft Corp), and statistical analysis was performed with the SPSS statistical package (SPSS Inc). All means in the text are expressed as mean SD. A *P* value 0.05 was considered statistically significant.

Results

Patient characteristics

Preoperative patient characteristics were summarized in table 2. 56 patients (42 men and 12 women) were included in the study. Patient ages ranged from 65 to 83 years (mean 72±٢ years). Preoperatively, all patients had NYHA class III or IV with a mean failure class of 3.4±٠.2. All patients were receiving maximized medical therapy for congestive heart failure, including combinations of diuretics, and afterload reducers. Preoperative ejection fraction ranged from 20 to 50% (mean 30±٢٪). These elderly patients had a mean Canadian Cardiovascular Society (CCS) anginal class of 2.8±٠.3.

Perioperative Data

Perioperative data are shown in table 3. The mean time of cardiopulmonary bypass was 198±7 min, with a mean aortic cross-clamp time of 136 ±4 min. Coronary artery bypass grafts (CARGs) were placed in all patients with the aim of total revascularization. The average number grafts was 2.7±0.2 (range, 2 to 5). 48 patients received left internal mammary artery bypass grafts (85.7%) and all received saphenous vein grafts. Three patients (5.36%) required placement of an intra-aortic balloon pump (IARP), while no patient required mechanical support. Trivial to mild regurgitation in 46 patients (82.14%), and 2+ regurgitation was found in 2 patients (3.57%). Three patients (5.36%) required mechanical valve replacement, due to residual 2 to 3+ mitral regurgitation after intra-operative echocardiographic evaluation. Three patients were returned to the operating room for postoperative bleeding. Median ventilatory support time and intensive care unit stay were 10 hours and 2 days respectively. The mean duration of hospitalization following surgery was 10±4 days (range, 4 to 34 days). Nine patients (16.07%) required longer than 24 hours of mechanical ventilator support. All patients have continued to receive medical therapy, consisting of combinations of calcium channel blockers, diuretics, and afterload reducing agents. However, medical regimens are lower postoperatively, with no patient receiving a higher dose of any medication in the postoperative period than in his or her preoperative regimen. There were 3 in-hospital (30 day) deaths, 2 patients died from multi-organ failure and one patient from severe heart failure.

Outcome

Follow-up echocardiography at 6 to 18 months was available for 32 patients. Measurements of LV size and volumes denoted that patients had a marked reduction in end-systolic and end-diastolic volumes and diameters with improvement of ejection fraction (table 4) .

All surviving patients have been angina free. The vast majority of patients (46 patients) reported improvement in their functional status following surgery. The NYHA and CCS classes significantly decreased from a mean of 3.4±0.2 to 1.8±0.3 and 2.8±0.3 to 1.9±0.1 respectively (table5).

Significant symptomatic multivessel coronary artery disease, with or without documented prior myocardial infarction.
Grade 3+ MR on a scale of 0 to 4+
Documented on preoperative echocardiogram or vetriculogram while patient is not actively ischemic Regurgitant jet to posterior wall of left atrium without reversal or blunting of pulmonary venous flow
No mitral stenosis
Type I or III b by Carpentier functional classification
Annular dilatation with normal leaflet motion (type I) OR Restricted leaflet motion during systole (type III b) No leaflet prolapse (type II) or other leaflet pathology

Table 1. Definition of Moderate Ischemic MR.

Characteristic	All patients (n = 56)
Age (years)	72 ± 2
Male sex	42 (75%)
Mean EF%	30.2±3.0
Diabetes mellitus	43 (76.78%)
Hypertension	50 (89.29%)
Chronic obstructive pulmonary disease	4 (7.14%)
Congestive heart failure	54 (96.43%)

EF: ejection fraction.

Table 2: Patient Characteristics.

Characteristic	All patients (n = 56)
Operation time (mean)	136 ± 4 min
Cardiopulmonary bypass time (mean)	198 ± 7 min
Intra-aortic balloon pump required	3 patients (5.36%)
Number of bypass grafts (mean)	2.7 ± 0.2
Left internal mammary artery	48 patients (85.7%)
Mitral repair	53 patients (94.64%)
Mitral replacement	3 patients (5.36%)
Grade 1 MR	46 patients (82.14%)
Grade 2 MR	2 patients(3.57%)

MR: mitral regurge.

Table 3: Intra-operative data.

Characteristic	All patients (n = 56)
Ventilation time (hours) (mean± SD)	10
ICU stay ,days (mean± SD)	2
Hospital stay (mean± SD)	10±4
Reoperation for bleeding	3 patients (5.36%)
In-hospital mortality	3 patients (5.36%)

ICU: intensive care unit.

Table 4. Postoperative outcome.

Characteristic	Preoperative	Postoperative	P value
NYHA class	3.4±0.2	1.8±0.3	HS
CCS	2.8±0.3	1.9±0.1	HS
EF	28.2±2.1	39.6±5.4	HS
LVEDV	178±51	139±41	HS
LVESV	116±45	72±38	HS

NYHA: *New York Heart Association,* **CCS***: Canadian cardiovascular society,* **EF***: ejection fraction,* **LVEDV***: left ventricular end-diastolic volume.* **LVESV***: left ventricular end-systolic volume,* **HS***: high significant (P value < 0.0001).*

Table 5: Outcome and Echocardiographic data.

Discussion

Mitral regurgitation (MR) in the elderly population is expected to become a relevant health problem in the future, considering the constantly increasing ageing of the population and the rapid increment of the prevalence of heart failure [7].

There is discrepancy in the literature regarding the benefit of repair in elderly patients. Some authors cite improved in-hospital and long-term survival in elderly patients age 70 years or older undergoing MV repair, whereas others suggest MV repair provides no benefit in patients older than the age of 60 years [8].

The most appropriate treatment for patients with ischemic mitral regurgitation (IMR) is often debated among patients with IMR, treatment with PCI, CABG, or CABG plus MV surgery is associated with improved survival compared with medical therapy [9].

In patients with moderate to severe or severe IMR, the American Heart Association/American College of Cardiology (AHA/ACC) guidelines [10] recommend surgical treatment, in particular if mitral valve repair is feasible. Suri and coworkers [11] stated in their study that functional quality of live (QOL) outcomes within the first 2 years after early MV repair are excellent using open and robotic platforms. These results may have implications regarding future evolution of clinical guidelines and economic health care policy.

Mitral regurgitation is well known to be a poor prognostic sign for patients with coronary artery disease and may affect up to 15% of patients undergoing coronary bypass surgery. If mitral regurgitation is not corrected, it profoundly worsens hospital mortality and late survival, even with good myocardial revascularization. Mitral reconstruction effectively corrected mitral regurgitation, confirmed both on intra-operative TEE and on follow-up transthoracic studies[12].

This study of 56 patients with moderate ischemic MR who underwent CABG was conducted in an attempt to determine whether CABG with correction of MR improve the function class and quality of life in the short term. The findings were that most of the patients had downgrading of their MR on intra-operative TEE, three patients needed mitral replacement after attempt of repair.

Our in hospital mortality was three patients (5.36%), early mortality tended to be higher in patients undergoing emergency surgery and in patients in preoperative functional class IV.

Christenson and his workers [13] reported the clinical outcomes of a cohort of 56 patients with moderate IMR underwent CABG alone. The 54 hospital survivors were followed for a mean period of 12 months, and there was only 1 death (8 months postoperatively). While the duration of follow-up was short, the severity of MR was mild, these results suggest that CABG alone may be appropriate therapy in some patients. The outcomes of these patients were not directly compared with similar individuals undergoing CABG + MV surgery.

The risk of surgery is higher in the elderly with higher operative mortality, higher incidence of low cardiac output (LCO), and longer hospital stay, but over time, surgical improvements have resulted in considerable reduction in operative mortality and morbidity[14].

The use of a rigid or semirigid complete annuloplasty ring is currently considered the gold standard for IMR in many centers because it is thought to prevent and treat the mitral annular dilatation that occurs as the left ventricle dilates[15]. Whereas, Mihaljevic and his workers [6] concluded that mitral valve annuloplasty in patients with IMR undergoing CABG is insufficient to improve long-term clinical outcomes.

Magne and associates[16] stated that ,as opposed to what has been reported in patients with organic MR, they found no evidence that mitral repair provides any benefit in terms of short-term or long-term survival compared to mitral replacement in patients with ischemic MR. These findings emphasize the need of a randomized prospective trial comparing these 2 operative strategies and provide an impetus for the development of new surgical techniques that directly target the causal mechanisms

of this complex disease. Ailawadi and coworkers[17] reported in their study, no differences in outcomes were identified when concomitant CABG and valve operation was required. Mitral repair can be performed over replacement when feasible even in patients older than the age of 75 years.

Additional evidence supporting the role of revascularization among patients with IMR can be extracted from the study by Gillinov and his workers[18] comparing outcomes after MV repair and MV replacement in a cohort of 482 patients with IMR. After subdividing their cohort based on risk, they concluded that >70% of patients would benefit from a strategy of repair over replacement. However, the benefit of valve repair was negated if an internal thoracic artery was not used for revascularization.

Trichon and his coworkers [9] reported in their results that revascularization is an important therapeutic goal in patients with IMR and is associated with an improved survival compared with medical therapy. Restoration of epicardial coronary flow, attenuation of adverse LV remodeling and the progression of LV dysfunction, and improvement in MV leaflet coaptation are possible mechanisms to explain this apparent benefit. Acknowledging the limitations of their observational analysis, they could not detect a survival benefit in patients with IMR receiving CABG plus MV surgery beyond CABG alone.

There is limited information in the literature on the late functional status of patients undergoing CABG alone for moderate ischemic MR. Duarte and their associates[19] reported a trend toward more class III and IV angina (29% versus 6%) and congestive heart failure (14% versus 6%) compared with case-matched controls. On the other hand, Bolling and coworkers[12] reported that nearly all patients undergoing mitral valve repair at the time of CABG moved from class III or IV to class I or II. These findings is concordant with our results in there is improvement of functional status and quality of life. Concomitant mitral valve repair may therefore be justified, if it can be performed with relatively low operative risk, to improve long term functional status. Chen[20] have clearly demonstrated improved functional status after mitral valve repair in a broad group of patients with severe left ventricular dysfunction, many with an ischemic etiology. This may suggest that patients with left ventricular dysfunction may extract greater benefit from mitral valve repair at the time of CABG for moderate ischemic MR. Tavakoli and coworkers [3] reported in their study that, the long-term benefit is substantial in terms of survival and functional capacity after correction of ischemic moderate grade 3 to 4 mitral regurgitation during the coronary artery bypass surgery. Their patients were preoperatively in functional class III or IV and postoperatively all but one survivors to follow-up in functional class I or II.

Clinical Implications

The present study addressed the specific question of whether CABG with mitral repair to correct moderate ischemic MR in the short-term. The long-term clinical implications of these results are not specifically addressed in the present study. Whether these results justify more liberal use of mitral annuloplasty depends on the answer to 2 follow-up questions: (1) Can mitral annuloplasty reliably and predictably correct moderate ischemic MR. (2) What is the long-term impact of residual MR on functional status and survival?

The limitations of our study

We performed a separate analysis of data stratified by surgeon, and although the number in this study was relatively small. Elderly patients undergoing mitral surgery may not represent all elderly patients with MR, and the benefit of surgery cannot be defined without a randomized clinical trial, which is not yet available or even ongoing. Long-term follow up is necessary to determine the impact of residual MR on late symptoms and survival. A prospective study with a randomized trial of CABG with or without mitral annuloplasty may be warranted to determine the optimal treatment strategy.

Conclusion

We recommend combined mitral valve procedure and myocardial revascularization, as complete as possible, for moderate mitral regurgitation secondary to myocardial infarction. This treatment of moderate mitral regurgitation is associated with improved NYHA class and quality of life. The conclusion of 'benefit in terms of functional capacity' is derived from the fact that most of our patients were preoperatively in functional class III or IV and postoperatively all survivors to follow-up in functional class I or II.

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Long Term Follow Up Of Surgical Ventricular Restoration Patients: Saudi German Hospital Experience

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Introduction: **Patients who underwent surgical ventricular restoration (SVR) with coronary artery bypass graft (CABG) surgery still had benefit at long term in the form of improved congestive heart failure functional class (CHF-FC) and left ventricular ejection (LVEF), smaller left ventricles and less hospital admissions.**

Objectives: **SVR is safe and reproducible procedure for dilated ischemic cardiomyopathy (DICM) with benefits that stay with the patients at long term follow up.**

Patients & Methods: **This is a retrospective study of 50 cases of SVR who were operated upon in the last 5 years. We included those patients with DICM, with LVEF < 35 % and had symptoms of angina and/or heart failure. Echocardiography and cardiac catheterization were done in all cases. Preoperative and postoperative left ventricular end systolic volume index (LVESVI), left ventricular end diastolic volume index (LVEDVI) and LVEF were assessed by echocardiography. CHF-FC was assessed by clinical interview with patients and results were analyzed statistically.**

Results: **The mean age of patients was 58 ± 8 years, all were males, 48 patients had CABG and SVR, and 2 patients had CABG, SVR and closure of small ischemic ventricular septal defect. No hospital mortality was reported. The mean LVEF was increased from 24±4 % to 46±6 % (p<0.02). LVESVI was decreased from 108±70 to 68± 40 ml/m² (p<0.01), the LVEDVI was decreased from 170± 40 to 118± 38 ml/m² (p<0.01). The mean CHF-FC was improved from 3.3± 0.3 to 1.8±0.3 (p<0.02). There was no sudden cardiac death, no readmissions for CHF. One patient died at 3 months of a stroke and one patient was missing at one year follow up and reported dead.**

Conclusion: **In our series we proved that patients who were given SVR with CABG surgery maintained an improvement in CHF-FC, LVEF, and reduction in LV size at long term follow up.**

KEY WORDS: **CABG, SVR, CHF, LVEF, DICM.**

Heart failure is one of the major health care issues in the Western world. An increasing number of patients are affected, leading to a high rate of hospitalization and high costs. Even with administration of the best available medical treatment, mortality remains high. The increase in left ventricular volume after a myocardial infarction is a component of the remodeling process. Surgical Ventricular Restoration (SVR) has been introduced as an optional therapeutic strategy to reduce left ventricular volume and restore heart geometry. So far, it has been established that SVR improves cardiac function, clinical status, and survival in patients with ischemic, dilated cardiomyopathy and heart failure [1].

Left ventricular remodeling is the process by which mechanical, neurohormonal factors, alter ventricular size, shape, and function. Remodeling occurs in several clinical conditions, including myocardial infarction (MI), cardiomyopathy, hypertension, and valvular heart disease [1].

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SVR has been developed with the goal of improving cardiac function through a reduction in left ventricle (LV) wall tension in accordance with the principle of Laplace's law. Since LV wall tension is directly proportional to the LV internal radius and pressure, and inversely proportional to wall thickness, any intervention to optimize this relationship would be beneficial in terms of improving wall compliance and reducing filling pressure. Optimization may also be beneficial in terms of enhancing the contractile performance of the LV by increasing the extent and velocity of systolic fiber shortening [2].

AIM OF THE WORK

We reviewed our experience in performing SVR over the last 5 years to prove that SVR is safe and reproducible procedure for dilated ischemic cardiomyopathy (DICM) with benefits that stay with the patients at long term follow up.

PATIENTS and METHODS

This is a retrospective study of 50 cases of SVR who were operated upon in Saudi German hospital, Jeddah, KSA in the last 5 years (2006-2011). We included those patients with DICM, with left ventricular ejection fraction (LVEF) < 35 % and had symptoms of angina and/or heart failure. Echocardiography and coronary angiogram were done in all cases. All cases had a full median sternotomy. Cardiopulmonary bypass and warm cardioplegia were used in all cases. The cross clamp was then applied and the heart arrested with warm blood antegrade cardioplegia every 20-30 minutes. Coronary artery bypass graft (CABG) surgery was performed as necessary. Left Ventricular Restoration was done using the Dor procedure [3]. The left ventricle is opened near the apex at least 1 cm lateral to the septum. The ventriculotomy was extended parallel to the left anterior descending artery. Delineation of the scarred and viable myocardium, with scar appearing white was done by both inspection and/or palpation of the ventricle. A Prolene suture is placed along the margin of the scar in circumferential or purse string fashion as described by Dor [3]. Ensure that the previous stitch was placed no deeper into the ventricle than the base of the papillary muscles. Put a purse string to anchor the endoventricular patch and reduce ventricular volume. A Dacron patch is then sewn to the ridge created by the purse-string suture with Prolene in a running fashion. Fold the ventriculotomy over the patch and close it with 2-0 Prolene. Be sure that there is no distortion of the patch . To avoid excessive resection, leaving too small residual volume, an intraventricular balloon; introduced by Dor [3] was filled to a volume of 60 mL/m^2 for preoperative left ventricular end-diastolic volume (LVEDV) < 150 mL/ m^2 or 70 mL/ m^2 for preoperative LVEDV > 150 mL/ m^2. It was removed before closure of the ventricle. Good homeostasis is done as our routine. Patients were then weaned off cardiopulmonary bypass with ionotropic agents and/or intra-aortic balloon pump (IABP). Trans-esophageal echocardiogram was used to assess the contractility, valves functions and ventricular size. Follow-up was done through out- patients clinic visits to either the attending cardiologist and/or the cardiac surgeon. The available data of these patients characteristics, intra-operative, post-operative data, Intensive care unit and hospital stay, complications and mortality were retrospectively reviewed and analyzed.

RESULTS

The retrospective analysis of data of 50 patients with DICM, low LVEF (<35%) and congestive heart failure (CHF) symptoms who had SVR in the setting of CABG surgery in the last 5 years (2006-2011) at our center revealed that all patients were males with mean age of 58±8 years. Thirty (60%) patients had diabetes mellitus and 35 patients (70%) had hypertension. The mean New York Heart Association Functional Class (NYHA-FC) was 3.3 ± 0.3, (table I). All patients had SVR in the setting of CABG surgery; only 2 (4%) patients had in addition surgical closure of small (3-5 mm) ischemic muscular ventricular septal defect (VSD). None of our patients had mitral valve repair or replacement. The other operative, postoperative data are shown in (table II).

Age (mean ± SD)	58± 8 years
Diabetes mellitus (%)	60%
Hypertension (%)	70%
Mean Left ventricular ejection fraction (LVEF %)	24±4%
Mean New York Heart Association-Functional Class	3.3 ± 0.3

Data are expressed as mean + SD, or percentage (%).

Table I. Study patients characteristics (50 patients)

Mean Cardiopulmonary bypass time	99±24 minutes
Mean aortic clamp time	68.2±10.3 minutes
Mean postoperative stay	7± 3 days
In-hospital mortality	None
Re-admission for congestive heart failure	None
Late mortality	2 patients (4%)

Data are expressed as mean + SD, or percentage (%).

Table II: study results

There was no operative or in-hospital mortality. There was a statistically significant improvement in LVEF and LV volume

indices. The mean LVEF was increased from 24±4 % to 46±6 % (p<0.02). Left ventricular end systolic volume index (LVESVI) was decreased from 108±70 to 68± 40 ml/m² (p<0.01), the left ventricular end diastolic volume index (LVEDVI) was decreased from 170± 40 to 118± 38 ml/ m² (p<0.01). Also the CHF symptoms were improved; the NYHA-FC was decreased from 3.3± 0.3 to 1.8±0.3 (p<0.02), (table III).

There was no sudden cardiac death, or readmissions for CHF. One patient died at 3 months of a stroke and one patient was missing at one year follow up and reported dead.

	Pre-operative	Post-operative	P- value
Mean LVEF	24±4%	46±6%	<0.02
Mean LVESVI	108±70 ml/m²	68± 40 ml/m²	<0.01
Mean LVEDVI	170± 40 ml/ m²	118± 38 ml/ m²	<0.01
Mean NYHA-FC	3.3± 0.3	1.8±0.3	<0.02

Abbreviations: LVEF = left ventricular ejection fraction. LVESVI = left ventricular end-systolic volume index. LVEDVI = left ventricular end-diastolic volume index. NYHA-FC = New York Heart Association-Functional Class. Significant P value <0.05.

Table III: comparison between preoperative and post-operative parameters

DISCUSSION

Ischemic dilated cardiomyopathy or LV aneurysm with symptoms of heart failure, angina and/or ventricular tachycardia (VT) are the main indications of left ventricular restoration. Restoration includes complete coronary revascularization to relieve ischemia, ventricular reconstruction to restore more physiological shape and volume to reduce LV wall stress and improve hemodynamic and, when necessary, endocardectomy and cryoablation to remove substrate for VT [4-6].

Surgical approaches have been designed to abort and reverse remodeling, diminish heart failure, and improve survival. Modified Dor Procedure achieves the following:

1. Relieves ischemia by coronary revascularization.
2. Diminishes ventricular volume.
3. Restores the ventricle to more normal geometry.
4. Further diminishes volume overload by mitral valve repair when appropriate [6].

We retrospectively reviewed the pre-operative, operative, post-operative and long term follow up data available for 50 male patients with DICM, low LVEF (<35%), CFH symptoms who had SVR in the setting of CABG surgery at our center; as this was a new starting procedure. Their mean age was 58±8 years. Thirty (60%) patients had diabetes mellitus and 35 patients (70%) had hypertension. The mean NYHA-FC was 3.3 ± 0.3. there was no operative or in-hospital mortality which could be explained by early diagnosis, proper anesthesia, cardiopulmonary bypass techniques, myocardial protection, peri-operative care, and absence of mitral valve repair or replacement during the procedures.

There was no sudden cardiac death or hospital re-admission for CHF which could be explained by the presence of a statistically significant improvement in LVEF and LV volume indices. The mean LVEF was increased from 24±4 % to 46±6 % (p<0.02). LVESVI was decreased from 108±70 to 68± 40 ml/ m² (p<0.01), LVEDVI was decreased from 170± 40 to 118± 38 ml/ m² (p<0.01). Also the CHF symptoms were improved; the NYHA-FC was decreased from 3.3± 0.3 to 1.8±0.3 (p<0.02). These improvement was maintained throughout the evaluation period.

One patient died at 3 months of a stroke and one patient was missing at one year follow up and reported dead; this low long term mortality (4%) could be similarly explained by a significant improvement in LVEF, LV volume indices and NYHA-FC.

The first consistent results using SVR were reported by Dor and co-authors. Similarly they showed that the procedure improves LV function, NYHA-FC, and survival by reducing ventricular volumes and increasing the LVEF. These results were observed not only in

patients with classic dyskinetic aneurysms, but also in those with dilated ischemic cardiomyopathy and severe LV dysfunction. [7-9].

A few years later the first international registry, the RESTORE Group (Reconstructive Endoventricular Surgery, returning Torsion Original Radius Elliptical shape to the left ventricle), confirmed the safety and the efficacy of SVR in 1,198 patients who underwent the procedure between 1998 and 2003 [5].

This study reported an improvement in EF from 29.6 ± 11.0% preoperatively to 39.5 ± 12.3% postoperatively (p < 0.001) and a decrease in LVESVI from 80.4 ± 51.4 ml/ m² preoperatively to 56.6 ± 34.3 ml/ m² postoperatively (p < 0.001), which are similar to our findings. Thirty-day mortality after SVR was 5.3%, with this value being higher among patients in whom mitral valve repair was performed along with SVR (8.7%), versus patients in whom no mitral valve procedure was required (4.0%, p < 0.001). The overall five-year survival was 68.6 ± 2.8%. After five years, 78% of patients were not readmitted to the hospital for CHF [5].

Mickleborough and colleagues [10] reported on 285 patients who underwent SVR by a single surgeon for class

III or IV heart failure, angina, or ventricular tachyarrhythmia during the period of 1983 to 2002. In addition to SVR, patients also concomitantly underwent CABG (93%), patch septoplasty (22%), arrhythmia ablation (41%), mitral repair (3%), and mitral replacement (3%). SVR was performed on the beating heart in 7% of patients. The authors reported hospital mortality of 2.8%; postoperative ejection fractions increased 10% ± 9% from 24% ± 11% ($p<0.000$) and symptom class in 140 patients improved 1.3 ± 1.1 functional class per patient. Patients were followed up for up to 19 years (mean, 63 ± 48 months), and overall actuarial survival was reported as 92%, 82%, and 62% at 1, 5, and 10 years, respectively.

The results reported by O'Neill and colleagues from the Cleveland Clinic [11] from 220 consecutive patients who underwent SVR. Seventeen percent of them had an implanted cardiac defibrillator (ICD); implanted in situ preoperatively, 49% had associated mitral valve surgery, and 7% required an IABP postoperatively. The 30-day mortality was 1% and survival at one, three, and five years was 92%, 90%, and 80%, respectively. They reported low in-hospital mortality similar to our result despite high incidence of mitral valve surgery which could be explained her by the protection provided by ICD inserted preoperatively in 17% of patients.

Sartipy and colleagues reported on 101 patients who underwent SVR using the Dor procedure at a single center for class III or IV heart failure, angina, and ventricular tachyarrhythmia during the period of 1994 to 2004 [12]. In addition to SVR, patients also concomitantly underwent CABG (98%), arrhythmia ablation (52%), and mitral valve procedure (29%). The authors reported early mortality (within 30 days of operation) was 7.9%; left ventricular ejection fraction increased from 27% ± 9.9% to 33% ± 9.3% postoperatively. Patients were followed up 4.4 ± 2.8 years, and overall actuarial survival was reported as 88%, 79%, and 65% at 1, 3, and 5 years, respectively.

LIMITATIONS

The small number of studied patients, the retrospective nature of the study and the lack of control groups. Together with the combination of SVR and CABG surgery which did not allow for evaluation of the specific role of each procedures are limitations to our work.

CONCLUSION

In our series we proved that patients who were given SVR with CABG surgery maintained an improvement in CHF-FC, LVEF, and reduction in LV size at long term follow up.

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Do We Still Need Temporary Pacing Wires After Coronary Artery Bypass Graft Surgery

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Background. **We routinely fix temporary epicardial pacemaker wires at the end of coronary artery bypass graft (CABG) procedures regardless the need for those. We had occasional troublesome bleeding from the fixing site which necessitated suture repair to stop the bleeding.**

Aim of the work **was to assess the actual need for temporary pacing wires in setting of isolated CABG surgery and its potential complications to weigh the benefit ratio of such practice.**

Methods. **This prospective observational study involved a total of 114 patients referred for CABG surgery in the period from December 2009 to January 2011. Fourteen patients were excluded because of CABG plus valve replacement surgery. A total of 100 patients had isolated CABG surgery and were observed prospectively during their hospital stay. A preoperative 12-lead electrocardiogram was used to identify conduction problems. Preoperative sinus bradycardia was not considered to be a preoperative arrhythmia as 82% of our patients were receiving beta blockers preoperatively. All patients had only ventricular pacing wires that were placed on the anterior or diaphragmatic surfaces of the right ventricle. Our anesthesia protocol is to start epinephrine infusion for all patients towards the end of CPB unless contraindicated or unless clinical judgment indicates a higher doses or additional inotropic agents are required. Postoperatively, all patients are evaluated individually to determine if pacing is required. This may include significant bradycardia and associated hemodynamic instability.**

Results. **The mean age of the studied population was 65.2±11.8 years, there was 88 male patients. 18% of patients had diabetes mellitus, 28% had hypertension, and 82% were receiving beta blockers. The mean LVEF was 45.1±16.4%. The mean CPB time was 99.1± 25.4 minutes, and the mean aortic cross clamp time was 68.2±10.3 minutes. 18% of patients had cardioversion in OR to resume sinus rhythm; it was resumed spontaneously in 82% of patient upon separation from CPB machine. Two patients had bleeding from the fixing site which necessitated suture repair to stop bleeding. None of our patients was in need for pacing to come off CPB machine. Fifteen patients received antiarrhythmic drugs on leaving OR for post operative ventricular tachycardia. Mean postoperative stay was 6.7±4.2 days. Two patients developed RBBB. Five percent of patients had postoperative AMI. Two patients died because of pump failure. Pacing in the post operative stay period was not needed for any patients.**

Conclusions. **The routine use of temporary pacing wires in setting of isolated CABG surgery has negligible role and rather has additional cost and potential for minor complications.**

Key Words: **Coronary artery bypass graft (CABG) surgery, pacing wires, arrhythmia, cardiac pacing.**

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We routinely fix temporary epicardial pacemaker wires at the end of coronary artery bypass graft (CABG) procedures regardless the need for those. Pacing wires have been used for atrial or ventricular pacing for bradyarrhythmias (1). We either fix those to the right ventricle using mounted needle on the wires or by

applying the uninsulated portion of the wire to the ventricular muscle using 4 or 5 zero prolene stitches.

We had occasional troublesome bleeding from the fixing site which necessitated suture repair to stop the bleeding. Upon literature review we came across cases of infection and chest wall sinus formation in the track of the wires (2). There are also cases of serious bleeding from injury to saphenous vein graft upon wire removal (3). Also there are reports of sustained ventricular tachycardia after wire removal (4). Diaphragmatic stimulation when putting one of the wires on the diaphragm can cause hiccups and pain (5).

Aim of the work

Looking at this policy we decided to assess the actual need for temporary pacing wires in setting of isolated CABG surgery and its potential complications to weigh the benefit ratio of such practice.

Patients and Methods

A total of 114 patients were referred to cardiothoracic department of Saudi German Hospital, Saudi Arabia for CABG surgery in the period from December 2009 to January 2011. Fourteen patients were excluded because of CABG plus valve replacement surgery.

A total of 100 patients had isolated CABG surgery and were observed prospectively during their hospital stay. A preoperative 12-lead electrocardiogram was used to identify conduction problems. Preoperative sinus bradycardia was not considered to be a preoperative arrhythmia as 82% of our patients were receiving beta blockers preoperatively.

Operative procedures

All patients underwent median sternotomy. Cardiopulmonary bypass (CPB) was carried out using nonpulsatile flow to achieve a mean arterial pressure of 60-80 mm Hg, continuous topical hypothermia and antegrade crystalloid cardioplegia were used.

All patients had only ventricular pacing wires that were placed on the anterior or diaphragmatic surfaces of the right ventricle.

Our anesthesia protocol is to start epinephrine infusion for all patients towards the end of CPB unless contraindicated or unless clinical judgment indicates a higher doses or additional inotropic agents are required.

Postoperatively, all patients are evaluated individually to determine if pacing is required. This may include significant bradycardia and associated hemodynamic instability.

Continuous variables are expressed as mean ± SD. Non continuous variables are expressed as percentage.

Results

The data of the study patients is summarized in table I. The mean age was 65.2±11.8 years, there was 88 male patients. Eighteen percent of patients had diabetes mellitus, 28% had hypertension, and 82% were receiving beta blockers. The mean left ventricular ejection fraction was 45.1±16.4%. The mean CPB time was 99.1± 25.4 minutes, and the mean aortic cross clamp time was 68.2±10.3 minutes. Eighteen percent of patients had cardioversion in operation room (OR) to resume sinus rhythm; sinus rhythm was resumed spontaneously in 82% of patient upon separation from CPB machine. Two patients had bleeding from the fixing site which necessitated suture repair to stop bleeding.

Age (mean ± SD)	65.2± 11.8 years
Sex (male/female)	88/12
Diabetes mellitus (%)	18%
Hypertension (%)	28%
Preoperative beta blockers (%)	82%
Mean Left ventricular ejection fraction (LVEF %)	45.1±16.4%
Prior myocardial infarction (MI) (%)	25%
Left main disease >50%	35%

Data are expressed as mean + SD, or percentage (%).

Table I. Study patients characteristics (100 patients)

Pacing in the post operative stay period was not needed for any patients; table II.

Inotropic on leaving operation room (OR) (%)	All patients
Pacing to come off cardiopulmonary bypass CPB (%)	None (0%)
Mean CPB time (minutes)	99.1±25.4 minutes
Mean aortic clamp time (minutes)	68.2±10.3 minutes
Cardioversion in OR (%)	18%
Antiarrhythmic drugs leaving OR (%)	15%
Pacing complications	2 patients had bleeding at fixation site
Post operative ECG changes	2 patients had right bundle branch block
Mean postoperative stay in days	6.7± 4.2 days
Postoperative MI (%)	5%
Mortality	2 patients
Use of temporary pacing	None (0%)

Data are expressed as mean + SD, or percentage (%). ECG = electrocardiogram.

Table II. Study results

None of our patients was in need for pacing to come off CPB machine. Fifteen patients received antiarrhythmic drugs on leaving OR for post operative ventricular tachycardia.

Mean postoperative stay was 6.7±4.2 days. Two patients developed permanent right bundle branch block. Five percent of patients had postoperative acute myocardial infarction. Two patients died because of pump failure.

Discussion

Each cardiac surgical center has its protocol of placing temporary epicardial pacing wires in isolated CABG patients. Standards of practice vary; some centers use primarily ventricular wires while others use both atrial and ventricular wires.

Our practice is to fix ventricular epicardial pacing wires. Temporary pacing wires have been used in perioperative period to improve patient hemodynamic.

To assess the actual need for temporary pacing wires in setting of isolated CABG surgery and its potential complication, we studied 100 patients (after excluding 14 patients) referred for isolated CABG surgery with mean age of 65.2± 11.8 years, there was 88 male patients. Eighteen percent of patients had diabetes mellitus, 28% had hypertension, and 82% were receiving beta blockers. The mean left ventricular ejection fraction was 45.1±16.4%. The mean CPB time was 99.1± 25.4 minutes, and the mean aortic cross clamp time was 68.2±10.3 minutes. Our patient characteristics are similar to patient populations studied before to assess value of routine pacing wires in setting of isolated CABG surgery (6,7).

Although 82% of our patients were receiving preoperative beta blockers and 18 % of patients had cardioversion to resume sinus rhythm upon weaning of CPB machine and 2 patients developed new permanent right bundle branch block (RBBB) postoperatively; none of them was in need for temporary pacing. This could be explained by our anesthesia protocol that uses routine epinephrine infusion for all patients towards the end of CPB unless contraindicated or unless clinical judgment indicates a higher doses or additional inotropic agents are required. This explanation was also raised by other investigators (6,7) who found that routine use of inotropic postoperatively could reduce the need for postoperative pacing in their patients population. Although these investigators reported that postoperative pacing was needed in 8.6% and 2.9% of their patients respectively. They found that preoperative arrhythmia (especially RBBB), pacing used to separate from CPB machine, and use of antiarrhythmic drugs leaving OR to be three most significant risk factors on multivariate analysis to predict the need for postoperative pacing. In our patients although 15% had antiarrhythmic drugs on leaving OR to treat ventricular tachycardia, and 2 patients had post operative RBBB; none of them was in need for postoperative pacing.

Mortality in our patients (2 patients) was not related to pacing as reported by others (6, 7). Only 2 patients had bleeding at site of fixing pacing wires intraoperatively and was secured by sutures which is considered minor complication. Although other investigators reported similar minor complications related to pacing (6,7); others reported more serious complications (2,3,4,5).

Study limitations

This study is limited by the small number of patients and by inherent design of observational studies as patients were not randomized to receive pacing wires.

Conclusions

The routine use of temporary pacing wires in setting of isolated CABG surgery has negligible role and rather has additional cost and potential for minor complications.

Recommendations

Large scale randomized trial is needed to identify high risk patients who may need post CABG surgery pacing to avoid unnecessary step of fixing pacing wires with its cost and potential complications.

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Sternotomy Approach for Modified Blalock-Taussig Shunt: Is It a Safe Option

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Background: **Central aorta-pulmonary artery shunts have fallen into disfavor because of shunt thrombosis and congestive heart failure, and a modified Blalock-Taussig shunt via thoracotomy can lead to pulmonary artery hypoplasia and disoion Since 1990 ,sternotomy has been the preferred approach for construction of MBT shunt especially in neonates ,and young infant .In this study . We reviewed the outcomes of a modified Blalock-Taussig shunt by a sternotomy approach**

***Methods*:** **In aretrospective non comparative study, fifty patients 25 males and 25 females had median sternotomy for modified Blalock- Tussing shunts. Their ages ranged from 2months to 9 months (mean of 6 months). Their weights ranged from 3 kg to 6kg (mean 4.5 kg).**

***Results*:** **Shunt failure occurred in 2l50 (4%)patients. The cause was occlusion of the shunt in two cases due to small graft size ,in which the graft was replaced by a larger size . Excessive shunt flow was reported in one case (2%), due to large size of the graft in relation to size of the PA .Re- exploration for bleeding was done in one patient .(2%) The early mortality rate was 2 l 50(4%) due to excessive shunt flow in one case, shunt occlusion in the other.**

***Conclusions*:** **The sternotomy route is technically easier , and is associated with few shunt failure. It provides better exposure to the surgeon.**

In the present era, primary correction is the preferred approach in the neonate or young infant with a cardiac anomaly and 2 ventricles. With only one functional ventricle or reduced pulmonary blood flow, an initial palliative systemic-to-pulmonary arterial shunt is mandatory. Our usual approach for construction of a right modified Blalock-Taussig (BT) shunt has been a right thoracotomy;[1] however, a number of disadvantages of this approach have become apparent. Dissection of the bifurcation of the right pulmonary artery (PA) and subsequent clamping during the anastomosis have resulted in a substantial incidence of distortion of the right PA just beyond the upper lobe takeoff, which is difficult to repair in subsequent procedures. Because the anastomosis is sited relatively more on the right PA, considerably more flow is directed into the right than the left PA, resulting in unbalanced PA development. Thoracotomy wounds in neonates who remained cyanotic because of the nature of their anomalies are more often complicated by delayed healing compared to sternotomy incisions. The onset of late scoliosis has been reported after thoracotomy incisions. Some reports have noted the development of chest wall-to-lung collaterals in patients with a previous thoracotomy.[2] Furthermore, there is a cosmetic disadvantage in using 2 incisions rather than a single sternotomy incision. Other problems include occasional phrenic nerve injury that can cause serious morbidity, and damage to the sympathetic nerves and ganglion, causing Horner's syndrome with cosmetic concerns. Experience with construction of a modified BT shunt through a sternotomy in first-stage palliation of hypoplastic left heart syndrome or for pulmonary atresia with intact ventricular septum suggested that this might be a better approach for the shunt procedure alone.[2] To determine the effect on morbidity and mortality of a median sternotomy approach for construction of a modified BT shunt, we reviewed the outcomes in 20 infants.

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Patient and Methods

Between January 2009 and December 2011 ,50 patient 24 (48%) males, 26 (52%) females who had complex cyanotic heart lesions underwent modified Blalock – taussing shunts at Abu ElRich and Egyptian child hospital through median sternotomy (table).

	Sternotomy
Tetralogy of fallot with small pulmonary artery branches	38
Transposition complex (TGA.VSD PS)	12
Single ventricle (DORV)	5
PULMONARY atresia with VSD	3
TRICUSPID ATRESIA	2

Their age ranged from 3 months to 8 months (mean of 5 .5months). Their weight ranged from 3 Kg to 8 Kg (mean 5.5 Kg)

Table 1. He diagnostic categories for ours patients

Surgical technique

Surgery, the patient was carefully positioned with the neck extended by a shoulder roll. Once the sternum has been vertically split and the thymus separated in the midline, the pericardium was opened in its cephalad portion, leaving it intact for a variable length near the diaphragmatic attachment for protection on resternotomy. The pericardium was suspended, and sharp dissection of the branch PA and the brachiocephalic artery and its branches was carried out. To enable smooth and unobstructed dissection of these vessels, the aorta was retracted to the other side, the superior caval vein was retracted laterally, and the right atrium was retracted inferiorly. A polytetrafluoroethylene (PTFE) graft of suitable diameter was selected (usually 3.5 mm for the average neonate, 4 mm for infants <5 kg, and 5 mm if >5 kg), and the proximal end was beveled. Heparin was routinely administered. A C-clamp was applied to proximal subclavian artery . An arteriotomy was donebon the inferior aspect, and anastomosis was done between the PTFE graft and proximal subclavian artery with continuous polin 7 \0. The graft was then passed underneath the innominate vein and cut to final length , C –clamp was applied to right pulmonary artery The PAwas opened longitudinally on its superior surface ,and distal anastomosis between PTFE graft and the PA completed .The clamp was released to allow back bleeding from thePA . Homeostasis was done . Before closure of wound in all cases blood gas analysis was done to test oxygen saturation. . The ductus arteriosus was ligated if patent; in cases of confluence or branch pulmonary origin stenosis, the shunt was placed before ligating the patent ductus arteriosus. The sternum was closed in the standard fashion.

All patients were admitted to the ICU after surgery ,blood pressure ,heart rate .and oxygen saturation monitoring was done .Routin blood gas analysis was done to detect early desaturation, or metabolic acidosis due to the low cardiac output .

An open shunt should result in adrop in ,diastolic blood pressure, increase in the pulse pressure , and increase in arterial oxygen saturation .the continuous flow murmur of the shunt could be heard over the infraclavicular region .if there is any doubt . immediate echcardiographic examination in ICU should be done.

Chest Xray was important to show if there was any pulmonary over flow dueto excessive shunt flow

The inotropic support (if was used in some cases) was withdrawn gradually ,according to the hemodynamic status ,and guided by the blood pressure , the central venous pressure oxygen saturation ,and peripheral temperature .Heoarin was started postoperatively after the chest tube drainage had decreased .then the patients received oral aspirin ,when they started oral feeding, and were discharged on oral aspirin (75mg daily).

RESULT

Shunt failure occurred in 2l50 (4%) patients. The cause was occlusion of the shunt in two cases due to small graft size in which the graft was replaced by alarger size. Excessive shunt flow was reported in two cases (4%)one of them was dueto large size of the graft in relation to the size of the PA. Re-exploration for bleeding was done in 3 patient (6%). The early mortality rate was 2l50 (4%) due to excessive shunt flow in one case, shunt occlusion in other.

DISCUSSION

Methods of palliating critical pulmonary oligemia in neonates and infants with complex cyanotic congenital heart disease continue to evolve. After its introduction in 1945, the BT shunt became the palliative procedure of choice for children with cyanotic congenital heart malformations.[2] Although the incidence of congestive heart failure and other postoperative complications was lower compared to other available central systemic-to-pulmonary shunts, several limitations were defined, including a lengthy surgical dissection time, differential PA blood flow, potential reduction in limb growth (ipsilateral to the anastomosis), and PA distortion.[3] PA distortion and other complications due to the use of native vessels to increase pulmonary blood flow has led to more frequent use of PTFE shunts either in a central position or as a modified BT shunt. Central aorta-PA shunts have largely fallen into disfavor because of unacceptably high incidences of complications such as shunt thrombosis, congestive heart failure, and PA distortion. The success of the shunt stems from its high patency rate, technical ease of creation and take-down, low operative mortality, and low complication rate.[4] The shunt should not supply excessive

pulmonary blood flow that might result in elevated pulmonary vascular resistance or impair ventricular performance secondary to excessive volume load. The shunt should not distort the PA, particularly distally, and it should encourage uniform PA growth and development.

Of the numerous options for a connection between the systemic and pulmonary circulations, the shunt that has been generally accepted as most likely to fulfill these criteria is the modification of the BT shunt in which a PTFE tube graft is inserted between the subclavian and pulmonary arteries.[6]

The preferred surgical approach as first described by de Leval and colleagues[6,7] was through a left thoracotomy with anastomosis to the left PA. However, in a child with a single ventricle, it is preferable to perform the anastomosis on the side opposite the superior vena cava, most commonly the left, for later conversion to a cavopulmonary shunt by an off-pump technique. There are several disadvantages of the thoracotomy approach. The more distal dissection along the right PA tree probably results in distal PA distortion, particularly beyond the takeoff of the right upper lobe. In contrast, a median sternotomy limits dissection to the right PA proximal to the right upper lobe takeoff. Any potential distortion from the distal anastomosis can be easily incorporated into a bidirectional Glenn shunt or Fontan anastomosis. Because the shunt is placed more centrally on the PA tree, flow distribution to the right and left lungs, barring non-confluence or distal stenoses, is more uniform. Amato and colleagues[6] used the sternotomy approach for central systemic-PA shunts and reported the absence of pulmonary vessel distortion in patients undergoing a central PTFE shunt in contrast to those who received classic and modified BT shunts. Furthermore, they observed more preferential flow to the side of construction, and subsequent uneven growth of the branch PA in patients undergoing classic and modified BT shunts.

We learned early in our experience that because the proximal anastomosis of the shunt is placed more proximal on the subclavian arterial system, and because the proximal anastomosis is technically better exposed and thus less likely to be narrowed by the suture technique, it is important to use a smaller size of graft than in the thoracotomy approach. Other considerations in determining the size of the graft selected include the presence of an additional source of pulmonary blood flow (pulmonary stenosis vs. pulmonary atresia) and an estimate of pulmonary vascular resistance. Although the sternotomy route for a modified BT shunt makes for a technically less demanding operation and has the cosmetic advantage of a single sternotomy incision, the need to undertake a resternotomy for subsequent complete correction, bidirectional cavopulmonary anastomosis or Fontan procedure, raises a theoretical disadvantage. The problems of injury to the heart or great vessels during reentry and prolonged operative time at subsequent reoperation were not observed. Evaluation of the patients in this series who went on to definitive repair revealed no serious disadvantage. There was no important difference in the subsequent hospital mortality[8]

Coupled with this change in surgical approach we also found that small shunt sizes are adequate for maintaining blood flow to the pulmonary circulation. The median sternotomy remains a less demanding operation for shunt construction, with greater control of the vessels and without the risk of lung compression and its attendant respiratory compromise. In small and sick neonates who may not tolerate lung compression through a thoracotomy, one is able to institute cardio-pulmonary bypass to complete the shunt. The complications rate is significantly lower in patients undergoing median sternotomy. Whether this is due to easier access through the sternotomy remains to be defined. The finding that the thoracotomy approach is associated with more complications has been noted by others who based their findings on a less homogenous group of patients spanning wider age and weight ranges.[9]

We advocate the sternotomy approach for a modified BT shunt in neonates and infants because it is technically easier to perform, cosmetically preferable, and perhaps hemodynamically superior. The hospital mortality rate is acceptable. Correction of any confluence or branch pulmonary stenosis is easily incorporated during this procedure. Our experience with reoperations suggests that the advantages of the sternotomy approach are not outweighed by the disadvantages of a subsequent resternotomy[10].

IN THE Thoracotomy approach , the patient is placed in lateral position on one side , which interferes with respiration through that lung ,while the other lung is being compressed to give the surgeon field to perform the anastmosis .This situation may result in drop in oxygen saturatuion during surgery (1)

There are some situation in which sternotomy approach is the first choice :

1- The surgeon may delay the decision to do a cavopulmonary anastmosis (which is more physiologic ,as it provides 30% of the cardiac output to the pulmonary circulation)or to do Ambt shunt (it supplies only 10% of cardiac output ,its main advantage is to augment the sie of the pulmonary artery branches).This applies to the following forms of pathology : (a) Cases of pulmonary atresia alone or if associated with tetralogy of Fallot,when surgeon couldn't get enough catheter data about the size of the PA,.(b) Patients of fallot atresia, and patients of TGA-VSD-PS who are ideal candidates for homografts, replacement ,but due to lack of homograft , they need MBT shunt or better a Glenn shunt according to the size of the pulmonary arteries.

2- In cases of pulmonary atresia ,the surgeon my be confronted with serious drop of oxygen saturation during surgery if it is done during thoracotmy after compressing the lung , and may need to start cardiopulmonary by pass .

3- When the dicision to do a total correction in tetralogy of Fallot cases a MBTshunt or palliative outflow patch in

cases with borderline Mc Goon ratio (1.5) according to size of pulmonary artery branches during surgery.

4- In addition, applying the vascular clamp on the pulmonary artery through thoracotomy may be hazardous, in cases of pulmonary atresia when there are big collaterals supplying the branches.

Sternotomy approach has the following advantages, better exposure ,less incidence of kinking of vessls ,. More over it provides equal blood flow to both lungs .However ,it had the disadvantage of excessive shunt flow if the anastmosis was done more proximally.

Conclusion

Modified Blalock tausing shunt is the most used type of shunts. It can be performed via thoracotomy or sternotomy incisions. Sternotomy approach facilitates the surgical technique and provides good cosmosis. It is especially indicated in neonates ,and when dicision is taken during surgery,whether to do aMBT shunt or cavopulmonary anastomosis.

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Early Outcome of Urgent Coronary Artery Bypass Grafting After Acute Coronary Syndrome

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Background: **Many patients with ACS may need urgent revascularization by percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG) due to continuing ischemia.**

Methods: **This study included 100 patients underwent coronary artery bypass grafting for acute coronary syndrome. Patients were divided into two groups according to the timing of surgery. The urgent group included 50 patients, and the elective group included 50 patients. The two groups were compared regarding preoperative, operative, and postoperative data.**

Results: **Hypertension, dyslipidemia, and smoking were significantly higher in the urgent group. The urgent group had a statistically significant higher heart failure score, angina score, and STS (society of thoracic surgeons) score. Left main disease was significantly more in the urgent group and ejection fraction was significantly higher in the elective group. Patient in the urgent group had a significantly longer ventilation time, larger amount of tube drainage, and larger number of blood products units used. The elective group had a significantly shorter intensive care unit (ICU) stay and total hospital stay. Postoperative complications did not show any statistically significant difference between both groups except the incidence of postoperative myocardial infarction which was significantly higher in the urgent group. No statistically significant difference could be detected between the two groups regarding mortality.**

Conclusion: **Patients undergoing urgent CABG have a significantly higher preoperative risk and a significantly worse early postoperative outcomes with a significantly higher chance of developing postoperative myocardial infarction. Postoperative mortality is expected to be higher in the urgent CABG patients but without a statistically significant difference between them and the elective patients.**

Acute coronary syndrome (ACS) is a leading cause of death and complications among patients suffering from coronary artery disease. Treatment of ACS patients has been significantly improved leading to the decrease of hospital and long-term mortality. Many patients with ACS may need urgent revascularization by percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG) due to continuing ischemia **(Montiero, 2006)**.

CABG offers a survival benefit when compared to medical treatment in patients with unstable angina and LV dysfunction, particularly in those with triple vessel disease. Also early CABG for acute myocardial infarction may be appropriate in patients with residual ongoing ischemia despite other types of therapy **(Eagle et al., 2005).**

Elective CABG refers to the patients whose cardiac function allowed them to be discharged from the hospital and readmitted at a later date. The procedure could be delayed without increasing the risk of compromised cardiac outcome. Urgent CABG refers to procedure required during the same hospitalization due to medical factors urging the patient to stay in hospital **(Luqman et al., 2009).**

The aim of this study is to identify the early clinical outcomes of urgent CABG after ACS compared to the elective procedures.

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Patients and Methods

This study was done in King Abdul-Aziz university hospital from July 2009 to July 2011. It included 100 patients underwent CABG for ACS. Patients were divided into two groups, the urgent group which included 50 patients underwent urgent CABG, and the elective group which included 50 patients underwent elective CABG.

Emergency CABG, including patient with cardiogenic shock, post resuscitation, and patients with mechanical complication of myocardial infarction are excluded from the study. Also patients with previous cardiac operations, off pump operations, or associated cardiac procedures were excluded from the study.

We used the definitions of society of thoracic surgeons (STS) for elective and urgent CABG **(Weiss et al., 2008)**. Elective CABG referred to the patient's cardiac function that has been stable in the days or weeks prior to the operation. The procedure could be deferred without increased risk of compromised cardiac outcome. Urgent CABG is a procedure required during the same hospitalization in order to minimize the chance of further clinical deterioration. Examples include worsening general condition, sudden chest pain, congestive heart failure, acute myocardial infarction, intra-aortic balloon pump, unstable angina with intravenous nitroglycerin or rest angina.

The two groups were compared regarding preoperative, operative, and postoperative data.

Results

This study included 100 patient, 50 patient in the elective group, and 50 patients in the urgent group. The indications of urgency included 7 patients with critical left main disease, 32 patients with persistent chest pain, 9 patients with combined critical left main disease and persistent chest pain, and 2 patients with failed coronary angioplasty. The mean time from the beginning of symptoms till the operation was 3.72±1.9 days in the urgent group and 22.02±7.7 days in the elective group.

Table 1 demonstrates demographics of all patients. Age was significantly lower in the urgent group. Hypertension, dyslipidemia, and smoking were significantly higher in the urgent group.

The preoperative data (table 2) showed that the elective group had a significantly higher incidence of unstable angina and non ST-segment myocardial infarction, and a significantly lower incidence of ST-segment myocardial infarction. The urgent group had a statistically significant higher heart failure score, angina score, and STS score with a statistically significant higher number of patients on vasodilators and inotropic support. Left main disease was significantly more in the urgent group and ejection fraction was significantly higher in the elective group. Wall motion score index (WMSI) was significantly higher in the urgent group.

Variable	Urgent n= 50	Elective n= 50	p-value
Age (years)	56.72±12.4	61.06±7.26	0.036
Female sex	14(28%)	12(24%)	0.41
Diabetes mellitus	32(64%)	28(56%)	0.27
Hypertension	37(74%)	27(54%)	0.03
Dyslipidemia	26(52%)	12(24%)	0.004
Obesity	6(12%)	7(14%)	0.48
Family history	16(32%)	11(22%)	0.184
Smoking	22(44%)	13(26%)	0.046
Chronic lung disease	7(14%)	4(8%)	0.262
Renal impairment	4(8%)	6(12%)	0.37
PVD	10(20%)	7(14%)	0.298
CVA	4(8%)	3(6%)	0.5

PVD=peripheral vascular disease; CVS=cerebrovascular accidents

Table 1. Demographic data of all patients

Bypass time and clamp time were significantly longer in the urgent group but the total operative time and the number of grafts used did not show any significant difference between both groups (table 3).

Postoperative data (table 4) demonstrates a significantly more patients in the urgent group needed inotropic support, vasodilators, and intra-aortic balloon pump. Patient in the urgent group had a significantly longer ventilation time, larger amount of tube drainage, and larger number of blood products units used. The elective group had a significantly shorter intensive care unit (ICU) stay and total hospital stay.

Postoperative complications (table 5) did not show any statistically significant difference between both groups except the incidence of postoperative myocardial infarction which was significantly higher in the urgent group. We had 7 mortalities (1 in the elective group and 6 in the urgent group). In the urgent group, 3 patients died of low cardiac output, 1 patient died from massive cerebral stroke, 1 patient died from septicemia, and 1 patient died from multiple organ failure. In the elective group, the only mortality was from low cardiac output. No significant difference could be detected between the two groups regarding mortality.

Variable		Urgent n= 50	Elective n= 50	p-value
Unstable Angina		9(18 %)	17(34%)	
Non ST-segment MI		14(28%)	28(56%)	0.001
ST-segment MI		27(54%)	5(10%)	
Heart failure class: III/IV		22(44%)	7(14%)	0.002
Angina class: III/IV		29(58%)	8(16%)	<0.001
Inotropic support		7 (14%)	0(0%)	0.006
Vasodilator		33(66%)	0(0%)	<0.001
IABP		3(6%)	0(0%)	0.121
Left main		21(42%)	4(8%)	<0.001
Left main equivalent		26(52%)	16(32%)	0.068
	1	0(0%)	2(4%)	
Diseased vessels	2	8(16%)	5(10%)	0.25
	3	42(84%)	43(86%)	
Ejection fraction %		47.28±10.37	56.06 ± 8.7	<.001
WMSI		1.22±0.24	1.12±0.14	0.013
	Mortality	9.63±5.56	1.57±0.79	
STS score	Mortality & morbidity	38.63±17.95	13.95±9.4	<0.001

MI=myocardial infarction; IABP=intra-aortic balloon pump; WMSI=wall motion score index; STS=society of thoracic surgeons.

Table 2. Preoperative clinical, angiographic, and echocardiographic data of all patients

Variable	Urgent n= 50	Elective n= 50	p-value
Numbers of grafts	3.16±.93	3.31±1.01	0.45
Bypass time (minutes)	142.98±45.04	106.58±52.01	0.003
Clamp time (minutes)	73.36±20.16	59.33±30	0.02
Operative time (minutes)	321.69±96.92	293.85±55.62	0.112

Table 3. Operative data

Variable	Urgent n= 50	Elective n= 50	p-value
Inotropic support	33(66%)	17(34%)	0.001
Vasodilator	38(76%)	24(48%)	0.004
IABP	7(14%)	1(2%)	0.029
Ventilation time (hours)	20.35±15.36	11.23±6.89	0.002
Tube drainage (ml)	1451.4± 587.6	1137.6±420.9	0.018
Blood units number	3.64±2.49	2.58±1.91	0.019
Plasma units number	7.44±3.13	4.92±3.57	< 0.001
ICU stay (hours)	105.76±70.3	53.69±37.1	< 0.001
Hospital stay (days)	15.32±9.3	8.68±3.27	< 0.001

IABP=intra-aortic balloon pump; ICU=intensive care unit.

Table 4. Postoperative data

Variable	Urgent n= 50	Elective n= 50	p-value
Myocardial infarction	7(14%)	1(2%)	0.025
Atrial Fibrillation	6(12%)	5(10%)	0.5
Pneumonia	2(4%)	1(2%)	0.5
ARDS	1(2%)	0(0%)	0.5
Pleural effusion	5(10%)	2(4%)	0.218
CVA	3(6%)	1(2%)	0.308
Renal impairment	7(14%)	7(14%)	1.0
Renal dialysis	4(8%)	1(2%)	0.181
GIT bleed	1(2%)	0(0%)	0.5
Exploration for bleeding	4(8%)	1(2%)	0.181
Mild wound infection	13(26%)	7(14%)	0.105
Deep wound infection	7(14%)	3(6%)	0.159
Sternal rewiring	4(8%)	2(4%)	0.5
Hospital readmission	5(10%)	2(4%)	0.218
Mortality	6(12%)	1(2%)	0.06

ARDS=acute respiratory distress syndrome; CVA=cerebrovascular accidents; GIT=gastrointestinal tract.

Table 5. Postoperative complications

Discussion

The outcome of CABG for ACS has improved significantly over the last few decades **(Chen et al., 2006).** Performing CABG during the same hospitalization for ACS seems to represent a short-term mortality benefit. This is particularly relevant, because these patients have worse risk factors, more coronary lesions, and increased hospital morbidity **(Montiero, 2006)**.

In our study, age was significantly lower in the urgent group (56.72±12.4 versus 61.06±7.26 years). This agrees with Brandrup-Wognsen et al (1995), Weiss et al (2008), and Parikh et al (2010) as they reported a lower age in patients with urgent CABG operations.

We found that hypertension, dyslipidemia, and smoking were significantly higher in the urgent group. These results were also recorded by Brandrup-Wognsen et al (1995) and Weiss et al (2008), but the contrary was recorded by Parikh et al (2010) as they found a lower incidence of diabetes, hypertension, dyslipidemia, and peripheral vascular disease in the urgent CABG patients.

Statistically significant more patients in the urgent group had left main disease (42% versus 8%). The same results were reported by Kim et al (2007), and Deyell et al (2010), as they reported a high incidence of left main disease in patient needed urgent surgery than the elective patients.

Preoperative ejection fraction was significantly lower in urgent group (47.28±10.37 versus 56.06 ± 8.7). Wall motion score index (WMSI) was also significantly higher in urgent group (1.22±0.24 versus 1.12±0.14). This may be because most patients in the urgent group had ST-segment elevation myocardial infarction and a significantly higher number of these patients needed preoperative vasodilators and inotropic support. This coincides with the results obtained by Abd-Alaal et al (2010) and Kim et al (2007).

Although the number of grafts did not show a significant difference between both groups, the bypass time and the clamp time were significantly longer in the urgent group. This may be attributed to the lower ejection fraction of the urgent group patients with difficulty to wean them from the cardiopulmonary bypass. Kim et al (2007) demonstrated a significantly longer total operative time, bypass time and the clamp time, while Abd-Alaal et al (2010) did not record a significant difference between both groups regarding the bypass time or the clamp time.

In our study, most postoperative parameters were significantly worse in the urgent group which is expected in this type of patients who had a significantly higher preoperative heart failure and angina classes and higher preoperative risk scores.

When looking at the postoperative complications and the early outcomes, no statistically significant difference could be detected between both groups except in the incidence of postoperative myocardial infarction which was significantly higher in the urgent group (14% versus 2%). These results were higher than that reported by Monteria et al (2006) (3.4%) and Kim et al (2007) (1.9%). This could be attributed to the higher preoperative risk in our patients.

Regarding mortality, it was higher in the urgent group (12% versus 2%) but did not reach a statistically significant level (p=0.06). Our results were higher than that recorded by Chen et al (2006) (3.3%), but lower than that recorded by Kim et al (2007) (17.3%). This variation could be attributed to the variable preoperative characteristics in each study.

Conclusion

Patients undergoing urgent CABG have a significantly higher preoperative risk and a significantly worse early postoperative outcomes with a significantly higher chance of developing postoperative myocardial infarction. Postoperative mortality is expected to be higher in the urgent CABG patients but without a statistically significant difference between them and the elective patients.

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AORTIC VALVE SPARING TECHNIQUES IN ASCENDING AORTIC ANEURYSM AND DISSECTION: IMMEDIATE AND EARLY RESULTS

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Background: **Valve-sparing aortic root replacement has been popularized as an alternative to aortic valve replacement in patients with aneurysmal disease or dissection involving the aortic root. It has the advantage of avoiding anticoagulation therapy required for mechanical valves and the possible reoperation related to prosthetic valve degeneration.**

Patients and methods: **50 consecutive patients with aortic root aneurysm and dissection associated with significant aortic regurgitation were operated upon using aortic valve re-implantation technique between 2008 & 2011 in the Departments of Cardiothoracic Surgery, Faculty of Medicine Cairo University. All patients were studied for aortic valve competence by comparing the preoperative, immediate post-operative, six months and one year follow-up echocardiographies**

Results: **The mean age of patients was 53.14±13.12. 22% of patients had dissection, and 34% of operations were emergent. The mean ischemic time was 164.34±18.6 min and the mean bypass time was 218.28±28.78 min. 8% of patients needed rexploration for bleeding. The mean hospital stay was 13.92±5.59 days. There was no aortic regurge at six months in 92% of patients , and at 12 months 88% of patients had no aortic regurge. In hospital mortality was 2%.**

Conclusion: **Valve sparing aortic root reimplantation is effective in correcting aortic insufficiency due to aortic root diseases with good results as regards durability of aortic repair. It had been popularized in the last decade over the classic root replacement (Bentall) procedure because preservation of the patient's native aortic valve allows for better hemodynamics, left ventricular performance, lesser risk of endocarditis and avoidance of lifelong anticoagulation.**

Replacing the aortic valve and root with a composite valve graft has been the mainstay of surgical treatment of aortic root abnormalities since the technique was introduced by Bentall and de Bono[1] in the 1960s.[2] Techniques for aortic valve-sparing root replacement were subsequently introduced by Yacoub in 1979 (remodeling)[3] and David in 1988 (re-implantation).[4]

Unlike aortic root replacement with a composite valve-conduit (Bentall), valve-sparing root replacement carries the theoretical benefits of avoiding anticoagulation therapy required for mechanical valves as well as possible reoperation due to prosthetic valve degeneration.[5]

The reimplantation method seems to be less likely to result in annular dilatation and ensures great freedom from recurrent aortic insufficiency, and as a consequence, greater freedom from reoperation in the long term[6] , also the resuspension of the aortic annulus and the attached cusps within a Dacron graft allows restoration of the subcommissural triangles to a more acute angle, thereby restoring valve competence and stabilizing the aortic annulus.[7]

Both the David and Yacoub techniques have similar midterm durability in acute type A aortic dissection repair. When compared with the Bentall procedure, neither technique compromises short-term or midterm survival after acute type A aortic dissection repair[8].

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Objective: This study is a trial to assess the short and intermediate term results of valve sparing aortic root reconstruction techniques as regards improvement of patient's functional status, left ventricular dimensions and functions, durability of competent aortic valve and to detect predictors of failure of aortic repair.

Patients and Methods

Study conduct: This prospective analytical study was conducted between 2008 & 2011 in the Departments of Cardiothoracic Surgery, Faculty of Medicine Cairo University.

Study population: 50 consecutive patients with aortic root aneurysm and dissection associated with significant aortic regurgitation were operated upon using aortic valve re-implantation technique and studied for aortic valve competence by comparing the preoperative, immediate post-operative, six months and one year follow-up echocardiographies.

Inclusion criteria: All patients with aortic root disease (type A acute aortic dissection or ascending aortic aneurysm >5 cm) and significant aortic insufficiency without organic changes in the aortic valve leaflets, regardless the aneurysm size, the left ventricular function.

Exclusion criteria

- Patients with organic valvular affection (rheumatic or active endocarditis).
- Patients with previous open heart surgeries (redo patients).
- Patients with recent preoperative myocardial infarction or cardiomyopathy.
- Patients with recent stroke or neurological deficit.

Every patient in the study group after being consented is subjected to the following scheme:

Preoperative Evaluation

History taking

- Demographic data as name, age, gender.
- Medical history of hypertension, diabetes, renal disorders, smoking, dyslipidemia, previous stroke or myocardial infarction

Clinical examination

- Complexion: for any marfanoid features
- Vital signs: blood pressure and pulses of upper and lower limbs for hypertension, big pulse volume, absent femoral pulses.
- Cardiac examination: for evidence of newly onset aortic regurgitation murmur
- Chest and neurological examination.
- Resting ECG: for heart rate and any associated ischemia or arrhythmias

Laboratory investigations

Complete blood count, liver and kidney functions, coagulation profile, lipid profile (total cholesterol, LDL, HDL, serum triglycerides), and inflammatory markers (ESR, CRP).

Radiological investigations: according to fixed scan regimen

- Chest x-ray
- Duplex of carotid and femoral arteries
- Contrast enhanced multislice CT of the thoracic aorta (for diameter of ascending, arch, and descending aorta) and coronary arteries to detect any associated coronary lesions.
- Magnetic resonance angiography was used for patients with renal impairment.
- Echcardiography (transthoracic and/or transesophageal) to assess:

1. Left ventricular dimensions and function: LVEDD, LVESD, EF.
2. Aortic valve morphology and degree of aortic incompetence (graded from 1 to 4 based on ratio of jet height to LVOT height).
3. Aortic root dimensions: Aortic annulus, Mid sinuses diameter, Sinu-tubular junction diameter, Ascending aortic diameter.

The commercially available echo-Doppler system is 2.5 mega/Hz transducer in 2D, M-mode, PW, and CF mapping studies using parasternal long axis and short axis and apical 4 chamber views.

Intraoperative Management

- Technique of aortic valve reimplantation.
- Mode of arterial cannulation: femoral artery or right axillary artery or distal ascending aorta.
- Cardio-pulmonary bypass data: total cross-clamp time, antegrade or retrograde cardioplegia
- Circulatory arrest data (if done): duration, antegrade or retrograde cerebral perfusion.
- Mode of coronary reimplantation: Bentall (direct button inclusion), Cabrol or modified Cabrol (by 8mm tube graft), or vein graft interposition.

- Intraoperative TEE data: degree of aortic regurge before and after repair, diameter of aortic annulus and ascending aorta.

Surgical Technique

The chest has been opened via a midline sternotomy and the pericardium incised. The aortic arch, including the origins of the supra-aortic vessels, is dissected to determine the extent of aortic replacement and to determine the cannulation site. Distal aortic arch, femoral arteries or right axillary artery are used for arterial cannulation, depending on the distal extent of aneurysmal disease; the right atrium is cannulated for venous drainage. A left ventricular vent catheter is inserted via the right superior pulmonary vein.

The aorta is cross-clamped inferior to the brachiocephalic trunk and transacted via a longitudinal incision extended towards the non-coronary sinus to allow for exploration of the aortic root. blood cardioplegia is used and administered directly into the coronary ostia. The infusion of cardioplegia is maintained throughout most of the procedure. Retrograde administration of cardioplegia via the coronary sinus may be used alternatively. The aortic valve is now inspected carefully. To achieve a good long-term result, the valve leaflets should not be overstretched. If the aortic valve does not seem suitable for reconstruction, the operation is continued as a composite replacement of valve and ascending aorta using the technique of Bentall and De Bono.

The aortic root is transsected subtotally at the level of the sino-tubular junction to allow for better exposure. Commissural stitches (Prolene 4/0, Ethicon) are placed for traction. These sutures will subsequently be used for fixation of the commissures within the vascular graft.

The aortic root is fully mobilized and dissected in the non-coronary perimeter, dissection proceeds to the insertion line of the atria, corresponding to that of the anterior mitral leaflet. The dissection is carried into the right and left coronary sinus.

The sinuses are excised, leaving approximately 5 mm of aortic wall superior to the insertion lines of the valve leaflets. The valve now resembles an aortic homograft prepared for free-hand insertion. Buttons of aortic wall are left around the coronary ostia with a rim of approximately 3 mm.

Mobilization of the aortic root is continued with improved visualization. Dissection is carried down to a horizontal line connecting the most inferior point of each sinus towards the right lateral aspect of the aortic root. Thus, in the commissure between the right coronary and non-coronary leaflets, the root is mobilized to the level of muscular septum and in the commissure between the left and non-coronary sinus to the insertion line of the anterior mitral leaflet. Only in the commissure between the right and left coronary leaflets does the dissection follow the insertion line of the valve. It is important to mobilize the right coronary sinus remnant to the most inferior point of valve insertion. Right ventricular muscle may adhere to the aortic wall and needs to be dissected to avoid asymmetry of the aortic root once the valve has been resuspended within the graft.

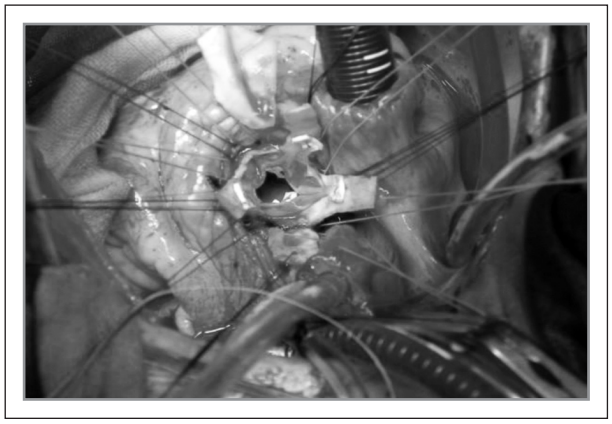
Horizontal mattress sutures (Ethibond 2-0, Ethicon) are placed along the plane of dissection (Fig.1). One suture is placed in the central portion of each sinus remnant. Towards the right lateral aspect, additional sutures are placed in a horizontal plane. In the commissure between the right coronary and noncoronary sinus, careful placement of these sutures in the transition zone between the muscular and membranous septum avoids damage to the bundle of His. Towards the commissure between the right and left coronary sinus the sutures follow the insertion of the valve leaflets.

The free height of all three aortic leaflets is measured. The size of the Dacron graft (Hemashield, Meadox Medical, Oakland, NJ) is estimated according to these measurements. 30-40% of leaflet height is considered adequate for coaptation. Thus, 60% to 70% of leaflet height will be the internal radius of the neo-aortic root to be reconstructed. The thickness of the aortic wall is taken into consideration also. If leaflet height is 22 mm, the neo-root will have an internal radius of 13 mm (60% of leaflet height). Adding 1 mm of radius for the thickness of the aortic wall, a 28 mm graft is chosen. It does not seem necessary to chose graft sizes of more than 30 mm in diameter.

The appropriated Dacron graft is prepared, It is cut to a length of 5 to 6 cm, which is sufficient for re-suspension of the aortic valve and facilitates the subsequent operative steps. The geometry of the valve is studied carefully. If the three leaflets are of approximately equal size, three markings at 120 degree angles are made on both ends of the graft. Corresponding to the commissure between the right and left coronary sinus, a triangle is excised to adjust the graft configuration to the geometry of the inferior suture line.

The mattress sutures placed previously are passed through the inferior rim of the Dacron graft, carefully maintaining the geometry of the aortic root. The commissural sutures are passed through the lumen of the graft. The aortic valve now comes to lie within the graft. The inferior sutures are tied anchoring the graft to the aorto-ventricular junction.

The aortic valve commissures are re-suspended within the graft (Fig. 2) using the commissural stitches that were placed earlier. Attention is paid towards maintaining the geometry of the valve using the markings made in the graft that was made earlier. It is of equal importance to maintain the relative height of the commissures. This is achieved by placing each commissure into the graft on similar tension while passing the suture transmurally through the graft. If the leaflets are of similar size, the commissures should lie in a horizontal plane. The valve is carefully inspected and checked for adequate coaptation. If necessary, the position of the commissures needs to be corrected at this point.



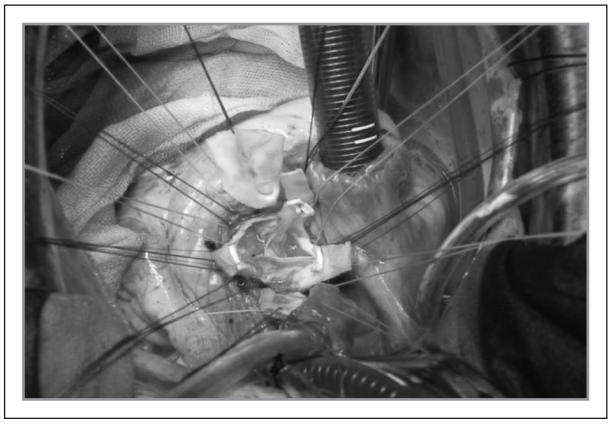


Fig 1. The sub-annular stitches arranged in horizontal mattress

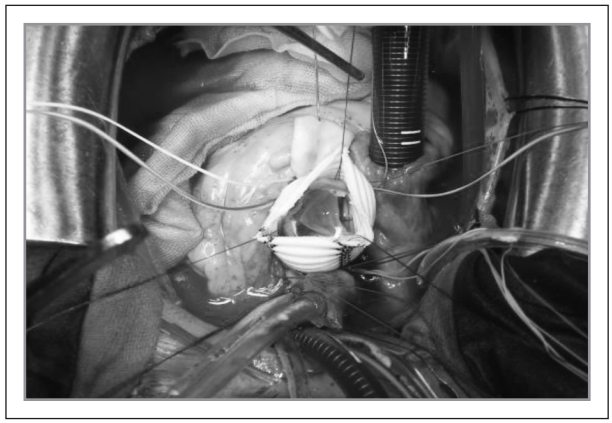


Fig 2. The three commissures are re-suspended using 4/0 prolone

The aortic wall remnants from which the cusps arise are now sutured to the graft using a continuous trans-mural running suture line. One suture (Prolene 4/0) is used for each sinus, starting at the lowest point and suturing towards the commissures. Careful placement of these sutures is important for subsequent haemostasis of the aortic root.

Once the latter suture lines have been finished and all sutures have been tied, the valve geometry is again inspected for symmetry and leaflet coaptation. The graft is filled with saline to assess valve competence. Occasionally, prolapse of one of the leaflets is encountered. This can he corrected by reducing the circumference of the free margin of the respective leaflet. A mattress suture (Prolene *6/0)* buttressed with a pericardial pledget is used for aortic valve reconstruction.

Both the right and left coronary ostia are re-implanted to the graft (by prolone 5/0). Care is taken to place the sutures along the rim of the coronary ostia, thus effectively excluding the diseased aortic wall. Using this technique, we have not observed recurrent aneurysm formation at the site of coronary implantation.

If aortic ectasia extends to the distal ascending aorta or aortic arch, or in the presence of dissection, a second graft is anastomosed to the appropriate level of the distal aorta.

For arch surgery, hypothermic circulatory arrest, with or without retrograde cerebral perfusion, is used. In acute type I dissection, the false arch lumen is obliterated using GRF glue. In chronic dissection, this may be achieved by including an externally placed strip of Teflon felt into the distal anastomosis. Partial replacement of the arch is performed. The second graft can be clamped and extracorporeal circulation resumed in standard fashion. The two grafts are shortened to the appropriate length and are anastomosed. The heart is deaired and coronary circulation is resumed.

Postoperative Follow Up

- Data of post operative course:
- Duration of ICU stay, total hospital stay, mechanical ventilation mode and time, inotropic support, and blood transfusion.
- Postoperative complications: Reexploration for bleeding, arrythmias and heart block, wound infection.
- Data of echocardiography: aortic valve competence and left ventricular function.
  - Early post operative (within first month)
  - After six months
  - After one year
  - NYHA Functional class clinical improvement.

Statistical Analysis

Data of the study was of both quantitative and qualitative types.

Pre and post operative clinical and echo data will be compared, tabulated, and statistically analyzed.

Results were expressed as means ± standard deviation (SD) or number (%).

Comparison between preoperative and postoperative data of different echographic parameters of the studied patients was performed using paired student t test.

Comparison between categorical data was performed using Chi square test.

The data were considered significant if p values was ≤ 0.05 and highly significant if p< 0.01 **(Riffenburyh, 2006)**.

- Data was statistically analyzed using SPSS (statistical package for social science) program version 13 for windows for all the analysis.
- A p value <0.05 was considered statistically significant.

Data are shown as mean, range or value and 95% confidence interval (95% CI) and frequency and percent

Results

The study included 50 patients which had re-implantation technique with different aortic root pathologies: The patients were subdivided in two groups:

- Group I: 39 patients with aortic aneurysm.
- Group II: 11 patients with acute type A aortic dissection

Of the 50 patients, 32 male and 18 female, 5 patients with Marfan syndrome and 5 patients with bicuspid aortic valve.

I. Preoperative Data

Characteristics	Patient group (n= 50)
Age (yrs)	
Range	16-74
Mean ± SD	53.14 ± 13.12
Sex	
Female/Male	18/32 (36/64%)
Diagnosis	
Aneurysm	39 (78%)
Dissection	11 (22%)
Timing of operative intervention	
Emergency	17 (34%)
Elective	33 (66%)

Table1. Demographic features of the studied patients

(a) Age: Range from 16-74 years. The average age 53.14±13.12.

(b) Sex: 32 male and 18 female. In the aneurysm group 24 male and 15 female in the dissection group 8 male and 3 female.

(c) Pathology:

a. 11 patients with type A acute aortic dissection.
b. 39 patients with ascending aortic aneurysm:
   i. 18 cases due to chronic dissection.
   ii. 10 cases with atherosclerotic aneurysm.
   iii. 7 cases with degenerative aneurysms.
   iv. 4 aneurysms due to vasculitis (aortitis).
c. From the 50 patients, 5 patients had Marfan syndrome and 5 patients had bicuspid aortic valve.

(d) Clinical and laboratory data:

a. All patients were hypertensive on medical treatment.
b. 8 patients were diabetic, 12 patients dyslipidemic.
c. 30 patients were smokers.
d. 8 patients had renal impairment (preoperative creatinine >2).
e. 3 patients presented with acute lower limb ischemia (all in the dissection group).

(e) Preoperative echo and MSCT data:

	Aneurysm group	Dissection group
ED	6.28 ± 0.72	5.4 ± 0.5
ES	4.31 ± 0.54	3.9 ± 0.4
EF	58.24 ± 5.82	60.00 ± 3.4
AI grade II	10/39	6/11
AI grade III	29/39	5/11
Aortic root diameter	5.6 ± 0.65	4.5 ± 0.5

Table 2. Preoperative echo and MSCT data

II. Operative Data:

Characteristics	Number	Percent
Mode of coronary implantation		
CABROL	21	42.0%
Direct	29	58.0%
Arterial cannulation		
Arch	9	18.00%
Femoral	32	64.00%
Right axillary	9	18.00%
Cross clamp time (min.)		
Range	120-198	--
Mean ± SD	164.34 ± 18.60	--
Cardiopulmonary bypass (min.)		
Range	180-260	--
Mean ± SD	218.28 ± 28.78	--
Total operative time	300±28	
Circulatory arrest time	**25**±13	
Graft diameter	**30±4**	

Table 3. Operative data of the studied patients

III. Postoperative Data

Characteristics	Number and Percent
• ICU stay (hours)	75 ± 9.1 hours
• Hospital stay (days)	13.92 ± 5.59 days
• Mechanical ventilation (hours)	11 ± 3.2 hours
• Inotropic support (dose of adrenaline)	0.07 ± 0.04 mg/Kg/min
• Blood loss in the first 24 hours	1250 ± 400 cc
• Re-exploration for bleeding	4 (8%)
• Transfusion requirements:	
- Packed RBCs (units)	4.3 ± 1.8 units
- Fresh frozen plasma (units)	8.5 ± 4.9 units
- Platelets (units)	6.6 ± 2 units
• In-hospital mortality	1 (2%)

Table 4. Postoperative data in the studied patients

Longer ICU stay and total hospital stay are observed in the dissection group as well as more blood loss and transfusion requirements.

Postoperative complications

(a) No postoperative renal or neurological complications.

(b) Re-exploration for bleeding in 4 patients (8%).

(c) Postoperative arrythmias: in 10 patients (7 AF, 3 SVT).

(d) Valve failure: 2 patients needed intra-operative Bentall conversion due to severe aortic regurge by TEE.

(e) 30 days mortality: 1 patient (2%) due to multiple organ dysfunctions.

(f) Wound infection: 3 patients (6%).

(g) No late mortality at one year follow-up.

IV. Echocardiographic Features

Characteristics	Preoperative (n= 50)	Postoperative at 1 month (n= 50)	Postoperative at 12 month (n=50)	*p*-value
ED	6.28 ± 0.72	5.42 ± 0.51	5.3 ± 0.4	0.001**
ES	4.31 ± 0.54	3.86 ± 0.52	3.6 ± 0.4	0.001**
EF	58.24 ± 5.82	59.54 ± 4.97	60.9 ± 2.4	0.158 NS
AR				
0	0 (0%)	45 (90%)	43 (86%)	
2+	16 (32%)	4 (8%)	6 (12%)	0.001**
3+	34 (68%)	0 (0%)	0 (0%)	

Data are expressed as mean ± standard deviation or number (%).
*NS= p> 0.05= not significant. **p< 0.01= highly significant.*

Table 5. Comparison between echocardiographic findings measured pre and post surgical operation of the studied patients

Discussion

The development of aortic valve-sparing operations to treat patients with aortic root aneurysms captured the interest of cardiac surgeons because of the well known limitations of prosthetic aortic valves and the general view that heart valve repair is usually better for the patient than heart valve replacement. Moreover, many patients with aortic root aneurysm have surgery because of dilation of the aortic sinuses rather than aortic insufficiency[9].

Valve sparing aortic root reconstruction had been popularized in the last decades over the classic root replacement (Bentall) procedure because preservation of the patient's native aortic valve allows for better hemodynamics, left ventricular performance, lesser risk of endocarditis and avoidance of lifelong anticoagulation[10].

In our study we have one case of in-hospital mortality in a 71 years old male presented with acute type A aortic dissection complicated by severe aortic regurge, renal impairment and acute lower limb ischemia. Patient underwent emergency surgery for replacement of the ascending aorta and reimplantation of the aortic valve. The patient had a stormy post operative course which ended in multiple organ dysfunctions and death on the 9th post operative day. This result constitute 2% of all our study population and about 9% of the acute type A dissection cases which is comparable with the early results of David and colleagues[9], who reported 3 in-hospital mortality in their series which contained 220 patients, and that of Subramanian and colleagues[8], who reported a 15% in-hospital mortality in patients with acute type A aortic dissection underwent aortic reconstructive surgery using the reimplantation technique.

Intraoperative conversion to the Bentall procedure was required in 2 patients due to presence of significant aortic incompetence by TEE done before complete weaning of the cardiopulmonary bypass, the incompetence was due to cusp prolapse that could not be managed otherwise. Oka and colleagues[11], presented 3 cases of Intraoperative conversion to the Bentall procedure in their series which consist of 101 patients underwent valve-sparing aortic root replacement using the reimplantation technique also due to marked leaflet prolapse.

Remodeling of the aortic root is a simpler and physiologically sounder operation than reimplantation of the aortic valve because it recreates the aortic sinuses and sinotubular junction and allows for near-normal aortic annulus and cusp motion[12]. Sizing of the graft for remodeling of the aortic root is relatively simple because it is based on the diameter of the sinotubular junction, which is not difficult to estimate in patients with normal aortic cusps[13].However, we believe that most patients with aortic root aneurysm, particularly those with the Marfan syndrome, eventually will have annuloaortic ectasia, and as

the annulus dilates, aortic regurge occures[14,15]. Fixation of the fibrous tissue beneath the aortic annulus with a band of Dacron did not prevent dilation of the aortic annulus after remodeling of the aortic root in patients with the Marfan syndrome[14]. In addition, in the study done by David and colleagues[9], remodeling of the aortic root was associated with a higher risk of late aortic incompetence than reimplantation of the aortic valve. Therefore, they stated that, reimplantation provided more stable valve function than remodeling did during the first 10 years of follow-up in patients with aortic root aneurysm.

Preoperative echocardiography in our study revealed that 16 patient(32%) had 2+ AR while 34 patients(68%) had 3+ AR. Echocardiography done during the first postoperative month showed that none of our patient had 3+ AR , 4 patients(8%) had 2+ AR, two of them were Marfan patient and one had bicuspid valve.

At one year follow-up, echocardiography showed another 2 patients who developed 2+ AR (one of them was Marfan patient), the 4 patients who were diagnosed in the previous study as 2+ AR remained so with no further deterioration, and 43 patients (86%) had competent aortic valve. None of our patients required reoperation for significant aortic incompetence during the follow up period.

A study from Hannover, Germany, recently reported the ten-year results of 126 patients who underwent aortic-valve sparing reimplantation surgery. The study included 21 patients (16.7%) with acute ascending aortic dissection, 4 patients (3.2%) with chronic type B aortic dissection, 26 patients (20.6%) with Marfan syndrome and 5 patients (4.0%) with bicuspid aortic valve. The indication for surgery was the pathology of the ascending aorta with aortic valve insufficiency. Aortic valve-sparing root replacement was considered if the aortic valve was undamaged and free of sclerosis and calcification. The median age was 66 (range 17-83) years.

The 30 day mortality was 4.8% (6 patients). 4 of these were acute ascending aortic dissections, 1 had a combined aortic arch aneurysm repair and coronary artery disease, and 1 had an aortic arch aneurysm with type B aortic dissection. The freedom from valve replacement at 1, 5 and 10 years was 96%, 91% and 87% respectively. 40% of re-operated patients had Marfan syndrome. In those who did not have re-operation, 89.5% had none or mild aortic regurgitation, and 9.2% had moderate aortic regurgitation. 47.4% were in NHYA class I, 43.4% in NHYA class II and 6.6% in NYHA class III[16] .

The long-term result of this study is good considering that it includes the learning curve of the surgeons performing it. The absence of any strokes or major bleeding is a clear advantage over composite valved-conduits, whether biological or mechanical. In their discussion, the authors acknowledge the technical complexity and longer duration of the operation and suggest that patients above 65 years of age may do better with a composite biological valved-conduit, which is easier and faster to perform, and which may have a similar durability in this age group. The authors also acknowledge that performing valve sparing root replacement in acute aortic dissections is controversial. Its use in Marfan syndrome is also cautioned with the authors stating that careful intraoperative inspection of the valve is important and those with significant cusp prolapse or morphological changes in the texture of the valve may do better with a Bentall procedure.

Excellent results were reported in another recent study from Toronto, Canada, which looked at 289 patients who underwent aortic-valve sparing root replacement (228 reimplantations, 61 remodellings). Freedom from re-operation at 12 years was 94.3% among all patients, 90.4% after remodelling and 97.4% after reimplantation (p=0.09). Freedom from moderate or severe aortic regurgitation at 12 years was 86.8% among all patients, 82.6% after remodelling and 91.0% after reimplantation (p=0.035). Survival at 1 and 12 years was 96.8% and 82.9% respectively. The survival of patients without aortic dissection who underwent reimplantation valve-sparing root replacement was similar to that of the general population matched for age and sex (91.8% for reimplantation vs 90.5% for the general population). The authors in this study advise that aortic-valve sparing root replacement should only be performed if the valve leaflets are normal and not excessively thinned, overstretched, fenestrated or prolapsing, and the key to long term success is the level and area of leaflet cusp coaptation achieved at the end of the operation[17].

Aortic valve-sparing root replacement may be advantageous over composite mechanical valved conduits in younger patients less than 65 years of age to avoid the need for life-long anticoagulation and associated bleeding risks, and thrombo-embolic complications. Excellent results can be obtained in centres with expertise in it. A higher but acceptable re-intervention rate can be expected in Marfan syndrome particularly with the remodelling technique[18].

Conclusion

Valve sparing aortic root reimplantation (Tirone-David technique) is effective in correcting aortic insufficiency due to aortic root diseases with good results as regards durability of aortic repair. It had been popularized in the last decade over the classic root replacement (Bentall) procedure because preservation of the patient's native aortic valve allows for better hemodynamics, left ventricular performance, lesser risk of endocarditis and avoidance of lifelong anticoagulation.

Special considerations are required for patients with bicuspid aortic valve and Marfan syndrome.

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Does previous Percutaneous Coronary Stenting Compromise Results of Subsequent Surgical CABG?

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Background: **During the last decade, Percutaneous Coronary Intervention (PCI) or Percutaneous Transluminal Coronary Angioplasty (PTCA) has undergone enormous advancements in techniques used to achieve coronary revascularization. However, PTCA is not a unified approach that suits all patient types, and hence personalization of the indications and steps is mandatory. Herewith, we assessed the impact of patient and procedural characteristics on patients in whom PTCA results failed & was followed by surgical CABG versus those who underwent CABG from the start in order to understand the causal relationship between these patient subsets over early and 2-years mid-term follow-up.**

Patients and Methods: **This prospective comparative analytic study was conducted between 2004 & 2011 in the Departments of Cardiothoracic Surgery and Cardiology of Faculty of Medicine Cairo University, El Mouwasat Hospital (KSA) as well as the Medical International Center (KSA) after obtaining the approval of the local ethical committees. Hundred patients who presented with critical coronary ischemia for which they were admitted for surgical CABG with or without previous PTCA were enrolled. Patients were allocated in 2 groups of equal number and matching preoperative risk factors. Group A contained 50 patients in whom only Surgical CABG was performed after only diagnostic angiocatheterization. Group B contained 50 patients in whom Surgical CABG was done following previous attempts for coronary revascularization by PCI (PTCA). Time lapse before urgent surgery (hrs) in group B patients ranged between 2.5 and 5 hours with mean of 3 ± 0.3 hours. Successful preoperative CPR was done in group B patients in 3 patients (6 %). All patients received mid-term postoperative follow-up over the first 2 years by regular clinical examination and recommended investigations.**

Results: **In group B, the total operative time, CPB time, and aortic cross clamp time were markedly prolonged compared to group A with high statistical significance. Intraoperative weaning off-CPB was more smooth using less support by catecholamine inotropics and IABCP in group A patients. In group A, there was a single mortality (2%) due to CHF in an uncontrolled DM 69-years old lady; versus 5 patients (10 %) in group B which occurred due to AMI with low CO ending by CHF on IABCP in 3 patients (6%); and permanent neurological deficit leading to coma then death in 2 patients (4%), who sustained cardiac arrest during PTCA and were resuscitated before urgent surgical revascularization. Morbidity complications occurred in 9 (18 %) of group B patients; versus only 2 (4%) in group A ($p < 0.01$). A favorable postoperative functional outcome occurred in both groups being more profound in group A patients as regards the clinical improvement (mean NYHA clinical Class & mean LVEF %). Patients of group A returned earlier to productive work within mean time of 28 ± 2.2 days; versus 50 ± 1.6 days for group B ($p < 0.001$). New ischemic pain requiring intensifying the medical therapy was detected in a single patient (2%) in group A; versus 6 patients (12%) in group B ($p < 0.001$). Mean postoperative LVEF (%) was 66 ± 5 in group A patients; versus 52 ± 0.2 in group B ($p < 0.03$). Mean postoperative NYHA class was 1 ± 0.2 for group A; versus 2 ± 0.7 in group B ($p < 0.05$). Multivariate analysis revealed that the independent predictors of risk for surgical CABG during in-hospital stay and 2 years postoperative follow-up were: age > 65 years,**

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female gender, body surface area ≤ 1.5, uncontrolled DM, Cleveland score >5, stent implantation, Preoperative delay, preoperative hemodynamic compromise (LVEF% < 40 %), prolonged aortic occlusion (ischemic) time; and use of arterial conduits. Predictors of the highest risk with the highest statistical impact were: previous stent implantation, preoperative delay of surgery, Cleveland score > 5, and preoperative hemodynamic compromise

Conclusion: **In view of our study results we concluded that the recent trend of insistence on performing initial PTCA stenting for all CAD patients as a fixed treatment step is ill-founded and is associated with higher mid-term mortality and morbidity. However, the question of whether a causal relationship can explain worse surgical outcomes after stenting still needs to be addressed by more greater-number comparative prospective analytic studies of multicenter distribution.**

KEY WORDS AND ABBREVIATIONS: **CABG: Coronary Artery Bypass Grafting PTCA: Percutaneous Transluminal Coronary Angioplasty IABCP: Intraaortic Balloon Counter pulsation PCI: Percutaneous Coronary Intervention PO: Postoperative MI: Myocardial Infarction LVEF%: Left ventricular ejection fraction % Statistical Significance was detected if P < 0.05**

In 1977, Gruntzig 1st. introduced Percutaneous Transluminal Coronary Angioplasty (PTCA). Since then, interventional cardiologists have had a growing role in treatment of atherosclerotic coronary artery stenosis [1]. Following this, the cardiologist-cardiac surgeon inter-relationship has changed with the lapse of time. In old times of acquiring experience in PTCA, cardiac surgeons were kindly requested by their peer cardiologists to form backup or standby teams in order to provide rescue coronary revascularization for patients in whom percutaneous coronary intervention (PCI) or Percutaneous Transluminal Coronary Angioplasty (PTCA) was unsuccessful in restoring coronary flow or when there was a procedural complication of PCI (eg, abrupt closure, dissection, cardiac tamponade) [2].

Over the past decade, however, there have been profound changes in PCI techniques, pharmacology, and device technology [3]. These changes encouraged the adoption of newer indications for more aggressive and sophisticated procedures; including new coronary stents (1994 to 1997) [4],[5]; glycoprotein IIb/IIIa agents (1997 to 2000) [6],[8]; and upfront and loading clopidogrel (2001 to 2004) [9],[10]. With time technology furtherly advanced, in parallel with the possible risks to PCI-treated patients [11].

Due to this ongoing trend, indications for PTCA have been continuously extended and new groups of patients presented for PTCA. The value of PTCA has even been demonstrated in patients with multivessel disease [12],[13] and with acute myocardial infarction [14]. Thus, there are obviously opposing trends, with improved PTCA performance on one hand and an increase in severity of coronary artery disease and general morbidity on the other hand.

Quite recently, PTCA was declared as the standard revascularization procedure in the setting of acute myocardial infarction (MI), and is increasingly being attempted in patients with significant age, co-morbidity, and high-risk multi-vessel coronary anatomy [15]. In contrast, other groups reported that during the first half of the 1990s, the frequency of MI after PTCA ranged between 1.0% and 4.9%, 0.3% and 1.0% for death, and 0.7% and 3.0% for emergency CABG [16],[17]. Acute and long-term outcomes of patients after emergency CABG for failed PTCA have been published in several reports; all of them were based on data from the pre-stent era. Larger series included between 91 and 346 patients who underwent emergency CABG [18-22] with a perioperative mortality between 1.4% [18] and 19% [20].

Similar to other groups [20-23], we used data from The Society of Thoracic Surgeons (STS) National Cardiac Surgery Database to look at how the use of emergent CABG after PCI has changed since 1994. We also looked to see trends in the risk profiles of these emergency patients and their outcomes after surgery. [23].

Objective: The purpose of this evaluation was to assess the impact of patient characteristics and procedural performance on perioperative outcome of patients undergoing emergency CABG after PTCA, in order to understand the relation between these factors and early-to-mid-term outcome following surgical CABG.

Patients and Methods

Study conduct: This prospective comparative analytic study was conducted between 2004 & 2011 in the Departments of Cardiothoracic Surgery and Cardiology of Faculty of Medicine Cairo University, El Mouwasat Hospital (KSA) as well as the Medical International Center (KSA) after obtaining the approval of the local ethical committees.

Study population: Hundred patients who presented with critical coronary ischemia for which they were admitted for surgical CABG either with or without previous PTCA were enrolled. Patients were allocated in 2 groups of equal number and matching preoperative risk factors age, gender, morphology, size, location, number, NYHA class, LV function (EF %). There were no statistically-significant difference between both groups in either cardiac or non-cardiac factors (P=NS) **(Tables 1&2)**.

Inclusion Criteria: critical coronary ischemia (Ischemic Heart Disease IHD) for which they were admitted for surgical CABG after previous PTCA. Diagnosis was according to Clinical Examination; Lab Investigations; Diagnostic Angiocatheterization; and Thallium Studies.

Exclusion Criteria: Patients who had associated serious valvular disease; or decompensated cardiac contractility.

Study groups

- ***Group A (Surgical CABG Directly):*** Contained 50 patients in whom only Surgical CABG was performed after diagnostic angiocatheterization.
- ***Group B (PTCA then Surgical CABG):*** Contained 50 patients in whom Surgical CABG was done following previous attempt(s) for PTCA coronary revascularization.

Definitions of Core-Data Elements (STS registry's definition (http://www.sts.org.)(24)

(**1**) ***Limiting (Unstable) Angina***: Patients undergoing either stenting or surgical bypass were assumed to have had limiting angina at least six weeks before the procedure, hence incurring a disutility that is correctable by surgery according to thallium studies.

(2) MI: Requires 2/3 criteria: (1) ischemic symptoms ± chest discomfort; (2) enzyme level elevation—1 of 4 are necessary (Creatine PK-MB > 10 % of CK or > 2 times upper limit of normal, creatine kinase >2 times upper limit of normal, lactate dehydrogenase LDH-1 > LDH-2 & Troponin T or I > MI decision limit for facility; or (3) serial (2 or more) ECG showing changes from baseline or serially in ST-T waveforms or new Q-waves.

(**2**) ***Left ventricular ejection fraction (LVEF%)***: assessed according to pre-PTCA angiogram & classified as "normal" if = 60%; "mildly reduced" if from 50-59%; "moderately reduced" if 40-49%; &"severely reduced" if ≤ 40%.

(3) Patients requiring emergency CABG: Those with ongoing, refractory unrelenting cardiac compromise ± hemodynamic instability, not responsive to any form of therapy except cardiac surgery.

Variable	**Group A** (n=50) (Surgical CABG Directly)	**Group B** (n=50) (Surgical CABG after PTCA)	p Value
Patient Number:	**50**	**50**	0.12*
Age (years)			
- Mean	54 ± 0.2	57± 0.1	0.34*
- Range	37 - 66	42 – 64	-
Female sex %	23 (46%)	21 (42%)	0.33*
Body Surface Area [mean/m2]	1.67 ± 0.02	1.72 ± 0.06	0.35 *
+ve Family history of IHD	14 (28%)	17 (34%)	0.51*
Duration of angina episodes (months)			
- Mean	35 ± 0.5	39 ± 0.2	0.43*
- Range	1–233	2–199	0.11*
Previous MI	18 (36%)	15 (30%)	0.53*
Unstable angina before PTCA	35 (70%)	38 (76 %)	0.44 *
Mild MR	7 (14%)	10 (20%)	0.34*
Diabetes Mellitus	20 (40%)	17 (34%)	0.67*
History of Cigarette smoking	36 (72%)	42 (84%)	0.14*
Hypertension	34 (68%)	39 (78%)	0.45*
Dyslipidemia	27 (54%)	33 (66%)	0.66*
Trunkal Obesity	42 (84%)	47 (94%)	0.78*
Previous Cerebral stroke	11(22%)	9 (18%)	0.88*
COPD	5 (10%)	8 (16%)	0.44*
Peripheral vascular disease	4 (8%)	6 (12%)	0.22*
LV Ejection Fraction %			
- Mean	49 ± 0.9	52 ± 0.2	0.33*
- Range	40 - 56	37 – 59	-

*IHD: Ischemic Heart Disease; MI: Myocardial Infarction NS: not significant PTCA: Percutaneous Transluminal Coronary Angioplasty COPD: Chronic Obstructive Pulmonary Disease MR: Mitral Regurge Values are expressed in mean ± SD *: Data is not statistically-significant*

Table 1. Preoperative Patient Characteristics

Variable	Group A (n=50) (Surgical CABG Directly)	Group B (n=50) (Surgical CABG after PTCA)	p Value
Distribution of the Coronary occlusive lesion:			
* ***Left Coronary artery***	**50 (100%)**	**50 (100%)**	0.22*
- Left main artery		5 (10 %)	0.34*
- Left anterior descending artery	50 (100 %)	50 (100 %)	0.55*
- Left circumflex artery	26 (52 %)	22 (44 %)	0.12*
- Diagonal artery	6 (12 %)	7 (14 %)	0.45*
- Intermediate Trunk	4 (8 %)	3 (6 %)	0.33*
* ***Right coronary artery***	**33 (66 %)**	**27 (54%)**	**0.44***
- Main trunk	13 (26 %)	15 (30 %)	0.14*
- Posterior descending branch	20 (40%)	12 (24 %)	0.61*
* **Coronary systems grafted**			
One		28 (56%)	0.76*
Two		22 (44%)	0.37*
- Stent implantations (number &%)	-	50 (100%)	0.22*
- Successful Preoperative CPR #	-	3 (6 %)	-
- Time lapse before urgent surgery (hrs)			
- Mean	elective	3 ± 0.3	-
- Range	elective	2.5 – 5	-

*#: Successful Preoperative CPR for cardiac arrest *: Data is not statistically-significant*

Table 2. Preoperative Angiocath Data

(**4**) ***Operative mortality:*** Death occurring during hospitalization in which surgery took place within 30 days.

(**5**) ***Clinical findings associated with PTCA failure:*** included persistent chest pain; ongoing ischemia including rest angina despite maximal medical therapy; electrocardiograph (ECG) changes of evolving MI within 24 hours following PTCA; unstable arrhythmias; persistent hypotension or shock (needing circulatory support); or cardiac arrest; pulmonary edema requiring ETT; signs of mitral valve dysfunction; aortic dissection; or technical angiographic accident. Successful preoperative CPR was performed in 2 (4 %) of group B patients.

(6) ***Emergency CABG after failed PTCA***: Revascularization (by angioplasty or coronary bypass grafting) of all major coronary arteries with stenosis ≥ 50%.

(7) ***Incomplete revascularization***: If at least one major coronary artery was left having a residual stenosis > 50% without successful angioplasty or bypass grafting.

Study End Points (by complications): Operative mortality - Reoperation for any reason – Return of ischemic pain - Prolonged ventilation (pulmonary insufficiency requiring ventilatory support for 48 hours - Permanent Stroke (new-onset cerebrovascular accident persisting >72 hours) - Deep Sternal Wound Infection - Renal Failure - Prolonged Postoperative Stay (discharge >14 days after surgery). All complications refer to events that occurred prior to discharge during the same hospitalization as surgery.

Revascularization Techniques used

(1) PTCA Revascularization Procedures

Coronary angioplasty was performed following the standard techniques of Judkins or Sones. Each patient received 1 g acetylsalicylic acid intravenously and at least 7,500 units of heparin at the beginning of the procedure. Intracoronary nitrates were regularly and repeatedly administered. All PTCAs were performed with in-house cardiovascular surgical backup. Rapid surgical support in the catheter laboratory was provided within a reasonable time. The operating theater of the Department of Cardiothoracic Surgery was informed and fully-prepared before each PTCA procedure. All data recorded during PTCA were analyzed with regard to the type of catheters, number

of inflations, any stents inserted, peri-procedural problems (eg, need for CCU management), and time delays (eg, from initial onset of a problem to surgery). Angiographies of the PTCA patients who underwent subsequent emergency CABG were evaluated in a blinded manner by a well-experienced cardiologist for the type and nature of the stenosis and the angiographic problem thought to have led to emergency surgery.

(2) Surgical revascularization (standard CABG)

In group A surgical revascularization was electively-planned and performed from the start as standardly-mentioned in the literature. In group B, it was done after PTCA was declared unsuccessful. In all patients, a midline sternotomy was started followed by aortic root and common atrial cannulation to institute cardiopulmonary bypass. Distal anastomoses are done on a silent heart obtained by intermittent blood-enriched cardioplegia with a full dose before each distal anastomosis is done. A warm K-free dose of blood (Hot Shot) is finally-given in the aortic root after LIMA-LAD anastomosis is secured patent. After regaining of myocardial contractility,proximal anastomoses were done on a beating heart aided by side-occlusion clamp. For weak contractility, a left femoral artery cannula was inserted after induction of anaesthesia to be ready for institution of intraaortic balloon counter pulsation (IABCP).

Follow-up: All patients received mid-term postoperative follow-up over first 2 years by regular clinical examination and recommended investigations. Questions focused on patient's actual physical abilities and recurrence of angina pectoris or exercise-related SOB (dyspnea). Answers were classified in accordance with the grading of the NYHA Classification. In addition, patients were asked for occurrence of myocardial infarctions or subsequent need for diagnostic or interventional procedures (re-angiography, re-PTCA, or re-CABG).

Statistical Analysis

All statistical tests were performed with SPSS 9.0. for licensed Windows. Univariate analyses were made using Student's unpaired t test for continuous variables (displayed as mean ± SD), cross-tables with the x2 test for dichotomous variables, and the Mann-Whitney rank sum test for categorical variables. Analyses for predictors of death during follow-up were performed with Kaplan-Meier models and the log rank test. Statistic significance was assumed if a p value of 0.05 or less was achieved. Multivariable analyses were performed by logistic regression test. The variables used for multivariable analyses were: age, body surface area, Cleveland score, gender, number of distal anastomotic points, LVEF%, number of diseased coronary vessels, stent implantation, aortic occlusion time; and use of arterial conduits.

Results

Operative Data: In group B, the total operative time, cardiopulmonary bypass (CPB) time, and aortic cross clamp times were prolonged (with statistical significance) compared to group A. Intraoperative weaning off-CPB was smoother needing less DC shocks, inotropic support and IABP in group A patients also with statistical significance (**Table 3**).

Variable	Group A (n=50) (Surgical CABG Directly)	Group B (n=50) (Surgical CABG after PTCA)	p Value
Total Operative Time (minutes)			
- Mean	**180 ± 8**	**266 ± 14**	**< 0.05**
- Range	**120 – 220**	**177- 310**	**-**
Cardiopulmonary bypass time (minutes)			
- Mean	**101 ± 5**	**130 ± 6.2**	**< 0.04**
- Range	**80 - 140**	**91 – 153**	**-**
Ischemic Time (minutes)			
- Mean	**57 ± 2.2**	**72 ± 6.2**	**< 0.03**
- Range	**44 – 71**	**63 – 102**	**-**
Mean Number of Distal Anastomoses	**2.01 ± 0.51**	**1.23 ± 0.41**	**< 0.05**
Regaining of Cardiac contractility & Weaning Off-Bypass:			
- Spontaneous after Hot shot	**27 (54 %)**	**20 (40 %)**	**< 0.05**
- Spontaneous + DC Shock	**13 (26 %)**	**15 (30 %)**	**0.25***
- DC Shock + inotropics	**9 (18 %)**	**10 (20 %)**	**0.55***
- Need for IABCP	**1 (2%)**	**5 (10 %)**	**< 0.03**

**: Data is not statistically-significant*

Table 3. Operative Data

Follow-up during the postoperative course: Group B patients needed longer times on mechanical ventilation, inotropic support, ICU and hospital stay. **Tables (4) & (5)**.

Postoperative patient outcome:

Mortality and Morbidity:

In group A, there was a single mortality (2%) due to CHF in an uncontrolled DM 69-years old lady; versus 5 patients (10 %) in group B which occurred due to AMI with low CO ending by CHF on IABCP in 3 patients (6%); and permanent neurological deficit leading to coma then death in 2 patients (4%), who sustained cardiac arrest during PTCA and were resuscitated before urgent surgical revascularization. Morbidity complications occurred in 9 (18 %) of group B patients; versus only 2 (4 %) in group A ($p < 0.01$).

Variable	**Group A** (n=50) **(Surgical CABG Directly)**	**Group B** (n=50) **(Surgical CABG after PTCA)**	**p Value**
Mechanical ventilation time (Hours)			
- Mean	7 ± 1.2	17 ± 4.2	< 0.03
- Range	(5 - 11)	(12-28)	-
Catecholamines Inotropic Support Time (Hours)			
- Mean	12 ± 4.5	37 ± 5.2	< 0.001
- Range	(9 - 17)	(22 – 58)	-
ICU Stay time (mean in hours)	38 ± 4.5	72 ± 15.5	< 0.02
Hospital Stay Time (mean in days)	7 ± 1.5	18 ± 2.1	< 0.04

*Times are expressed as mean duration in minutes **: value is statistically-non-significant*

Table 4. Postoperative in-Hospital Data

Variable	**Group A** (n=50) **(Surgical CABG Directly)**	**Group B** (n=50) **(Surgical CABG after PTCA)**	**p Value**
In-hospital Mortality:	**1 (2%)**	**5 (10 %)**	-
- AMI/Low CO/CHF on IABCP	1 (2%)	3 (6%)	< 0.04
- Permanent neurologic injury (Coma)	-	2 (4%)	-
Morbidity:	**2 (4 %)**	**9 (18 %)**	**< 0.01**
-Prolonged Mechanical Ventilation*	1 (2 %)	2 (4 %)	< 0.05
-Transient renal insufficiency*	-	1 (2 %)	-
- AF until discharge	-	1 (2%)	-
- Reopening for hemostasis	-	3 (6 %)	-
- Wound sepsis	1 (2 %)	1 (2 %)	0.34*
- LV tachycardia requiring cardioversion	-	1 (2%)	0.55*
Functional Outcome (2 years PO):			
Time before returning to Work (mean/ days)	28 ± 2.2	50 ± 1.6	< 0.001
New ischemic pain (intense medical therapy)	1 (2%)	6 (12%)	< 0.001
Mean LVEF (%)	66 ± 5	52 ± 0.2	< 0.03
Mean NYHA class	**1** ± 0.2	2 ± 0.7	< 0.05

*PO: Postoperative LV:Left ventricle MI: Myocardial Infarction CO: Cardiac Output CHF: Congestive heart failure IABCP: Intraaortic Balloon Counterpulsation CHF: Congestive Heart Failure *: requiring dialysis*

Table 5. Postoperative Patient Outcome

Functional outcome over 2 years postoperatively:

A favorable postoperative functional outcome occurred in both groups being more profound in group A patients as regards the clinical improvement (mean NYHA clinical Class & mean LVEF%). Patients of group A returned earlier to productive work within mean time of 28 ± 2.2 days; versus 50 ± 1.6 days for group B ($p < 0.001$). New ischemic pain requesting intensive medical therapy was detected in a single patient (2%) in group A; versus 6 patients (12%) in group B ($p < 0.001$). Mean LVEF (%) was 66 ± 5 in group A patients; versus 52 ± 0.2 in group B ($p < 0.03$). Mean NYHA class was 1 ± 0.2 for group A; versus 2 ± 0.7 in group B ($p < 0.05$) **(Table 5)**.

Multivariate analysis revealed that the independent predictors of risk for surgical CABG during in-hospital stay and 2 years postoperative follow-up were: age > 65 years, female gender, body surface area ≤ 1.5, uncontrolled DM, Cleveland score >5, stent implantation, Preoperative delay, preoperative hemodynamic compromise (LVEF% < 40 %), prolonged aortic occlusion (ischemic) time; and use of arterial conduits. Predictors of the highest risk with the highest statistical impact were: previous stent implantation, preoperative delay of surgery, Cleveland score > 5, and preoperative hemodynamic compromise **(Table 6)**.

Variable	OR	95 % CI	p Value
Age > 65	2.03	1.10 - 3.77	0.01
Female Gender	4.34	1.11 - 4.65	0.02
BSA ≤ 1.5	3.05	1.27 – 7.19	0.02
Uncontrolled DM			
Cleveland Score > 5	6.31	1.24 - 32.21	0.004
Stent Implantation	4.25	1.38 - 25.11	0.001
Preop delay	1.02	1.02 - 1.05	0.002
Preop Hemodynamic compromise	2.02	1.20 – 3.56	0.003
Prolonged ischemic time	3.32	1.24 – 1.34	0.03
Use of arterial conduits	1.24	1.11 – 4.54	0.05

Preop: Preoperative Preoperative Hemodynamic compromise = Low CO + LVEF% < 40 OR: Odds Ratio CI: Confidence Interval*

Table 6. Independent predictors of success of surgical CABG

Discussion

Many cardiological centers nowadays consider that emergency CABG after failure of PTCA is scarcely required. For justifying this statement, they reported incidence of emergency CABG following failure of PTCA ranging between 0.32 and 7% [26-32]. They added that although worse outcomes after coronary stenting have previously been reported [33], the lower incidence rate of failed PTCA is nowadays attributed to the increased operator experience in PTCA techniques and intracoronary stent usage [29-32].

Several hypotheses having either medical or surgical backgrounds were postulated as a possible explanation to how initial PTCA-stenting impacts the outcome of subsequent surgical CABG, and many of them merit concern. Surgical groups[34-41], admitted that usually they do not prefer to revascularize post-PTCA patients for many reasons. The first reason is that in-stent re-stenosis is usually followed by a higher risk of early venous graft failure after future CABG surgery[34,35]. The second reason is that presence of intracoronary stents usually forces the surgeon to implant the grafts more distally, hence revascularizing terminal branches only and causing recurrence of angina pain shortly thereafter [36-38]. The third reason is that preoperative antiplatelets, needed to ensure proper post-PTCA stent patency, may cause excess postoperative bleeding after CABG surgery [38-41]. The difficult issue is that stopping this medication has been related to in-stent thrombosis even in patients undergoing beating heart surgery without cardiopulmonary bypass [35],[36]. Another issue of concern is the pathophysiological response occurring in response to implanted stents (which are intravascular foreign bodies). Adverse surgical outcomes may occur following PTCA-stenting as they may cause prolonged endothelial dysfunction in the form of a local inflammatory response leading to persistent radial mechanical strain, and vessel wall rupture [37-39].

The results of our study, provides data clues conforming with the surgical groups [22-27,34-37]. All commenting on previously-mentioned reasons emphasizing on the imperative need to make a rational choice for initial revascularization strategy. Many of them declared preoperative PTCA to cause more hazards during subsequent surgical CABG. Conforming with their statements, our results showed that the operative times (total operative, CPB, and ischemic times) were longer (showing statistical significance) in the post-PTCA patient group. These patients showed initial critical hemodynamics that needed time to be stabilized. A longer time was also consumed in dissecting the more-distal coronary branch. Despite meticulous epicardial dissection, fewer distal anastomoses (1.23 ± 0.41 points versus 2.01 ± 0.51 in elective CABG) were achieved due to the technical difficulty of implanting on a thinner distal coronary branch. Eventually, more time had to be spent to secure adequate hemostasis after graft implantation. The latter task seemed exceptionally-difficult in light of the inability to stop preoperative antiplatelet mediacations before

surgery. Moreover, intraoperative weaning off-CPB was difficult in the post-PTCA group and needed a longer time span for re-circulation and "hot-shot" potassium-free cardioplegia. DC Shocks were needed in more of group B patients 15 patient (30 %) versus only 13 patients of group A (26 %). For hemodynamic stability, high inotropic doses were needed in 10 the PTCA patient group (20 %); versus 9 patients (18 %) in the elective group. IABCP support was needed in more of group B (5 patients, 10 %) versus only 1 patient (2%) in the elective group ($p < 0.03$).

In our opinion, the "more-distal" implantation of the grafted conduit, was responsible for reducing the magnitude of clinical improvement following CABG in the post-PTCA (group B patients) compared to elective surgery. This was reflected postoperatively by the longer mechanical ventilation time, the higher inotropic support, ICU and hospital stay times; mean NYHA clinical Class; mean LVEF%; and time span before returning to work. Patients of group A returned earlier to productive work within mean time of 28 ± 2.2 days; versus 50 ± 1.6 days for group B ($p < 0.001$). Mean LVEF (%) was 66 ± 5 in group A patients; versus 52 ± 0.2 in group B ($p < 0.03$). Mean NYHA class was 1 ± 0.2 for group A; versus 2 ± 0.7 in group B ($p < 0.05$). Another important indicator was the reemergence of a new ischemic pain requesting intensive medical therapy in 6 patients (12%) of the PTCA group; versus only a single patient (2%) in group A ($p < 0.001$).

On the other hand, cardiologists [16-22], argue by stating that worse surgical outcomes after PTCA-stenting are artefacts caused by the natural progression of the atherosclerotic disease process in itself. They reported that re-intervention in these patients is not a consequence of previous coronary stenting[23-26]. They added that no wide-scale meta-analyses or even observational studies with cardiothoracic surgery data-bases gave retrospective data concerning future outcome of post-PTCA surgical revascularization demonstrating a causal relationship between PTCA-stenting and worse outcomes after bypass surgery.

To add more solidity to their opinion, a study was done in 2006 by Thielmann and colleagues [33], explained furtherly that if CAD patients were well-matched for their preoperative demographic data, general risk factors, co-morbidity parameters, and angiographic characteristics, a significantly higher number of patients with the highest stent burden had hypertension and hyperlipidemia, received aspirin and statins, suffered more often from MI, and had more often been treated with thrombolysis. This suggested that these patients were really more-risky candidates for surgical intervention, perhaps because they suffered from more aggressive coronary disease, independent of the effects of stenting. Our study results were in disagreement with that opinion as despite proper preoperative matching, our post-PTCA patients still experienced worse outcomes after surgery.

It was found that certain implications for practice when patients amenable to surgical revascularization are initially revascularized with coronary stenting rather than CABG point towards the fact that they are being denied an optimum long-term management [36-38]. In addition to exposing these patients to the increased mortality and morbidity associated with stenting which by-itself can pose fatal complications as intrapericardial bleeding and death [15-17]. Our results demonstrated that a significant percent of patients who subsequently underwent surgical bypass after PTCA-stenting developed worse mid-term outcomes compared to those patients initially revascularized with CABG.

Due to the world-wide trend calling for limiting any procedure's financial concerns, it has previously been suggested that patients may prefer to opt for an initial stenting (which costs averagely less than standard surgery) especially when they know that the option of coronary bypass is available later; even when angina symptoms return again [41]. However, this can be argued by the dire need to ensure the availability and the precise timing of offering surgical bypass in combination with percutaneous intervention which is – in our opinion – of paramount importance.

Multivariate analysis revealed that the independent predictors of risk for surgical CABG during in-hospital stay and 2 years postoperative follow-up were: age > 65 years, female gender, body surface area ≤ 1.5, uncontrolled DM, Cleveland score >5, stent implantation, Preoperative delay, preoperative hemodynamic compromise (LVEF% < 40 %), prolonged aortic occlusion (ischemic) time; and use of arterial conduits. Predictors of the highest risk with the highest statistical impact were: previous stent implantation, preoperative delay of surgery, Cleveland score > 5, and preoperative hemodynamic compromise. Our findings matched well and stood in line with those reported by other surgical groups who favored prompt initial surgical revascularization from the start [40-47].

By demonstrating the higher morbidity and mortality rates of CABG following PTCA which was also reported by other groups [10-20], a final word of caution must be said to emphasize that stenting of patients who ultimately may need CABG, such as younger patients or diabetic patients, not only denies them definitive management but will also result in worse mid or even long-term outcomes. It is for these reasons that we should reform the system of preoperative obtaining of the fully-informed patient consent as well as the patient referral mechanisms. A great deal of evidence makes us suspect whether or not in our community adequate information is routinely and properly given to patients undergoing revascularization after multidisciplinary discussion or on an evidence-based informational data. Other surgeons expressed similar suspecting fears [42-47].

Conclusion

In view of our study results we concluded that the recent trend of insistence on performing initial PTCA stenting for all CAD patients as a fixed treatment step is ill-founded and is associated with higher mid-term mortality and morbidity. However, the question of whether a causal relationship can explain worse surgical outcomes after stenting still needs to be addressed by more greater-number comparative prospective analytic studies of multicenter distribution.

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Blunt Chest Trauma; Early Results in a single Saudi Centre

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Introduction and Aim of the Work: **Traffic accidents, falls, kicks, collapse under weight, occupational, large animal activity accidents and blast injuries are the main causes of chest trauma. The clinical status of the patient, momentum of the trauma, age, more than two rib fractures, flail chest, subcutaneous emphysema and possible intra-thoracic injury help in making the decision for hospitalization. The risk of mortality due to chest trauma is related to the presence of more than two rib fractures, age older than 60 years and an Injury Severity Score (ISS) greater than or equal to 16. The ability to identify those patients having significantly higher risk for morbidity and mortality ensures the establishment of treatment priorities and efficient management of existing injuries.(1) This is a retrospective study of a single centre in Hail; KSA that serves more than 1 million of people.**

Key words: **blunt chest trauma.**

Patients and Methods: Retrospective analysis of the files of our cases that have been admitted in our centre due to blunt chest trauma between December 2005-January 2009 was done. It includes 300 cases admitted in our hospital in Hail; KSA due to blunt chest trauma. The demographic data of the patients, type of trauma, site of trauma, associated injuries, general condition of the patient, management done and follow up of the survivors are presented and analyzed.

Results: **Three Hundred patients were admitted in our department for blunt chest trauma. Two hundreds and 30 were males. The median age was 32 years and ranged between 1 year and 84 years. Only 85 cases were Saudi. Lone chest trauma was diagnosed in 84 patients. Thoracotomy was done in 49 cases. Two hundreds and 80 survived. Twelve cases died intra-operatively and 8 died in the postoperative period.**

Conclusion: **The general condition during admission is the most important predictor of survival of cases of blunt chest trauma.**

Thoracic trauma comprises 10–15% of trauma and is the cause of death in 25% of death due to trauma. (2-3)

Blunt chest trauma causes the following injuries; pneumothorax in 28.8%, haemothorax in 24.1%, fracture ribs 3 or less in 23.9%, haemo-pneumothorax in 11.1%, fracture ribs more than 3 in 2.9%, pulmonary contusions in 2.4%, pulmonary lacerations in 2%, diaphragmatic rupture in 1.8%, flail chest in 1.7%, fracture clavicle in 1.5% and fracture sternum in 0.7%.(4)

Age, haemopneumothorax and mechanical support had no demonstrable impact on mortality in cases of chest trauma. ISS was found to be the only strong predictor of death after blunt chest trauma. Adequate oxygenation, carbon dioxide clearance and normal blood gases' values without ventilatory support along with the maintenance of pulmonary and tracheal hygiene, systematic analgesia and the management of associated injuries improve the outcome. **(3)**

The aim of this study is to review our experience in the presentation and management of cases of blunt chest trauma admitted to our centre in Hail; KSA during a period of more than 4 years.

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Patients and Methods

Retrospective analysis of the files of all the cases that have been admitted in our centre due to blunt chest trauma in more than 4 years between December 2005 and May 2010 was done. It includes 300 cases of significant blunt chest trauma that needed to be admitted and some of them needed to be operated upon in our centre for thoracic and or extra-thoracic injuries. Once the patients present in the emergency room, triage is done. The ER team follows the ABC's (Airway, Breathing, and Circulation) during the primary survey. During initial examination, potentially life-threatening conditions such as tension pneumothorax are treated. The presence of severe chest trauma may mandate endotracheal intubation. A second survey is then performed as well as insertion of appropriate intravenous line. These patients require evaluation and imaging for potential neurologic, intra-abdominal, vascular or extremity trauma. The presence of distended neck veins, tracheal deviation, subcutaneous emphysema, chest wall instability, absent breath sounds or muffled heart sounds are alarming signs for us. Vital signs are monitored specially the respiratory function and arterial saturation. An arterial blood gas should be sent with the initial laboratory studies, an electrocardiogram and a portable chest radiograph (CXR) should be obtained. A portable CXR yields rapid information about the pleural space including pneumothorax or haemothorax, which may require tube thoracostomy. A Focused Abdominal Sonography for Trauma (FAST) of the abdomen and precordium should be rapidly performed. (5) The need, if any, for additional imaging and/or procedures is driven by the patient's cardiopulmonary stability, physical examination, laboratory and radiographic findings. The demographic data of the patients, age, sex, type of trauma, site of trauma, associated injuries, general condition of the patient, resuscitation measures, management done ,and follow up of the survivors.

Statistical analysis

We used Fisher's Exact test for all the variables to get the significant predictors. SPSS 16 was used. Follow up of the survivors was done by clinic visits.

RESULTS

The number of cases included in this study was 300 in a period of more than 4 years in a single centre in Hail; KSA. Males were 230(76.6%). Lone chest trauma was diagnosed in 84 cases (28%). The main cause of blunt chest trauma was a road traffic accident (RTA) which occurred in 276 (92%) cases.

The reason for admission in those 84 patients were; Multiple fracture ribs in 18, Flail chest in 11, Pneumothorax in 10, Haemothorax in 25, Haemo-pneumothorax in 14, diaphragmatic rupture in 11 cases, Massive surgical emphysema in 9 and pericardial tamponade in 2 victims. Twenty cases were presented with shock. Intensive care unit (ICU) admission was required for 126 (42%) patients; the other 174 (58%) were managed in a regular surgical ward. Associated extra-thoracic injuries were found in 216 cases. More than one extra-thoracic injury was found in 154 cases and one extra-thoracic injury was found in 62 cases. The commonest extra-thoracic injuries were limb fractures in 139 cases, head injuries in 40 cases, abdominal trauma in 49 cases, Spine injury in 14 cases, scapular injury in 17 cases, and pelvic fractures in 6 cases. The median hospital stay of the survivors was 12 days. The median ICU stay was 6 days. The causes of death were as follows; twelve cases with intraoperative death and 8 postoperative deaths. The intraoperative deaths were due to uncontrolled airway injuries in 1 case, massive brain injuries in 4 cases, massive cardiac injury in 2 cases, retroperitoneal hematoma in 3 cases, pulmonary vein injury in 1 patient and dislodged endo-tracheal tube with cyanosis and hypoxia in 1 case. The postoperative deaths were severe shock and electrolyte disturbances in 2 cases, wound infection in 2 cases, DVT and pulmonary embolism in 3 cases and chylothorax in a case.

No.	300
Age in years	32
Male/Female	230/70
Non Saudis/Saudis	215/85
Lone Chest trauma/Combined trauma	84/216
Multiple fracture ribs	*18*
Pneumothorax	*10*
Haemothorax	*25*
Haemo-pneumothorax	*14*
Diaphragmatic rupture	*11*
Massive surgical emphysema	*9*
Pericardial tamponade	*2*
Observation	177(59%)
ICU admission	126(42%)
Chest Tube	99(33%)
Lone Chest tube	74(24.66%)
Chest tube + thoracotomy	25(8.33%)
Thoracotomy	49(16.33%)
Urgent	24(8.0%)
Delayed	25(8.33%)

Table 1. Some demographic Data.

Thoractomy done in:	49(16.33%)
Causes :	
Massive Hemothorax	20(6.66%)
Tamponade	2(0.66%)
Airway injury	2(0.66%)
Diaphragmatic injury	15(5%)
Massive or prolonged air leak	10(3.33%)

Table 2. Causes of Thoracotomy.

Injuries	Patients (percent)
Brain Injury	40(13.3%)
Spinal injury	14(4.6%)
Extremities fracture	139(46.3%)
Abdominal Trauma	49(16.33%)
Retroperitoneal hematoma	9(3%)
Splenic rupture	17(5.6%)
Liver tear	21(7%)
Abdominal vascular injury	2(0.66%)
Scapular fracture	17(5.6%)
Pelvic fracture	6(2%)

Table 3. Extra-Thoracic injuries.

Cause of death	No (%)
Airway injury	1(0.33%)
Massive Brain Injury	4(1.3%)
Massive hemothorax	3(1%)
Cardiac & Great vessels	2(0.66%)
Pulmonary stump	1(0.33%)
Retroperitoneal hematoma	3(1%)
Hypoxia in OR	1(0.33%)
Severe shock	2(0.66%)
Wound infection	2(0.66%)
Pulmonary embolism	3(1%)
Chylothorax	1(0.33%)

Table 4. Causes of Death; Early death is in Bold font and late in normal font.

Discussion

Blunt force mechanisms frequently result in thoracic trauma. Thoracic injuries cover the spectrum from trivial to lethal, and more than half are associated with head, abdomen or extremity trauma. Fortunately more than eighty percent of injuries can be managed non-operatively utilizing tube thoracostomy, appropriate analgesia and aggressive respiratory therapy. Patients requiring emergency thoracotomy are either in shock or have life threatening injuries and, as expected, have significant mortality and morbidity. Injury to the thorax directly accounts for approximately 25% of trauma related mortality and is a contributing factor in another 25%. Early mortality results from haemorrhage, catastrophic injury or associated head or abdominal trauma. Not unexpectedly, late deaths are related to sepsis and organ failure. Blunt injury to the thorax most commonly results from motor vehicle collisions, with motorcycle accidents, pedestrians struck and falls next in frequency. Mortality from blunt trauma often results from abdominal and, especially, head injury. Rapid assessment and interventions, such as tube thoracostomy and airway control, can be life saving. The patient's haemodynamic status drives early treatment, often necessitating emergency surgery. Detailed imaging studies are reserved for haemodynamically stable patients. (5)

The number of cases included in this study was 300 in a period of >4 years in a single centre in Hail; KSA. Hail is on the high way between (Northern region, Syria and Turkey) and Holy Makkah and Madinah. So a lot of pilgrims are passing through this way. This may explain the relatively large number of our cases and also the higher incidence of non Saudis in our study. Males were 230(76.6%). Lone chest trauma was diagnosed in 84 cases (28%). The reason for admission in those 84 were; Multiple fracture ribs in 18, Flail chest in 11, Pneumothorax in 29, Hemothorax in 25, Hemopneumothorax in 14, diaphragmatic rupture in 11 cases, Massive surgical emphysema in 9 and Tamponade in 2 victims. Twenty cases were presented with shock. Associated extra-thoracic injuries were found in 216 cases. The incidence of pneumothorax after major trauma is estimated at 20% with the predominate mechanism being MVCs. Air can collect in the pleural space from the outside atmosphere through a penetrating wound or from within the thorax due to airway or alveoli disruption. The spectrum of symptoms varies from cardiovascular collapse with a tension pneumothorax through to no symptoms at all with small occult pneumothoraces. Diagnosis is generally made by physical examination in conjunction with imaging such as CXR, CT scan and bedside ultrasound. (5-6-7).

We had 29 cases of traumatic pneumothorax which was managed by chest tube. If the lung collapse persists or there is continuous air leak, bronchoscopy was done before exploration. Airway injury was diagnosed in 2 cases and we repaired a 3 cm tear in the lower trachea and a 2cm in the right main bronchus. Both were done through a right thoracotomy. Thoracotomy in our series was done in 49 cases. Urgent thoracotomy was done in the 1st 24 hours in 24 patients only as the clinical picture was very clear. We needed more than 24 hours in 25 cases. Urgent thoracotomy was done in 9 cases of massive hemothorax, 2 tamponades, 1 airway injury and 12 diaphragmatic injuries. Observation was done in more than 59% of the cases. It consisted of good pain control, monitoring, splinting, CBC and X-ray follow-up. This goes in agreement with Ceran et.al.,2002 who used observation in 71% in the form of blood and plasma transfusion, nasal oxygen, naso-tracheal and bronchial suctioning.(8) Our thoracotomy rate was 16.33%. Ceran et. al.,2002 showed a thoracotomy rate of 27.2%, Hanafi et.al.,2011 reported a thoracotomy rate of 4.5% of their whole

series which was more than 22% in his elderly patients. Sirmali et.al.,2003 reported a thoracotomy rate of 2.9%. Richardson JD 1985 needed thoracotomy in 5% of victims. They needed just chest tube in 39% of cases while in our study, it was needed in 33%(8-9-10-11) We were very aggressive with a very low threshold towards the exploratory thoracotomy after we lost some cases in the start of our program. The Pathognomonic diagnostic signs that should not be missed are gas bubbles in the chest, naso-gastric tube in the chest and positive Gastrografin study. (12) The associated injuries were the rule and lone chest trauma is the exception. Combined associated /lone thoracic injuries; 72%/28% in our series. Hanafi et.al.,2011 reported combined/lone injuries of 31%/69%. Our mortality rate was 6.66%. The causes of death were; massive brain injury in 1.33%, massive hemothorax in 1%, retroperitoneal hematoma in 1%, DVT pulmonary embolism in 1%, severe shock in 0.66%, wound infection in 0.66%, hypoxia in 0.33% and airway injury in 0.33%. Hanafi et.al.,2011 reported a mortality rate of 1%, Lee et.al.,1990 reported mortality rate of 1.8% while Liman et.al.,2003 reported a 1% mortality rate. Sirmali et.al., mortality rate is 5.7% (11) We agree with Sirmali et.al., that the true mortality is higher due to the fatalities that do not reach the hospital. Liman et.al.,2003 found the risk factors of mortality as more than 2 rib fractures, age older than 60 years and injury severity score equal to or more than 16. Sirmali et.al., found the elderly age plus multiple fracture ribs as the significant risk factors of death. In a study done by Sersar et.al., 2010(13), The significant predictors of early mortality after Blunt Traumatic Diaphragmatic Rupture were; Male Gender, Splenectomy, Combined thoracotomy and laparoromy, Intestinal tear and Diagnosis within 1week to 1 month. (13)

As per Cordts Filho et.al., 2011, the presence of a pelvic fracture is a marker of greater severity and worse prognosis in victims of blunt trauma.(14) This goes with our finding also. We found that fracture 1st and 2nd ribs, age >50 years, fracture pelvis and severe shock state at 1st presentation as the risk factors of death after blunt chest trauma.

Conclusions

Fracture 1st and 2nd ribs, age >50 years and severe shock state at the first presentation considered as the predictive risk factors of death in blunt chest trauma.

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PAIN CONTROL AFTER THORACOTOMY: PARAVERTEBRAL BLOCK BY BUPIVACAINE

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Objective: **to assess the paravertebral block as an alternative method for postthoracotomy pain for our conventional methods.**

Methods: **The puncture site was situated 2.5—3 cm laterally to the thoracotomy close to the spinous process and an 18-gauge needle was inserted perpendicularly to the skin. A catheter was then inserted 2—3 cm. After careful aspiration through the catheter, an initial bolus of 15 ml of bupivacaine 0.5% was infused. starting with a bolus dose of 15 ml followed by bolus of 10ml, respectively. In our center, the disposable concentrations of local anesthetics for surgical use are bupivacaine 0.5%.**

Results: **There were no intraoperative or postoperative hazards in any of our patients regarding insertion of the catheter or infusion of the local anaethetic . VAS scores in relation to thoracotomy performed showed lower scores in anterior thoracotomy that were statistically significant mean and every hour (p>0.01). Nine patients needed meperidine 50mg i.m. as emergency drug at sometimes .**

Conclusion: **The multimodal treatment including the TPVB alternated with endovenous methamizol and subcutaneous meperidine as rescue, during the first 72 h (the most painful postoperative period) provides effective analgesia after thoracic surgery.This management could be considered an alternative to thoracic epidural analgesia.**

Postthoracotomy pain control represents a crucial problem in the clinical management after thoracotomy. Pain strongly limits pulmonary ventilation resulting in a functional lung restriction. Coughing and secretion clearing may be compromised, determining possible bronchial obstruction, atelectasis and/or parenchymal lung infection. Pain is, therefore, considered a major independent factor responsible for increased perioperative morbidity and mortality.Although a number of methods have been proposed for postthoracotomy analgesia (1-6).

Given the fact that systemic opioids are not potent enough to control neurogenic pain without detrimental effects on respiratory outcome (7), epidural analgesia is considered as the gold standard for thoracic analgesia (8)

However thoracic epidural analgesia carries the risk of dural puncture, epidural hematoma, epidural abscess, and side effects such as hypotension, bradycardia, and urinary retention and these commonly occur. Regional anesthesia bythoracic paravertebral block could be a good alternative for post-thoracotomy pain (4).

However, it has been largely demonstrated that a thoracic paravertebral infusion of a local anaesthetic provides similar pain relief with few side effects. This procedure is advantageous because it can be performed under direct vision by the surgeon and permits a simpler postoperative management. It also reduces the occurrence of chronic postthoracotomy neuralgia and stress responses, and preserves pulmonary function (9).

Bupivacaine has been the most frequently used local anesthetic according to published studies. It is a contrasted potent drug; however it has been reported toxic when limit dosages are overpassed (10).

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The paravertebral space(PVS) is a potential space, which is turned into a temporary cavity by fluid (e.g. Local anaethetic) forming a wedge- shaped space that lies to the side of the vertebral column. Of the structure passing through the PVS, the most important are the intercostals and sympathetic nerves. Spread of LA alongside the spine to adjacent PVS, anterior to the transverse process produces multilevel block.(11)

In addition to the superior and inferior movement of injectate within the paravertebral gutter across the heads and necks of ribs, there are other potential sites of spread. Medial spread through the intervertebral foramen into the epidural space has been observed fluoroscopically. (12)

Patients and Methods

Included in this prospective study were patients scheduled for an anterior (AT) or posterolateral (PT) thoracotomy for intrathoracic operation during 2008 to 2010. Written informed consent was obtained in all the cases . The use of visual analog scale (VAS) for pain measurement was explained to those involved in the study. Patients of every group (AT and PT) were allocated randomly to the analgesic technique bupivacaine 0.5%, 10 ml/6 h.

General anesthesia was induced with 1.5—2 mg/kg of propofol, 2 mm/kg of fentanyl, and 0.6 mg/kg of atracurium and maintained with sevoflurane, nitrous oxide, and oxygen. All patients were intubated with a double-lumen endobronchial tube for one-lung ventilation.

An anterior or posterolateral thoracotomy was implemented in the forth (AT) or fifth (PT) intercostal space.One tube for wedge resections and two tubes for lobectomies were placed after resection two spaces lower than our incision; after pneumonectomy chest tube was removed in the operating room. The paravertebral catheter was placed by the surgeon before closing the thoracotomy.

The puncture site was situated 2.5—3 cm laterally to the thoracotomy close to the spinous process and an 18-gauge needle was inserted perpendicularly to the skin. The needle entering into the paravertebral space was located visually. A catheter was then inserted 2—3 cm. After careful aspiration through the catheter, an initial bolus of 15 ml of bupivacaine 0.5% was infused. The total dose, volume and concentration of bupivacaine were selected regarding previous studies, all of which showed the efficacy of plain bupivacaine in concentrations ranging from 0.2% to 0.5%, starting with a bolus dose of 15 ml followed by bolus of 10ml, respectively. In our center, the disposable concentrations of local anesthetics for surgical use are bupivacaine 0.5%

Postoperatively, patients received 10 ml of bupivacaine every 6 h with 2 g of endovenous methamizol intercalated every 6 h, and meperidine, a synthetic opioid,as rescue drug (bolus of 50 mg subcutaneous).

Patients' pain was evaluated with a VAS graded from 0, no pain, to 10, the worst pain score, recorded 1 h after the paravertebral analgesic bolus.

The study period lasted 72 h, and data collection was performed by a third person (the assigned ward nurse) who was blinded to the randomisation and wrote the VAS score in the patient sheet.

The following data were assessed: (1) 1, 6, 24, 48, 72 h pain scores, (2) any requirement for emergency analgesia (meperidine) and (3) adverse events related to the analgesia technique, respiratory depression (respiratory rate <8 breaths/min), cardiotoxicity, confusion, sedation, urinary retention, nausea, vomiting and pruritus.

RESULTS

No pruritus or periods of excessive somnolence were reported in our patients sheet.There were no intraoperative or postoperative hazards in any of our patients regarding insertion of the catheter or infusion of the local anaethetic .

Patients Data was collected in Table (1).

Types of surgery and operative data was collected in table (2).

Table(3) shows average and standard deviation of VAS scores.

VAS scores in relation to thoracotomy performed showed lower scores in anterior thoracotomy that were statistically significant mean and every hour (p>0.01).

Nine patients needed meperidine 50mg i.m. as emergency drug at sometimes .

One patient developed postoperative atelectsis and pneumonic patch and needed medications and suctioning.

Mean hospital stay was 6.7+0.6 days.

Age	63.2+8.9
Male/Female	24/6
Weight	73.5+7.1
Height	168.2+6
ASA score I/II	25
ASA score III	5
Operative time AT/PT(min)	100+37/123+32

Table (1) Patients characteristics

Anterior thoracotomy:	
Wedge resection	5
Pericardia window	2
Mediastinal mass	3
Postero-lateral thoracotomy:	
Lobectomy	11
Decortication	8
Pneuomonectomy	1

Table (2) Type of Thoracotomy and operative Data

VAS	AT(10)	PT(20)
VAS 1h	3.1+0.9	4.5+2.1
VAS 6h	5.7+2.1	7.2+1.5
VAS 24h	5.9+1.0	6.5+1.3
VAS 48h	4.1+1.2	5.8+1.2
VAS 72h	2.9+1.5	4.3+1.1
Mean	4.2+1.2	5.3+1.5

Table (3) Average and standard deviation of VAS score

DISCUSSION

Adequate pain control in the early postthoracotomy period is one of the most effective ways to prevent respiratory complications and to achieve a quicker functional recovery after thoracotomy(8,13) .

In the development of thoracotomy-related pain, emphasis has been attributed to the extent of muscular severing and to the trauma on costo-vertebral joints and on the anterior costal cartilage due to wide spreading of the ribs (14,15) .

TPVB was described at the beginning of the 20th century. Recently, because of the possibility of inserting a catheter into the thoracic paravertebral space, it has been evaluated for postoperative analgesia after thoracotomy(16) .

Thoracic paravertebral space is a vertically and horizontally open space located between the intercostal and epidural space. Local anesthetic injection can diffuse through this space to upper and lower nerve roots.

Consequently analgesia achieved using a paravertebral block can span several segments. The intensity of the block will depend on the potency, concentration and volume infused of the local anesthetic (17,18) .

The insertion of the thoracic paravertebral catheter has been described by a surgical approach under direct vision as in the current study or by a skin puncture generally performed by the anesthesiologist(19) .

Therefore, our effort in the last years was towards the standardization of a muscle-preserving access to be employed for all major pulmonary resection in the attempt to ensure good quality of perioperative pain control associating the less possible patient discomfort related to the analgesic procedure and this has been supported by many authors(20,21,22) .

We decided also to standarize and evaluate our pain management policy with the most frequently employed local anesthetic (bupivacaine).

Although a direct comparison with other analgesic methods is not performed in this study, the pain scores registered when paravertebral is employed are comparable with historical results obtained in the literature with epidural analgesia and and other reports.(6,23,24) .

Epidural analgesia has been reported to provide better pain control if compared with other currently employed methods(13,25) including intercostal blocks, thus appearing as the gold standard technique in this setting. However, epidural anesthesia is not suitable for all patients and carries risks of potential complications such as bleeding, infection, dural perforation, hypotension, bradycardia, and urinary retention(4,13) . Furthermore, immediate or delayed respiratory depression may occur when opioids are administered epidurally.

Moreover, although there are only few studies in the literature comparing intercostal nerve block (more frequently continuous INB) with epidural anesthesia, the advantages related to the latter technique are not always confirmed. In two studies(26,27) , the administration of lumbar epidural morphine was found to have lower efficacy than a continuous intercostal blockade. In another trial(6) authors were not able to demonstrate any significant difference. However, all these studies mainly consider patients operated through a posterolateral or a standard lateral thoracotomy and trials comparing the efficacy of these analgesic techniques in association with muscle -sparing techniche are not available in literature.

It is a fact that higher levels of block are obtained increasing concentration of the anesthetic. On the other hand a higher volume of anesthetic is supposed to block more intercostal nerves, compensating a lower concentration(17) . Theoretically the day dose in bolus of bupivacaine for TPVB (the more toxic of local anesthetics employed) cannot exceed 400 mg(28) . In ours study we employed a summed concentration per day of 225 mg of bupivacaine with a volume of 45 ml.

Some reports suggest that it may be necessary to use higher concentrations to achieve better VAS scores(29,30) . However there are insufficient studies to determine if these higher concentrations of local anesthetic would provide better pain control without toxicity.

In our series we saw no toxicity related to local anesthetics. Regarding the need for rescue analgesia with loca anesthetics. We obtained similar results with other reports.

Analyzing our data regarding the type of thoracotomy it is remarkable the difference in mean VAS values between AT and PT (Table 3) with a strong statistically significance ($p < 0.01$) in the mean and all the postoperative hours. AT showed to be a less painful incision in comparison to PT with statistically significant values.

We believe that TPVB bolus facilitates postoperative care and monitoring is simplified. Consequently this policy could be more suitably adapted to patients in surgical wards avoiding highly monitored ICU.The multimodal treatment including the TPVB alternated with endovenous methamizol and subcutaneous meperidine as rescue, during the first 72 h (the most painful postoperative period) provides effective analgesia after thoracic surgery.

This management could be considered an alternative to thoracic epidural analgesia.

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Preoperative Embolization in Surgical Management of Massive Thoracic Tumors

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Moustafa H M Othman **

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Background. **The surgical excision of giant highly vascular tumor may be challenging. The aim of this study is to describe our experience with preoperative percutaneous embolization of massive vascular chest tumors before its surgical excision.**

Methods. **By evaluation of demographics, clinical presentation, radiographic studies, bronchial arteriography and the role of percutaneous embolization for massive vascular chest tumors before its surgical excision at Assiut University Hospital , Assiut, Egypt; from 2009 to 2011. We describe our experience with eight cases of giant, highly vascular thoracic tumors treated by preoperative embolization and followed by successful excision after 48 h. They were 3 men and 5 women with a mean age of 40 years.**

On the basis of (CT) findings, a selective angiography was performed showing a rich vascularization of the all tumors. The feeding arteries were embolized using polyvinyl alcohol (PVA) particles of different sizes, according the size of the feeding vessels and tumor vascular bed. Forty-eight hours after embolization, the patient underwent surgery. Total excision of tumors was achieved by piecemeal removal technique.

Results. **Eight cases of giant, highly vascular thoracic tumors treated by preoperative embolization and followed, after 48 h by successful excision. Overall, 8 embolization sessions were performed with a total of 24 arteries embolized; the average number of arteries embolized per patient was 3. There are no major complications related to preoperative embolization. With this technique, reduction in tumor size was obtained, ranging from 20% to 30%; perilesional edema and easy differentiation of ischemic tumor tissue facilitated surgical dissection of the mass from the adjacent structures in all cases. Piecemeal removal of the tumor was carried out in all patients with minimal blood loss and complete excision of the tumor.**

Conclusions. **Preoperative embolization of giant vascular thoracic tumors is useful to decrease perioperative blood loss and to facilitate surgery with achievement of total excision. We recommend preoperative angiography for all massive chest tumors that may have a vascular pedicle amenable to embolization, particularly when piecemeal removal of the tumor may be necessary.**

Key Words: **Thoracic tumors • Preoperative embolization • Surgery**

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Surgery of giant, highly vascular thoracic tumors can be challenging. The surgical risk is amplified by potential hemorrhage, problematic surgical exposure, difficult handling of the tumor and poor vascular control. Decrease in tumor bulk can rarely be achieved by induction chemo or radiotherapy for the low response rate of some malignancies.

We report our experience with the use of preoperative embolization in the surgical management of giant, highly vascular thoracic tumors.

Few single case reports of preoperative embolization of pleural or mediastinal tumors are available in the literature; It used before surgical removal of a massive solitary fibrous pleural tumor [1], a mediastinal hemangiopericytoma[2], a medistinal

paraganglioma[3] and an intrapericardial pheochromocytoma[4] with successful subsequent removal and minimal intraoperative blood loss.

Patients and Methods

Here in we describe our experience with eight patients of giant, highly vascular thoracic tumors underwent preoperative embolization of feeding arteries of the tumors and followed by surgical excision after 48 h. Additionally, we review the demographic characteristics, clinical features, results of imaging techniques, complications related to percutaneous embolization and follow-up.

This group consisted of 3 males and 5 females. Their age ranged from 12 to 60 years with a mean age of 40±10.4 years. The operations were performed at Assiut university hospital, Assiut, Egypt; between January 2009 and December 2011.The study was approved by the Institutional Ethics Committee and all patients or their guardians provided informed consents.

Tumor identification was solitary fibrous pleural tumor (one patient), extraskeletal (mediastinal) myxoid chondrosarcoma (one patient), extra abdominal fibromatosis (desmoid tumor) (one patient), huge chest wall chondrosarcoma (one patient), large thymoma with plural extension (three patients), paravertebral chondrosarcoma (one patient).

Statistics

All data are presented as mean ± standard deviation. Comparison of preoperative and postoperative values was performed using the Student's *t* test. A significant difference was considered when the *p* value was less than 0.05.

Preoperative evaluation

Evaluation was done for the demographics, clinical presentation, radiographic studies, bronchial arteriography and the role of percutaneous and transarterial embolization for massive vascular chest tumors before its surgical excision.

Preoperative radiological evaluation included chest x ray and CT scan (Fig. 1&2); MRI and bronchoscopy were not used routinely. The tumor was isolated in all patients.

Preoperative CT guided needle biopsy or open biopsy was done in most cases.

Preoperative embolization

On the basis of angio-computed tomographic scan (CT) findings and magnetic resonance imaging (MRI) findings, a selective angiography was performed showing a rich vascularization of the all tumors. The feeding arteries were embolized by 150–500 μm polyvinyl alcohol (PVA) particles (Contour®-PVA Embolization Particles, Target Therapeutics, Boston Scientific, USA) (Fig. 3&4).

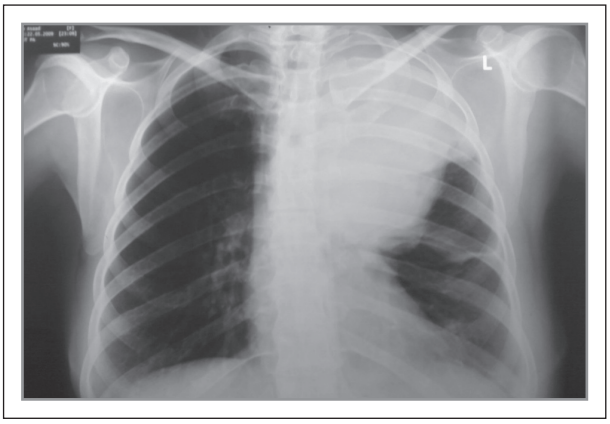

Fig 1. Chest roentgenogram of patient with massive left-sided solitary fibrous tumor of the pleura.

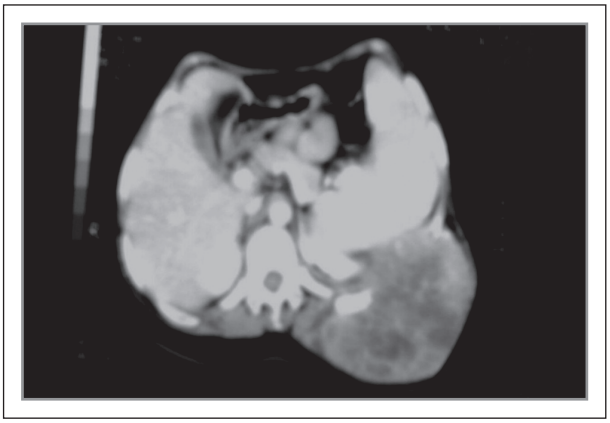

Fig. 2. CT imaging of giant thoracic chondrosarcoma.

Selective percutaneous angiography of subclavian artery, thyrocervical trunk, costocervical trunk, internal thoracic and intercostal arteries was frequently performed in this study. Avoidance of bronchial arterial origin of the spinal artery was done.

If spinal supply is noted during diagnostic angiogram we could bypass its origin using microcatheter coaxially through the diagnostic guiding catheter before embolization.

Operative management

Forty-eight hours after embolization, the patients underwent surgery. Total excision of tumors was achieved by piecemeal removal technique with minimal blood loss.

All surgical procedures were performed by the same surgeon (the author). Routine monitoring and anesthesia were used in all patients.

Surgical approaches used in this study were partial sternotomy, anterior and posterolateral thoracotomy out to complete resection.

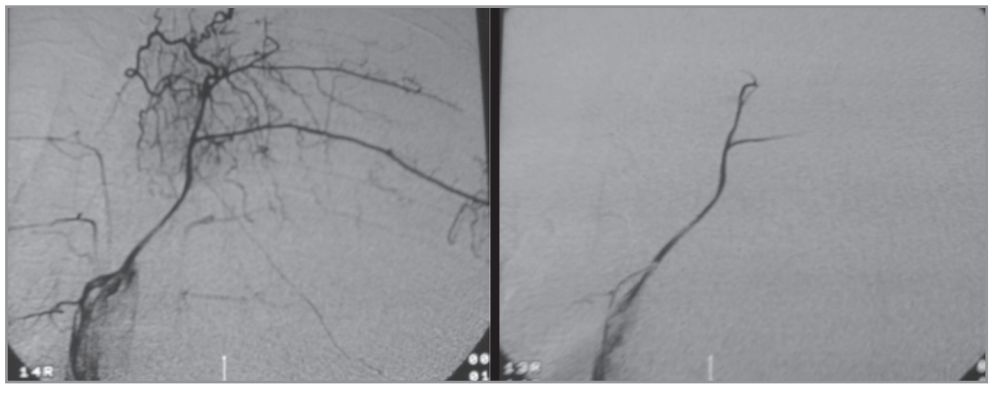

Fig. 3.
(a) Preliminary angiography showing tumor feeding vessels from a hypertrophic bronchial artery.
(b) Postembolization angiography showing no residual blood flow to the mass.

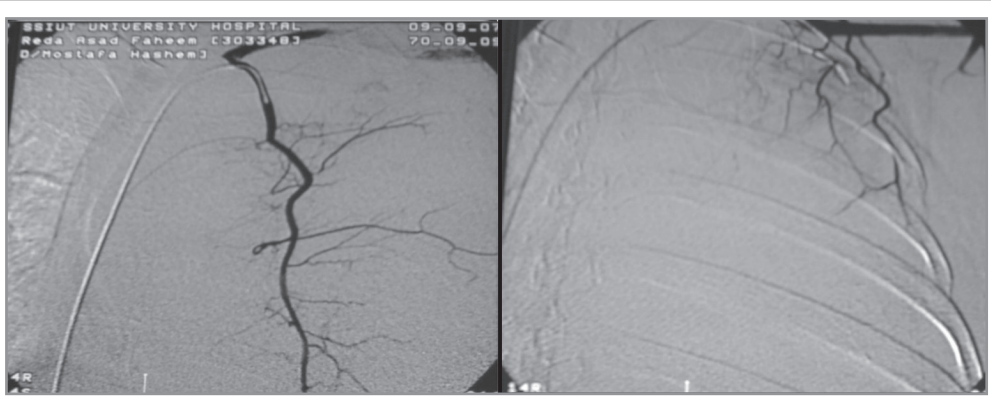

Fig 4.
(A) Pre- and
(B) postembolization angiograms of the left internal mammary artery, the principal blood supply to the tumor, showing successful occlusion.

Postoperative management

Routine postoperative management was done, with observation of blood loss and early complications of percutaneous embolisation.

Histopathological study confirmed type and grade of malignancy and the patient might undergo adjuvant therapy.

Follow-up evaluation

The patients followed up within 12 months, for recurrence of tumor and late complications of percutaneous embolisation.

RESULTS

Eight cases of giant, highly vascular thoracic tumors treated by preoperative embolization and followed by successful excision after 48 h.

Predominant presenting signs or symptoms at the time of evaluation for surgical treatment were exertional dyspnea (5 patients), chest pain (3 patients) and cough 2 (patients).

All cases treated by preoperative one embolization session. Overall, there were 8 embolization sessions for the 8 patients with a total of 24 arteries embolized (including bronchial and nonbronchial systemic arteries). The average number of arteries embolized per patient was 3.

The following arteries were embolized: right bronchial artery (2); left bronchial artery (3); intercostal arteries (9); right internal mammary artery (2); left internal mammary artery (3); inferior phrenic artery (2); thyrocervical trunk (3).

The emolizing material was used to embolize arteries in all our patients, was polyvinyl alcohol (PVA) particle of different sizes according the size of the feeding vessels and tumor vascular bed.

Complete resection was achieved in all patients within 48 hours after embolization.

With this technique, reduction in tumor size was obtained, ranging from 20% to 30%; perilesional edema facilitated surgical dissection of the mass from the adjacent structures in all cases. Piecemeal removal of the tumor was carried out in all patients with minimal blood loss.

Two patients presented with fever the day after the procedure ,one patient complained of paresthesia and mild pain in the left forearm, spontaneously subsiding within a couple of days and one patient developed mild facial palsy may due to massive

resection of solitary fibrous pleural tumor. The postoperative course was smooth and the patients were discharged home after mean of 10 days postoperatively.

The patients had follow-up periods ranging from 6 months to 12 months without evidence of local recurrence of tumor or metastases.

DISCUSSION

Remy et al [5] performed the first BAE (bronchial artery embolization) in 1973 to control hemoptysis. This was followed by a large series by Remy et al [6] in 1977 of 104 patients who were treated by embolization of both the bronchial and nonbronchial arteries to control hemoptysis. Subsequently, BAE was widely used, because nonoperable patients could be treated and other patients could be stabilized prior to surgery.

Large intrathoracic tumors may reach massive proportions before becoming symptomatic. Their large size may make resection hazardous, particularly when excision in one piece is unlikely, and there is a vascular pedicle which is inaccessible via the chosen operative route by virtue of the size of the tumor.

Reduction of tumor size is required in order to allow a complete and safe resection. Decrease in tumor bulk can rarely be achieved by induction chemo or radiotherapy for the low response rate of some malignancies.

One of the main benefits of preoperative embolization is the reduction in tumor volume that ranged from 20% to 30%.

Without preoperative embolization, piecemeal removal of giant thoracic sarcomas may be unattainable because of the risk of severe or lethal bleeding. Forty-eight hours after embolization, the tumor surface can be cut with the cautery without significant bleeding [7].

Solitary fibrous tumors of the pleura are rare and benign; however, even benign forms can recur many years after incomplete resection [8].Origin is most frequently from visceral pleura, with only 20% arising from parietal pleura. Tumors more than 8 cm are more likely to have a parietal pleural origin and have a vascular pedicle [9].A tumor more than 10 cm is more likely to be malignant. Nearly one-half of solitary fibrous tumors of the pleura overall are attached to the pleura by a single pedicle [10].

Solitary fibrous tumors of the pleura can reach massive proportions. Resection is generally curative in all benign cases, and in approximately half of malignant cases [11].

Angiography can be a valuable investigation to delineate any major feeding vessels in solitary fibrous tumors, which may then be embolized preoperatively. As these tumors are attached to the pleura by a highly vascularized pedicle in 38% to 46% of patients, particularly if the tumor is large [12].

Tumor vascularity must be preliminarily assessed by angio-CT scanning. CT scan performed without media contrast may lead to a useless angiography [13].

The ischemia-induced perilesional edema is another advantage of preoperative embolization, facilitating dissection of the tumor from the adjacent structures.

Saluja et al [14] have suggested that coils should not be used for BAE as they cause proximal occlusion and do not allow for repeat embolization if necessary. We agree that coils will prevent repeat embolization of the same artery, but we aim at occlusion of the vascular bed of the tumor which was achieved using PVA particles. Polyvinyl alcohol and coils provide permanent occlusion, while gelatin sponge particles are considered to provide temporary occlusion.

It is well-documented that bronchial arteries vary significantly in their numbers and sites of origin. More than 70% of bronchial arteries arise from the descending aorta between the levels of the fifth and sixth thoracic vertebrae [15]. Based on a study of 150 human cadavers in 1948, Cauldwell et al [16] defined four types of anatomic variation. The most common type is that of a single right bronchial artery with two left bronchial arteries (41%). Up to 20% of bronchial arteries may have an aberrant origin (from other systemic arteries), and nearly 10% arise from the anterior surface of the aortic arch or the descending aorta. A spinal artery can originate from a bronchial artery in up to 5% of patients, with right side being more common than the left side.

Preoperative embolization for parietal tumors lead to shrinking of the tumor and decrease tension pain and easy differentiate ischemic tumor tissue from surrounding, in addition to decrease intraoperative bleeding[1].

Bronchial and nonbronchial arteriography and embolization were well-tolerated by our patients. Our results have shown this is an effective procedure with which to facilitate dissection of the tumor from the adjacent structures and decrease intraoperative blood loss.

None of our patients had major complications. The complications that may result from embolization are transverse myelitis as a result of the use of nonionic contrast agents, more neurotoxic materials, and the inadvertent embolization of the spinal arteries [17]. To avoid such neurologic complications, superselective embolization was utilized using micro catheter coaxially passed through the diagnostic guiding catheter. This refers to embolization of more terminal branches of the arterial tree, beyond the origin of the spinal arteries.

Previous studies concluded that by using superselective embolization distal to the spinal or mediastinal branches, neurologic complications could be avoided and that the embolization may be more effective. This is in contrast to the series by Mal et al, [18] who observed the following three episodes of spinal cord complications: Brown-Séquard's

syndrome, which regressed after 4 months without sequelae; paraparesis with spontaneous regression after 2 weeks; and complete paraplegia without regression. If a spinal artery arises from a bronchial artery, we will only embolize the distal bronchial artery if we can achieve a stable distal position beyond the spinal artery origin.

Other complications may occur are subintimal dissection, guidewire perforation, and reflux of embolic agents into the aorta without adverse effects. Transient dysphagia, pleuritic chest pain, shoulder pain, and a groin hematoma also occurred[19].

The follow-up of our patients ranged from 6 months to one year; it revealed that one patient had facial palsy, may due to injury of sympathetic chain during dissection of her massive solitary fibrous tumor of the pleura and not due to embolization.

CONCLUSIONS

In conclusion, angiography and embolization are valuable adjuncts in surgical removal of giant vascular thoracic tumors. Preoperative embolization is useful to decrease perioperative blood loss and to facilitate surgery with achievement of total excision.

We recommend angiography of all massive tumors in the chest before operation, particularly when they are so large that piecemeal excision may be anticipated. Bronchoscopy and CT scanning have important roles to determine the site and probable anatomic source of blood supply of tumor, prior to the patient undergo angiography.

Percutaneous embolization of huge thoracic tumors may help in patients who are not good surgical candidates because it leads to shrinking and decrease the size of the tumor.

Embolization distal to the spinal artery may significantly decrease the number of complications and may allow a complete embolization.

Further studies are needed to determine whether any of the various embolic materials currently available is superior in preventing recanalization.

Footnotes

• Abbreviation: BAE = bronchial artery embolization

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Small Bore Catheter versus Wide Bore Chest Tube in Management of Malignant Pleural Effusions

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Background: **Pleural effusion is a common problem especially in cancer patients with advanced disease. Treatment usually consists of sequential thoracentesis or tube thoracostomy but the use of small bore wire guided (Seldinger) chest drains have become increasingly common.**

Patients and methods: **Sixty patients fulfilled the inclusion criteria and were randomized into group I with small bore catheters (10 – 12 F) and group II with large bore chest tubes (28 – 32 F). Data were collected regarding efficacy of drainage, chest pain, duration of chest drain in patients, duration of hospitalization and complications.**

Results: **Both groups were similar regarding efficacy of drainage, duration of chest drain placement and recorded complications. Regarding chest pain using VAS (Visual Analogue Scale) group I (VAS 2.1 ± 1.5 cm) was lesser than group II (VAS 6.3 ± 1.4 cm), also duration of hospitalization was lesser in group I (2.1 ± 2.3 days) than group II (5.7 ± 2.7 days).**

Conclusions: **Small bore catheter is a good alternative to large bore catheter for drainage of malignant pleural effusion; as it is equally effective with no added complications and significantly less painful. Moreover, small bore catheter drainage reduces the length of hospital stay and can be performed as outpatient procedure.**

Key words: **Malignant pleural effusion • pleural effusion management • pleural catheter • chest tube**

Pleural effusion is a common problem especially in cancer patients with advanced disease. Patients typically present with progressive dyspnea, cough and/or chest pain that significantly compromise their quality of life. Treatment usually consists of sequential thoracentesis or tube thoracostomy. **(1)**

The traditional method of drainage is tube thoracostomy with conventional large bore chest tube connected to underwater seal with or without continuous wall suction which requires hospitalization, expensive, limits patient mobility and can cause significant patient discomfort. **(2)**

Over the last few years, the use of small bore (8 – 14 F) wire guided (Seldinger) chest drains have become increasingly common; however there is little information on the efficacy of these drains outside of closely controlled trials. The British Thoracic Society recommended small bore catheters for the treatment of pneumothoraces **(3)** and malignant effusions. **(4)**

The aim of this study was to compare small bore catheter versus wide bore chest tube in the management of malignant pleural effusion.

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Patients and Methods

This is a prospective randomized study that was conducted at The Cardiothoracic Surgery Department, Tanta University Hospitals, during the period from May 2010 to

June 2011. The study protocol was approved by The Research Ethics Committee of Tanta University. The planned procedure was explained to every patient and a written consent was obtained from participants.

Patients included in the study were patients with symptomatic malignant pleural effusions planned to undergo drainage. Patients with hydro-pneumothorax, empyema and encysted pleural effusions were excluded from the study.

Sixty patients fulfilled the inclusion criteria and were randomized by 1:1 mode into two equal groups (group I and II). Group I was patients had been subjected to the insertion of small bore catheters (10 – 12 F) and group II was patients had been subjected to the insertion of traditional large bore chest tubes (28 – 32 F).

In both groups, the procedures were performed in the operating theater and under complete aseptic conditions. No preoperative sedatives were given before chest drains insertions. The selected site of insertion was the 5th or 6th intercostals space in the mid-axillary line. The site was prepared with povidone iodine and infiltrated with 2% lidocaine for local anesthesia.

The insertion of small bore catheter was done using Seldinger technique **(5)** without radiological guidance and connected to a closed gravity drainage bag system (figure 1) while the insertion of chest tube was done using blunt dissection technique and connected to an underwater seal drainage system.

Data collected from the patients include:

Pre-operative: Full history taking regarding dyspnea and its grade, chest pain and history of previous operations and diseases. Full clinical examination, preoperative plain chest X ray and other laboratory or radiological investigations as needed. Diagnostic thoracentesis was done and samples were examined for physical and chemical analysis and cytological study.

Operative: Operative procedure, intensity of chest pain and occurrence of any complications were recorded.

Post-operative: Plain chest X-ray PA and lateral views were done immediately after operation to confirm appropriate drain position and then daily to assess the effectiveness of drainage and detect complications. Clinical follow up for evaluation for grade of dyspnea, intensity of chest pain and the amount and character of the drained fluid. The duration of drain placement and total duration of hospital stay were recorded.

The pain intensity experienced by all of our patients at the time of the drain insertion was evaluated using a 10 cm visual analogue scale (VAS) pain intensity rating which is a horizontal line measuring exactly 10 cm with the end points 0 cm (no pain) and 10 cm (worst pain ever). **(6)** Each patient was asked to make a mark on this line and then the line is measured from the end of no pain and recorded in centimeters. According to Jensen et al. **(7)** the results were measured and recorded: VAS scores less than 0.5 cm labeled as no pain, VAS scores from 0.5 to 4.4 cm labeled as mild pain, VAS scores from 4.5 to 7.4cm labeled as moderate pain, VAS scores 7.5 cm and greater labeled as severe pain.

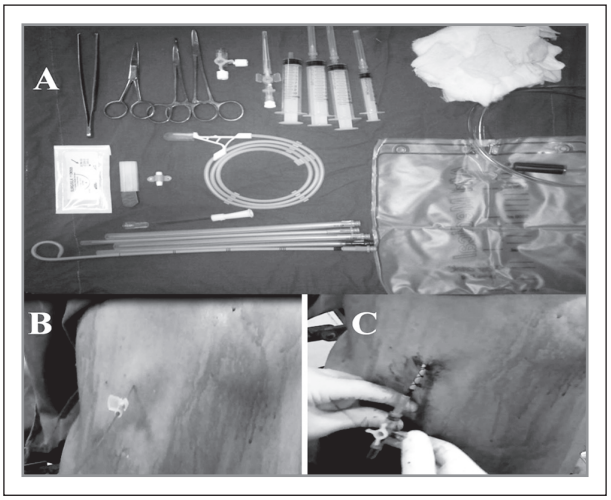

Fig 1. A: Pigtail catheter 12 Fr and kits used for insertion, B: insertion of guide wire through the trocar, C: securing the pigtail catheter after insertion.

Results

During the period of this study 78 patients with symptomatic malignant pleural effusions were referred to our department. Only 60 patients met the inclusion criteria and were included in the study. The remaining 18 patients were excluded; 5 because of empyema, 5 because of hydro-pneumothoraces and 8 because of encysted pleural effusions.

Those 60 patients divided into 2 equal groups; Group I: including 30 patients with small bore catheters and Group II: including 30 patients with large bore chest tubes.

Pre-operative data

In group I, there were 11 males (36.7 %) and 19 females (63.3%), with age ranging from 33 to 74 years (mean 54.9 ± 9.9 years) while in group II, there were 15 males (50 %) and 15 females (50 %), with age ranging from 31 to 77 years (mean 52.3 ± 11.7 years).

There was no statistically significant difference between the two groups as regards preoperative data (table 1).

Operative data

In group I, the sizes of the small bore catheters were 10 Fr and 12 Fr while in group II, the sizes of the large bore chest tubes were 28 Fr and 32 Fr (table 2).

		Group I	Group II	P- value
Age		54.9 ± 9.9	52.3 ± 11.7	> 0.05
Sex	Male	11 (36.7%)	15 (50%)	> 0.05
	Female	19 (63.3%)	15 (50%)	
Side of effusion	Right	12 (40%)	16 (53.3%)	> 0.05
	left	18 (60%)	14 (46.7%)	
Primary malignancy	Breast cancer	16 (53.3%)	12 (40%)	> 0.05
	Lung cancer	6 (20%)	10 (33.3%)	
	GIT cancer	4 (13.3%)	4 (13.3%)	
	Ovarian cancer	2 (6.7%)	1 (3.3%)	
	Spinal tumors	0	2 (6.7%)	
	Unknown primary	2 (6.7%)	1 (3.3%)	
Grade of dyspnea	Grade I	0	0	> 0.05
	Grade II	0	0	
	Grade III	23 (76.7%)	21 (70%)	
	Grade IV	7 (23.3%)	9 (30%)	
Effusion in CXR	Mild	0	0	> 0.05
	Moderate	19 (63.3%)	17 (56.7%)	
	Massive	11 (36.7%)	13 (43.3%)	

Table 1. Preoperative data of the patients.

		Group I	Group II
Size of small bore catheters	10 F	6 (20%)	
	12 F	24 (80%)	
Size of large bore chest tubes	28 F		11 (36.7%)
	32 F		19 (63.3%)

Table 2. Sizes of chest drains inserted.

Post-operative data:

The efficacy of drainage was evaluated by improvement of dyspnea, postoperative CXR and amount of drainage (table 3). There was no statistically significant difference between both groups regarding these items.

The chest pain intensity experienced by every patient at the time of chest drain insertion and in the postoperative period was evaluated using a 10 cm VAS for pain (table 3) and showed that there was statistically significant difference between the two groups as regards pain.

Although the duration of chest drain placement in the patients showed no statistically significant difference but the total duration of patients' hospitalization showed statistically significant difference between both groups (table 3). It is important to notice that 14 patients (46.7 %) from group I were managed as outpatients while no patients from group II were managed as outpatients.

Recorded complications

Although complications were different in both groups (table 4), but all were statistically not significant between both groups and no patient required any further surgical intervention due to these complications. Other complications as hemothorax, organ injury, malposition, kinking or blockage of chest drains did not occur in any patient of both groups.

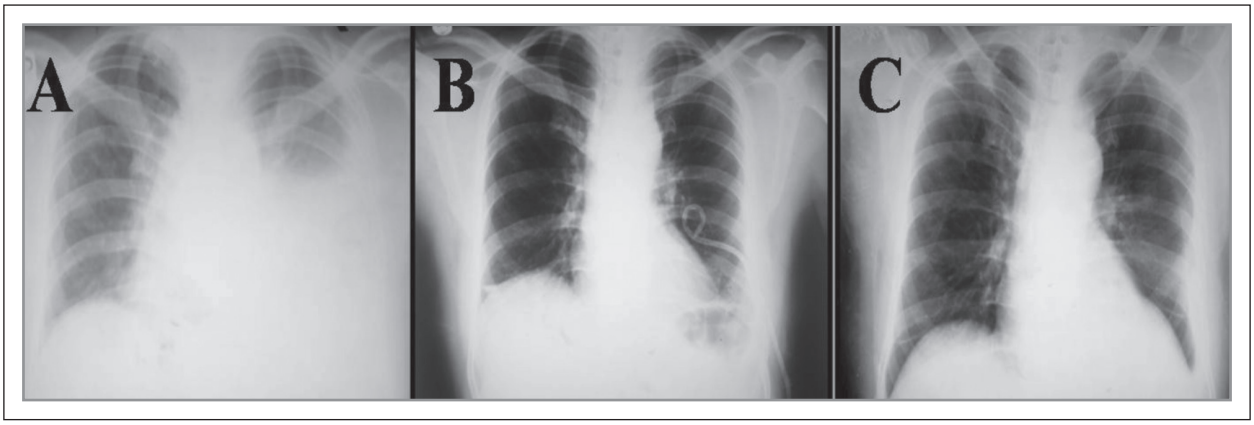

Fig. 2. A: CXR showing left pleural effusion, B: CXR with pigtail inserted, C: CXR showing complete drainage.

		Group I	Group II	P- value
Dyspnea	Grade I	25 (83.3%)	24 (80%)	>0.05
	Grade II	5 (16.7%)	6 (20%)	
	Grade III	0	0	
	Grade IV	0	0	
CXR	no residual effusion	28 (93.3%)	29 (96.7%)	>0.05
	Minimal residual effusion	2 (6.7%)	1 (3.3%)	
Amount of drainage (ml)		3450 ± 697	3737 ± 846	>0.05
Chest pain intensity VAS (mm)		2.1 ± 1.5	6.3 ± 1.4	<0.05*
Duration of chest drain (days)		4.5 ± 1.3	5.4 ± 2.5	>0.05
Duration of hospitalization (days)		2.1 ± 2.3	5.7 ± 2.7	<0.05*

Table 3. Postoperative data of the patients. **** significant***

	Group I	Group II	P- value
Pneumothorax	1 (3.3%)	0	>0.05
Empyema	0	1 (3.3%)	>0.05
Accidental dislodgment	0	1 (3.3%)	>0.05

Table 4. The incidence of recorded complications.

Discussion

The traditional practice for drainage of malignant pleural effusions is either thoracentesis or chest tube with underwater seal drainage. Nowadays, small bore catheter (pigtail catheter) has been increasingly used worldwide.

In our study the small bore catheter has the same efficacy as the wide bore chest tube for drainage of malignant pleural effusion. This is in agreement with Parulekar et al. **(8)** who studied 102 cases; 58 patients (57%) were treated with small bore catheters and 44 patients (43%) received conventional large bore chest tubes. They did not find any major differences in the outcomes with the use of either size of chest tubes. Also, Cafarotti et al. **(9)** who retrospectively reviewed the data of 1092 patients with different pleural lesions of them 324 drains for malignant effusions with success rate 93.8% for small bore wire guided chest drains (12F).

Using the VAS for pain intensity, the small bore catheter (VAS 2.1± 1.5) is significantly less painful than the large bore chest tube (VAS 6.3 ± 1.4) and better tolerated when assessed by the patient. In the study of Horsley et al. **(10)** who measured

the pain experienced by patients at the time of insertion of small bore wire guided chest drains. The VAS was 23 ± 16.4 mm. also, Cafarotti et al. **(9)** measured the mean VAS score 46 mm. both concluded that small bore wire guided chest drains are well tolerated by patients. . These results seems logic if we recognize that the average intercostal space in adults measures at the 5th intercostals space in the mid-axillary line 8.8 ± 1.4 mm. A 24 F chest tube has an outer diameter of 8 mm; while 32 F chest tube has an outer diameter of 10.7 mm. this causes pain due to compression of the neurovascular bundle. In contrast, small bore catheter 8 F has a diameter of 2.7 mm, so doesn't impinge on the neurovascular bundle or alter the geometry of the intercostal space. **(11)**

Although the duration of chest drains placement in the patients showed no statistically significant difference but the total duration of patients' hospitalization was much lesser in group I than group II and this can be explained by the fact that 14 patients (46.7 %) from group I were managed as outpatients while all patients in group II were managed as inpatients.

Parulekar et al. **(8)** and Caglayan et al. **(12)** reported that there was no statistically significant difference between both groups as regards the duration of chest drain placement. Saffran et al. **(13)** and Musani et al. **(14)** reported that implementation of small bore pleural catheters for home drainage of malignant pleural effusions provided cost effective and minimally invasive outpatient approach to relieve respiratory symptoms and to achieve pleurodesis compared to other strategies for management of malignant pleural effusions. On the other hand Parulekar et al. **(8)** who managed both groups as inpatients and found that there was no statistically significant difference between the two groups as regards the total duration of hospitalization.

Although some complications were encountered in one group and not in the other group but all of them are statistically not significant and generally none of the both techniques have more incidences of complications than the other. The incidence of pneumothorax occurred in small bore catheter patients was 3.3 % while with Davies et al. **(15)** the incidence was 4/77 cases (5.2%) and with Horsley et al. **(10)** it was 2/52 (3.8%).

Conclusions

From this study we conclude that small bore pleural catheter has the same efficacy as the large bore chest tube in drainage of malignant pleural effusion. Also it is significantly less painful and reduces the length of hospital stay for the patient.

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Extraction of Inhaled Tracheobronchial Pins, Middle of the Night or the Next Morning?

Mohab Sabry, MD

Background: **Aspiration of pins in the tracheobronchial tree is frequently seen problem in Islamic countries especially in young teenage females using headscarfes. These conditions are usually early presented and seeking medical advices and easily diagnosed using chest radiography.**

Patients and methods: **This is a retrospective study included 121patients with inhaled tracheobronchial pins presented to CardioThoracic surgery department, Tanta University Hospitals from January 2010 to December 2011. All these patients had been subjected to rigid bronchoscopy for extraction of the inhaled pins and were categorized into 2 groups: group I, rigid bronchoscopy was done as an emergency procedure whatever the time of presentation and group II, rigid bronchoscopy was done as a scheduled procedure in the next available daytime operating list.**

Results: **Group I included 48 patients and group II included 73 patients. There were no statistically significant differences between the 2 groups regarding preoperative data and complications from the presence of the pin, but group II had better rate of success(95.9%) for tracheabronchial pin extraction than group I (87.5%) and also shorter bronchoscopic time (29.5±18.4 min.) than group I (42.6±22.4 min.).**

Conclusions: **Delaying the extraction of tracheobronchial pins to the next scheduled daytime operating list is a safe practice. We have not identified any respiratory distress or adverse outcomes related to delaying bronchoscopy to the next available daytime operating list.**

Key words: **Rigid bronchoscopy • foreign body inhalation • tracheabronchial foreign bodies • pins inhalation.**

Foreign body inhalation is usually one of the frequently seen and challenging cases in the field of thoracic surgery

In non Islamic countries, usually the majority of foreign bodies aspiration occurs in children and if occurred in adults, most of foreign bodies aspirations are seen in the 6th or 7th decade of life when airway protective mechanisms function inadequately e.g. due to central nervous system dysfunction, intubation or facial traumas. **(1)**

However, in Islamic countries some traditional or social habits have become a discrete category of foreign bodies' aspiration. This is seen in women wearing headscarves in Islamic countries because of socio-cultural and religious tradition. Some women tend to hold the headscarf pin between their lips while wearing headscarves using their two hands to secure the veil. Any maneuver, such as laughing, talking and coughing then predispose them to aspiration, especially in the young teenage groups where they lack experience with such maneuver. **(2-6)**

In contrast to other forms of foreign body aspiration, headscarf pin aspirations tend to be easily diagnosed as all of these inhaled foreign bodies are radio-opaque and, as such, can be picked up easily by chest radiography. Furthermore, in contrast to other forms of foreign body aspiration, chronic forms are rarely encountered because patients tend to seek medical advice quicker than in organic foreign body aspiration. Therefore, diagnostic bronchoscopy is rarely needed but rather a therapeutic intervention is required. **(7)**

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Patients and Methods

This is a retrospective study included patients with inhaled tracheobronchial pins presented to CardioThoracic surgery department, Tanta University Hospitals from January 2010 to December 2011. All these patients had been subjected to rigid bronchoscopy for extraction of the inhaled pins. Those patients were categorized into 2 groups: group I, rigid bronchoscopy was done as an emergency procedure whatever the time of presentation and group 2, rigid bronchoscopy was done as a scheduled procedure in the next available daytime operating list.

Exclusion criteria were patients with inhaled foreign bodies other than pins and patients had been subjected before to previous failed bronchoscopic trials for pins extraction.

Diagnosis of foreign bodies in the tracheobronchial tree is based on patient`s history for pin inhalation and plain chest x ray postero-anterior and lateral views for confirmation of the presence of the pin in the tracheobronchial tree. Prophylactic oral antibiotics for 5 days were routinely described to all patients in both groups.

Data collected:

Preoperative data collected for the patients included age, sex, clinical examination for the patients, site of pin in the tracheobronchial tree, duration of inhaled pin inside the patient at time of presentation, complications from the presence of the pin and occurrence of spontaneous expulsion before bronchoscopy.

Operative data included duration of the bronchoscopic maneuver starting from insertion of the bronchoscope tube till extraction of the pin, success rate of pin extraction by the rigid bronchoscopy and intraoperative complications.

Postoperative data included complications occurred in the patients post bronchoscopic maneuver.

Results

During the period of study 139 patients with inhaled tracheobronchial pins had been presented to CardioThoracic surgery Department, Tanta University Hospitals. From those patients 18 patients were excluded because they had been subjected before to previous failed bronchoscopic trials for pins extraction in other centers so they routinely scheduled in the operating list.

The remaining 121 patients were classified into 2 groups: group I included 48 patients in whom rigid bronchoscopy was done as an emergency procedure whatever the time of presentation and group II included 73 patients in whom rigid bronchoscopy was done as a scheduled procedure in the next available daytime operating list.

Preoperative data of the patients (table 1) showed that there were no statistically significant differences between the 2 groups regarding age, sex, respiratory distress, site of pin in the tracheobronchial tree, duration of inhaled pin inside the patient at time of presentation, complications from the presence of the pin but there was statistically significant difference regarding occurrence of spontaneous expulsion before bronchoscopy as 4 patients from group II spontaneously expulsed the pin with an attack of severe cough before the scheduled time for bronchoscopy.

		Group I (n= 48)	Group II (n= 73)	P- Value
Age (years)		15.3 ± 6.9	16.7 ± 7.6	>0.05
Sex	Male	5 (10.4%)	9 (12.3%)	>0.05
	Female	43 (89.6%)	64 (87.7%)	
Respiratory distress		0	0	>0.05
Site of pin in tracheobronchial tree	Tracheal	4 (8.3%)	3 (4.1%)	>0.05
	Right bronchus	28 (58.3%)	48 (65.8%)	
	Left bronchus	16 (33.3%)	22 (30.1%)	
Duration of inhaled pin inside the patient at time of presentation (hours)		6.1 ± 11.8	8.4 ± 13.3	>0.05
Complications		0	0	>0.05
Spontaneous expulsion		0	4 (5.5%)	<0.05*

Table 1. Preoperative data of the patients. ****significant***

		Group I (n= 48)	Group II (n= 73)	P- Value
Duration of bronchoscopic maneuver (minutes)		42.6 ± 22.4	29.5 ± 18.4	<0.05*
Success of pin extraction		42 (87.5%)	70 (95.9%)	<0.05*
Intraoperative complications	Pneumothorax	1 (2%)	1 (1.4%)	>0.05
	Subcutaneous emphysema	4 (8.3%)	5 (6.8%)	
	Severe bleeding	0	0	

Table 2. Operative data of the patients. ****significant***

		Group I (n= 48)	Group II (n= 73)	P- Value
Postoperative complications	Hemoptsis	31 (64.6%)	50 (68.5%)	>0.05
	Fever	10 (20.8%)	12 (16.4%)	>0.05
	Chest infection	2 (4.2%)	2 (2.7%)	>0.05

Table 3. Postoperative data of the patients.

Operative data of the patients (table 2) showed that there were statistically significant differences between the 2 groups regarding duration of bronchoscopic maneuver and success of pin extraction by rigid bronchoscopy but there was no significant difference regarding intraoperative complications. Cases of pneumothorax from both groups required insertion of chest tubes but subcutaneous emphysema was limited to small area and resolved spontaneously without surgical interference.

Postoperative data of the patients (table 3) showed that there were no statistically significant differences between the 2 groups regarding postoperative complications occurred in the patients such as hemoptsis, fever, and chest infection. Cases of hemoptsis from both groups had blood tinged sputum that last for maximum 48 hours. Also, fever did not last for more than 48 hours in any case in both groups. Chest infection was in the form of acute bronchitis that required intravenous antibiotics for 5-7 days and resolved completely.

Discussion

Timing of bronchoscopy for extraction of tracheobronchial foreign bodies is usually a matter of controversy. In our center, some surgeons prefer to go immediately once the case is diagnosed to the operating room for bronchoscopic extraction of the foreign body but others prefer to schedule this patient to the next operating list.

The opinion of immediate interference is supported by the fact that the longer a foreign body is left in situ, the greater the inflammatory response and the likelihood of complications. But this inflammatory response is much more significant with food particles because of their oil content, most frequently inhaled vegetable matters, such as peanuts, seeds and nuts set up intense inflammatory responses, thus narrowing the airway further, causing consolidation to develop distal to the obstruction. **(8)**

The opinion of delayed interference is also supported by the fact that delaying removal of suspected inhaled foreign bodies to allow optimal circumstances for manipulation of the airway is a safe practice and no adverse outcomes related to delaying bronchoscopy to the next available daytime operating list in the clinically stable patient. **(9)**

A few studies were done on the inhaled pins in Islamic countries and did not focus on timing of bronchoscopy but they recommend that once diagnosed by means of radiography, these inhaled pins should be removed bronchoscopically either by rigid bronchoscopy or flexible bronchoscopy. **(10)**

In our study as there were not any patients presented with real respiratory distress due to pin inhalation and all of them just needed reassurance, so all of them could be managed safely either as emergency or scheduled procedures.

The scheduled procedures in our study had better rate of success for tracheabronchial pin extraction and also shorter bronchoscopic time than the emergency procedures. This can be explained by the availability of more expert surgeons during the scheduled daytime operating list, better circumstances

in the operating room including stuff and equipments and also better anesthesia team.

Although we encountered some cases of spontaneous expulsion of the inhaled pin before the scheduled operating list (5.5%) and this was also reported in other study with an incidence of 5/17 (29.4%) **(11)**, but we did not feel safe to depend on this and postpone the patients for more than the next daytime operating list.

No added complications were recorded related to timing of interference in both groups neither the immediate nor the delayed group.

The main limitation of our study is the retrospective nature of the analysis. However, within this acceptable limitation, we believe our work will shed more light into the subject of headscarf tracheobronchial pin aspiration.

Conclusions

From this study we can conclude that delaying the extraction of tracheobronchial pins to the next scheduled daytime operating list is a safe practice. We have not identified any respiratory distress or adverse outcomes related to delaying bronchoscopy to the next available daytime operating list

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Short Term Outcome of Pulmonary Resections For Tuberculosis-Related Hemoptysis

Hany Mohamed El-Rakhawy, MD

Objectives: **To evaluate the results and short term outcome of pulmonary resections for patients complaining of tuberculosis-related hemoptysis.**

Patients & Methods: **The study included 18 patients with tuberculosis-related hemoptysis, proved radiologically to have localized pulmonary lesions as a source for hemoptysis, all patients subjected to the routine laboratory investigations. In all patients pulmonary resection was done either in the form of lobectomy (in 15 patients) or pneumonectomy (in 3 patients).**

Results: **According to severity of hemoptysis 4 (22.2%) patients presented by massive hemoptysis, 6 (33.3%) patients presented by major hemoptysis and 8 (44.4%) patients presented by minor hemoptysis. Radiological findings showed cavitary lesions in 15 (83.3%) patients and 3 (16.7%) patients had destroyed lung. operative time ranged from 86 to 210 minutes, with a mean of 144 minutes. There was no intraoperative, nor post-operative mortality. There was no major complications with smooth postoperative course and follow-up.**

Conclusion: **Pulmonary resection for patients having tuberculosis-related hemoptysis carry favorable results and excellent short term outcome.**

Keywords: **Tuberculosis, Hemoptysis, Lobectomy, Pneumonectomy, Destroyed lung, Cavitation.**

Hemoptysis is defined as the expectoration of blood originating from the tracheobronchial tree or pulmonary parenchyma. The severity of hemoptysis has various definitions, ranging from 100 mL to 1 L of blood expectorated in 24 hours.[1] Hemoptysis due to pulmonary tuberculous lesions is a common cause of morbidity, and occasionally mortality.[2]

As mycobacterium tuberculosis (MTB) infects one-third of the world's population.[3] So, pulmonary tuberculosis (PTB) is a common cause of hemoptysis especially in developing countries.[4] Although, the central mechanisms resulting in tissue damage have not been defined.[5] MTB subverts the host immune response to drive proteolytic destruction of the extracellular matrix and caseation that leads to cavitation.[6-8]

hemoptysis due to pulmonary tuberculosis occurs as a complication of many sequelae such as cavities and bronchiectasis.[9] Pulmonary tuberculosis produces a broad spectrum of radiographic abnormalities.[10] Cavitation is the most important radiologic finding in PTB. Cavitation implies a high bacillary burden and high infectivity.[11] Destroyed lung caused by tuberculosis is an end-stage phenomenon prone to serious complications. The involved lung is nonfunctional with demonstrable absent perfusion and ventilation. It is nonetheless richly vascularized by systemic arterial connections. This neovascularization is effected by the bronchial arterial system and includes the adjacent intercostal arteries, branches of the subclavian, axillary, pericardial, diaphragmatic, and esophageal arteries. Thin-walled new vessels bleed readily as evidenced by the commonness of chronic, recurrent, and often massive hemoptysis.[12]

Treatment options for hemoptysis include bronchoscopic balloon tamponade using Fogarty catheter with or without endobronchial instillation of epinephrine, bronchoscopic laser photocoagulation, bronchial artery embolization and surgical

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resection for localized lesions.[13-16] Bronchial artery embolization rarely results in control of hemoptysis because of the massive collateral blood vessels.[17] Surgical resection is a definitive curative method for hemoptysis with localized lesions.[18]

Patients and Methods

This is a prospective study, included 18 patients presented by different degrees of recurrent hemoptysis, the study was conducted at Department of Cardiothoracic Surgery, Benha University Hospital & Department of surgery in 23rd of July Chest (Sadr El-Marg) hospital since Jan 2008 till Jan 2010 to allow a minimum follow-up period of 6 months for the last case operated upon. Preoperatively all patients subjected to: Full medical history and clinical examination. Chest X-ray PA & lateral views and Chest CT **Fig. (1,2)** & Sagittal CT reformation.**Fig.(3)** CBC& complete coagulation profile. ECG done for all patients & Echocardiography for selected cases. Liver function tests and Kidney function tests. Bronchscopic examination by fiber-optic bronchoscpe. Sputum analysis for acid fast bacilli for three successive days.

A standard double-lumen tube was used for one-lung ventilation, and the operation was performed through a posterolateral thoracotomy in all patients. After entering the thoracic cavity of the affected side, adhesions are freed by blunt and sharp dissections. For cases operated by lobectomy, lobar arteries and veins of the targeted lobe are identified and transected after ligation by 2 proximal and one distal ligatures, the bronchus of the targeted lobe is freed from the surrounding tissues, clamped by bronchus clamp and resected. The bronchial stump is closed by interrupted 3/0 PDS stiches. For cases operated by pneumonectomy, the main pulmonary artery and the two pulmonary veins of the targeted lung are identified ligated and transected after ligation by 2 proximal and one distal ligatures, the bronchus of the targeted lung is freed from the surrounding tissues, clamped by bronchus clamp and resected. The bronchial stump is closed by interrupted 3/0 PDS stiches.

After assuring hemostasis, two chest-drainage tubes were inserted for cases operated by lobectomy and one chest-drainage tube for cases operated by pneumonectomy intercostal nerve block was performed for postoperative analgesia. Rescue postoperative analgesia was provided in the form of intramuscular injections of mepridine 50 mg only on request or if pain hindered respiration. Resumption of oral intake was allowed once patient was fully conscious and able to swallow. For cases operated by pneumonectomy, the chest tube was clamped close to the skin, opened when needed if the mediastinum is not centralized then removed after 24 hours. For cases operated by lobectomy chest tubes were removed after stoppage of the air-leak and approaching minimal amount of drainage for two consecutive days. Patients were discharged after assuring absence of wound complications.

Results

- The study included 18 patients; 10 females and 8 males with mean age (SD) of 47.94±12.62 years; range: 22-69 years. With mean male age of 53.25 years and mean female age of 43.7 years.
- 11 (61.1%) patients are diabetic, 7 of these patients are female and 4 males
- 5 (27.8%) patients were sputum positive for acid-fast bacilli.
- 4 (22.2%) patients presented by massive hemoptysis, 6 (33.3%) patients presented by major hemoptysis and 8 (44.4%) patients presented by minor hemoptysis.
- Radiological findings showed cavitary lesions in 15 (83.3%) patients and 3 (16.7%) patients had destroyed lung. Of those having cavitary lesions 8 patients had the lesion in right upper lobe, 7 in the left upper lobe. And of those having destroyed lung two had destroyed right lung and one had destroyed left lung. **Table (1) shows Demographic & clinical data and CT findings.**
- 4 patients of those with cavitary lesions, showed fungus ball within the cavity Fig. (4). 2 of these patients had right sided lesions and 2 left sided.
- Consequently, 8 (44.4%) patients operated by right upper lobectomy, 7 (38.8%) patients operated by left upper lobectomy, two (11.1%) patients operated by right pneumonectomy and one (5.5%) patient operated by left pneumonectomy. **Fig. (5)**
- Intraoperative blood transfusion ranged from 500 to 1500ml of blood with a mean (SD) of 805.56±348.9 ml.
- The mean (SD) operative time was 144.28±36.3, 3 minutes ranged from 86 to 210 minutes.
- There was no intraoperative mortality.
- 5 (27.8%) patients complicated by prolonged air-leak, one of them had wound infection that became evident on the 5th post-operative day.
- In the three cases for whom pneumonectomy was done the chest tube, was clamped in the operative room and removed after 24 hours, as there was no shift of the mediastinum, the mean period for chest tube removal in this study was 6.39 days with SD of 3.91 and the rage was 1-17 days.
- Hospital stay of the patients ranged from 5-22 days with a mean (SD) of 8.94±4.22 days. **Fig. (6)**

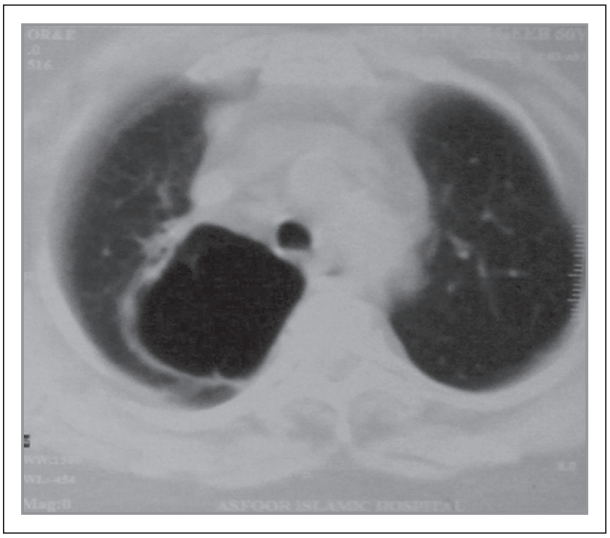

Fig. 1. CT-Chest showing Rt. Upper lobe large cavity

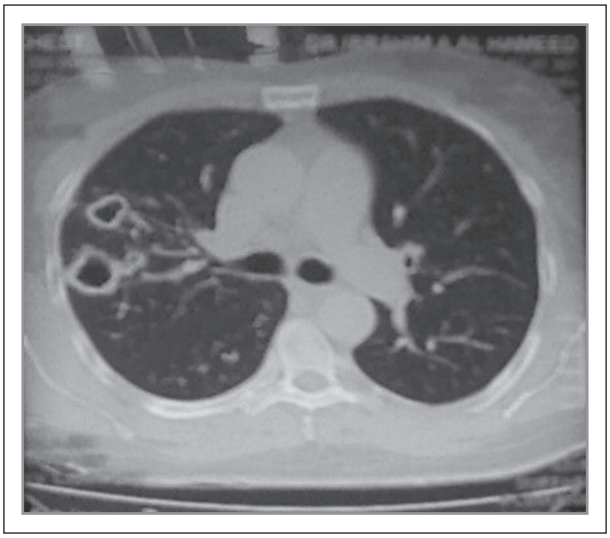

Fig. 2. CT-Chest showing Rt. Upper lobe multiple cavitary lesions.

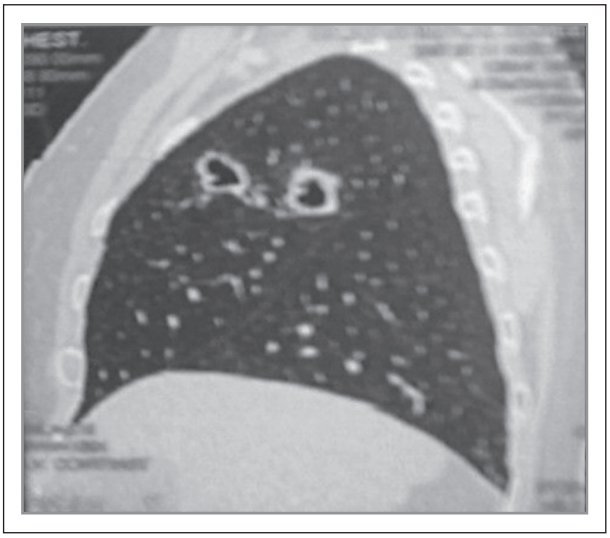

Fig. 3. CT-Chest sagittal reformation showing multiple Rt. Upper lobe cavitary lesions.

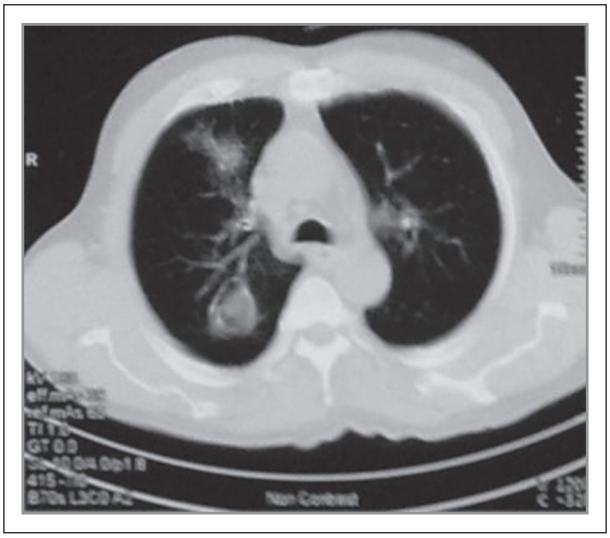

Fig. 4. CT-Chest showing Rt. Upper lobe cavity with a fungus ball

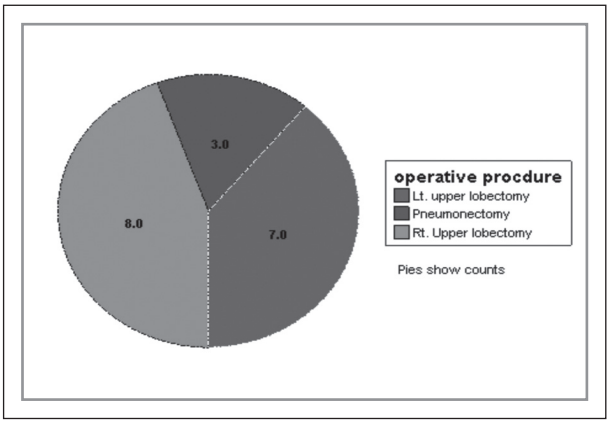

Fig. 5. The percentage of the operative procedure

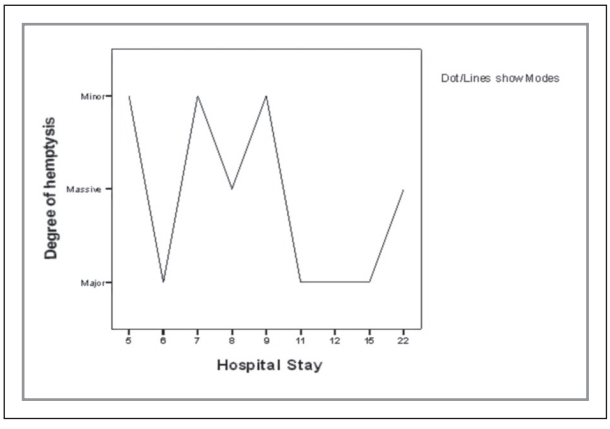

Fig.6. Interactive graph between the degree of hemoptysis and hospital stay

No.	Age	Gender	Diabetes	Degree of Hemoptysis	CT Findings
1	48	Female	Diabetic	Massive	Cavity
2	55	Male	Diabetic	Major	Cavity
3	32	Female	Non-diabetic	Major	Cavity
4	63	Female	Diabetic	Massive	Cavity
5	56	Male	Diabetic	Minor	Destroyed lung
6	22	Female	Non-diabetic	Major	Cavity
7	48	Male	Non-diabetic	Minor	Cavity
8	39	Female	Diabetic	Minor	Cavity
9	57	Female	Diabetic	Massive	Cavity
10	62	Male	Non-diabetic	Minor	Cavity
11	47	Female	Diabetic	Minor	Destroyed lung
12	46	Male	Non-diabetic	Major	Cavity
13	56	Male	Diabetic	Minor	Cavity
14	34	Male	Non-diabetic	Minor	Cavity
15	52	Female	Diabetic	Major	Cavity
16	29	Female	Non-diabetic	Major	Cavity
17	69	Male	Diabetic	Minor	Destroyed lung
18	48	Female	Diabetic	Massive	Cavity

Table 1. Demographic data, clinical data and CT findings.

Discussion

All patients included in this study known to have pulmonary tuberculosis for which they were receiving or still receiving antituberculous medications. Based on the quantity of blood expectorated per day and according to **Erdogan et al.**[19] hemoptysis is classified in three groups : persistent minor (less 200 mL daily, lasting at least 4 days), major (200 to 600 mL daily), and massive (more than 600 mL daily). In this study, the same classification is used as an indicator for the severity of hemoptysis. **Erdogan et al.**[19] in a similar study on surgical management of tuberculosis-related hemoptysis, that included 59 patients; the degree of hemoptysis was massive hemoptysis in 21 (35.6%) patients, major hemoptysis in 24 (40.7%) patients and minor hemoptysis in 14 (23.7%) patients. While, in this study: 4 (22.2%) patients presented by massive hemoptysis, 6 (33.3%) patients presented by major hemoptysis and 8 (44.4%) patients presented by minor hemoptysis. 2 of the patients presented by massive were operated in same day of admission as emergency cases, the other 2 cases were operated in the next day of admission. The other patients were operated in the 3rd & 4th day of admission.

Kim et al.[20] stated that, relative risks of developing PTB of all types and bacteriologically confirmed cases were 3.47 times and 5.15 times higher in the diabetics (TBDM), than in non-diabetics. In this study, 11 (61.1%) patients are diabetic and 5 (27.8%) were sputum positive for acid-fast bacilli. Also, regarding diabetes and TB lesions **Pérez-Guzman et al.**[21] reported that TBDM patients developed cavitations (82%) vs. (59%) in TB without DM and more multiple cavities were seen in TBDM patients (25% vs. 2%). In this study all patients with destroyed lung (*n=3*) are diabetic, and 8 patients with cavitary lesions are diabetic.

Ashour et al.[22] reported the incidence of lung destruction in 1600 cases of pulmonary tuberculosis, lung destruction have been present in 172 (11%). The left lung was destroyed in 109 (63 %) and the right in 63 (37%). in this study there were 3 (16.7%) cases of post-tuberculous lung destruction, 2 of them had destroyed right lung and one had destroyed left lung.

In this study, 4 patients had aspergillomas presented by fungal ball within the cavitary lesion, aspergillomas is a very common squelae of post-tuberculous cavitary lesions as in a study done by **Regnard et al.**[23] on 89 patients surgically treated for aspergillomas, Seventy percent of aspergillomas had developed in cavitation as sequelae of tuberculosis.

All patients presented by massive hemoptysis *(n=4)* received preoperative blood transfusion, 4 patients who presented by major hemoptysis *(n=6)* and 5 patients of those presented by minor hemoptysis *(n=8)* received preoperative blood transfusion. All patients received intraoperative blood transfusion ranged from 500 to 1500 ml. with a mean of 806 ml, there was no postoperative blood transfusion for any of the patients. Regarding this point the results of this study was far away from that reported by **Lu et al.**[24] as only 5 of 14 patients included in that study required blood transfusion with mean intraoperative and postoperative blood loss within the first 24h of 192.3 ml.

The mean operative time was 144, ranged from 86 to 210 minutes, which was within the normal range of any lobectomy or pneumonectomy. The time depended on the degree of adhesions, the fissure being complete or not, and the time to obtain hemostasis which vary from patient to another.

There was no intraoperative, nor post-operative mortality; and this result was better than that obtained by **Ayed**[25] who reported hospital mortality rate of 4% (2/53), for cases of pulmonary resection for massive hemoptysis. Also, was better than the results obtained by **Erdogan et al.**[19] who reported perioperative mortality of 6.8%.

Brik et al.[2] reported bronchopleural fistula and recurrent hemoptysis in a similar study. In this study, apart from prolonged air-leak that occurred in 5 patients and delayed wound healing ended by wound gaping in one patient which resolved by curettage with re-stitching the wound and frequent dressing , there was no notable complications.

Hospital stay of the patients ranged from 5-22 days with a mean of 8.9, which much less than that reported by **Andréjak et al.**[26] who reported average hospital stay of 25 days.

Sputum culture done for previously sputum positive cases *(n=5)* after 2 months of the antituberculous medical treatment, and all became sputum negative, and advised to continue the antituberculous regimen for another 4 months. All patients followed for 6 months post-operatively in the out-patient clinic with no recurrence of the hemoptysis, nor any notable complications related to the surgery.

Conclusion

Tuberculosis-related hemoptysis is a serious condition, if the source of hemoptysis is localized, surgical resection of the source of hemoptysis in the form of lobectomy or pneumonectomy carries favorable results and excellent short term outcome.

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Outcome of Bronchopulmonary Carcinoid Tumors: A Ten – Year Review of A Single Institution's Experience

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Background: **Surgical resection remains the gold standard for treatment of carcinoid tumors. The slow growth behavior of the typical type and apart from the atypical type has encouraged a conservative resection option with more towards tissue sparing techniques. This report presents a single institute retrospective audit of surgical management including bronchoscopic resection of 73 patients with carcinoid tumors.**

Methods: **Between 2000 and 2010 we retrospectively analyzed the data of 73 consecutive patients undergoing anatomical, tissue sparing and non-anatomical and bronchoscopic resection for carcinoid tumors.**

Results: **There were 43 females and 30 males with mean age of 41.9 ± 13.9. Their most common symptoms were hemoptysis and cough. The most common radiological appearance was a perihilar mass in 67.1 % of patients. Surgical resection was done in 68 patients (93.1 %) in which anatomical resection was done in 57 patients (78%) and non-anatomical/ bronchoscopic resection in 16 patients (eleven patients underwent wedge resection and five patients underwent bronchoscopic excision). Nodal involvement was present in 7 patients (9.5 %) with pN1 in 5patients and pN2 in 2. There was no hospital mortality or major morbidity and 5 years survival was 97.3 %.**

Conclusion: **Carcinoid tumors have mostly been responsive to surgical resection with good prognosis, however pathological type and nodal status influence outcome.**

Keywords: **Neuroendocrine lung tumors, bronchopulomonary carcinoid**

Bronchial carcinoid is a rare malignant neoplasm, arising from pulmonary neuroendocrine cells and represent 2-5 % of all lung cancers [1]. In 1999 the WHO classified carcinoid tumors into typical and atypical types according to the number of mitosis and the presence of necrosis [2, 3]. Typical carcinoid tumors typically located centrally are slowly growing, low-grade malignancy with favorable prognosis after resection [4]. However, in up to 15 % of cases local lymphatic involvement has been documented and in another 15 % distant metastasis may occur. Atypical carcinoid is more aggressive with intermediate malignant behavior. In this report we audit our surgical management including bronchoscopic resection to investigate the outcome and prognosis after conservative management.

Patients and Methods

This is a retrospective study of 73 consecutive patients admitted between January 2000 and January 2010 at Cairo University Hospitals who underwent surgical or bronchoscopic resection of carcinoid tumors of the lung. The medical data of all patients were analyzed and include preoperative evaluation regarding patients demographic data including age, sex, smoking, associated syndromes, latent time for diagnosis, preoperative imaging and diagnostic tool (chest x-ray and CT scan) and fibro-optic bronchoscope. All tumors which were accessible to bronchocopic biopsy were considered central, while those not accessible were considered peripheral.

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Every effort was done to preserve lung parenchyma and perform systematic mediastinal and hilar lymph node dissection. Both clinical and later pathological staging were considered. All pathological specimens were reviewed by a single pathologist according to WHO classification into typical and atypical carcinoid. Operative data include type of the operation. The post operative period data was also analyzed regarding intensive care course, post procedure complications and hospital stay. Follow up was strictly followed at outpatient chest clinic including follow up chest x-ray at 6 months, and then yearly interval. Emails and telephone were used to follow some remote patients with their local referring doctors.

Results

Patient demography and clinical evaluation (table 1)

There were 43 females (58.9 %) and 30 males (41%), with a mean age of 41.9 ± 13.9 ranging from 16 – 72 years. The m/f ratio was 1:1.4. In this study 15 patients were smokers in the male group and only one patient of the smokers had atypical carcinoid. The main presenting symptom in this study was hemoptysis, followed by repeated pulmonary infection and asthma like symptoms. The mean time from symptoms to referral for surgical opinion was 150 ± 60.3 days ranging from (60 – 375) days. Two patients were referred for recurrence following previous surgery for carcinoid 12 and 23 months after resection. These patients were operated upon in another center and presented with hemoptysis.

Variables	
Age	mean 41.9 ±13.9 years
Sex m/f	1:1.4
Smoking	20.5 %
Presentation	
1. Hemoptysis	50.6 %
2. Repeated chest infection	31.5 %
3. Cough	32.2 %
4. Dysponea	31.5 %
5. Asthma like symptoms	17.8 %
6. Recurrence	2.7 %
7. Accidental discovery	2.7 %
Time from symptoms to referral	mean 150 days ± 60.

Table 1. Demographic and clinical data

Diagnostic radiology and bronchoscopy (Table 2,3)

The most common radiological appearance was perihilar opacity in 67.1%, peripheral opacity in 20.5 % and signs of bronchial obstruction in 19.1 % of patients. Positron emission tomography was done in two patients with mediastinal lymph nodes and was negative. Fifty-two patients underwent preoperative flexible bronchoscopy (71.2 %). Endobronchial mass could be seen in 27 patients out of which 19 (36.5 %) patients had an endobronchial mass with significant extraluminal extension (iceberg lesion). In 16 (30.7 %) patients there was no endobronchial lesion detected and a transbronchial biopsy was done with 50 % positive yield. This resulted in 35 patients (67.3 %) with positive biopsy. In this group of patients mild to moderate bleeding occurred in 9 patients (17.3 %), and could be managed with ice-cold saline. In two patients argon plasma coagulation was used. These patients were kept overnight under observation in the hospital. Non of the patients needed blood transfusion.

Appearance	Patients (n = 73).
Rounded hilar mass	7 (9.5 %)
Rounded or ovoid perihilar mass	49 (67.1 %)
Signs of bronchial obstruction	14 (19.1 %)
1. Atelectasis	6
2. Bronchiactasis	5
3. Lung abscess	2
4. Air trapping	1
Peripheral nodule	15 (20.5 %)
Presence of calcification	4 (5.4 %)
Recurrence	
1. Case I	Left main stump
2. Case II	Left main bronchus

Table 2. Radiological data

	Patients (n=52)
Biopsy accessible lesion	43(82.6%)
1. Endobronchial tumor	
a. Complete	8 (15.2 %)
b. Incomplete (iceberg)	19 (36.5 %)
2. Parenchymal (extrabronchial)	16 (30.7 %)
Biopsy non-accessible lesion	9 (17.3 %)
Number of biopsies/lesion	3 ± 1*
Positive biopsies	35(67.3 %)
Complications	
1. Non-specific chest pain.	5 (9.6 %)
2. Mild to moderate Bleeding.	9 (17.3 %).

Table 3. Bronchoscopic data ****mean±SD***

Tumors characteristic (Table 4)

Seven patients (9.5 %) had the tumor in the main bronchus (4 right and 3 left) with two patients referred with recurrence. The first patient had a recurrence on the left main stump 12 months following left pneumonectomy and the other in the left main bronchus following right pneumonectomy 23 months earlier. Seventeen patients (23.8 %) had the tumor in the upper lobe (11 right and 6 left). Twenty-one patients (28.7 %) had the tumor in the intermediate bronchus and 26 patients (35.6%) had the tumor in the lower lobe (15 right and 11 left). Two patients (2.7%) had the tumor in their right middle lobe. The mean tumor mass size was 39.2 ± 14 mm ranging from (10 – 70) mm. The mean pT1 size was 23.7 ± 6.4 mm and the mean pT2 size was 48.9 ± 10.3. The tumor was less than 30 mm in 25 patients (34.2 %) and more than 30 mm in 48 patients (65.7%). In this study 5 patients had pN1, their mean tumor size was 44.2 mm. There were 2 patients with pN2, their tumor size was 60 and 70 mm respectively. The microscopic examination of the 73 patients showed that 70 patients (95.8 %) were of typical carcinoid while only 3 patients (4.1 %) were atypical pathology. Two patients of the atypical type had pN2 and the third was recurrent on the left main bronchus 23 month following right pneumonectomy. Calcifications were present in 8 patients (10.9%) in which calcifications were seen on CT scan in 4 patients (5.4 %).

TNM staging (Table 4)

All patients in this study had the carcinoid tumor confined to the bronchopulmonary tissue including two patients with recurrence. In this study we retrospectively restaged the patients according to the 7th edition TNM classification for lung cancer. Almost one-third of the patients (31.5 %) presented with stage IA. Almost half of the patients (46.5 %) presented with stage IB. Twelve patients (16.4 %) presented with stage IIA. Two patients (2.7 %) presented with stage IIB and another 2 presented with stage IIIA.

Operative procedure and complications. (Table 5)

In this study 5 patients out of 73 had bronchoscopic removal of intraluminal carcinoid (table 4). Sixty-eight patients were operated upon, the most frequent resection was lobectomy in 41 patients (56.1%) in which 2 patients had sleeve lobectomy, bi-lobectomy was done in 9 patients, and 3 patients had pneumonectomy. Lung tissue sparing procedures were done in 20 patients including five endoscopic resections. In the other 15 patients, 11 wedge resections and 4 anatomical segmentectomy were done. The mean hospital stay was 7.1 ± 2 days ranging from 5 – 11 days. There was no perioperative death and no complications apart from atelectasis in 3 patients that responded to physiotherapy and 2 patients with superficial wound infection that required frequent dressings.

Variables	Patients (n = 73)
Site	
1. Main bronchus	7 (9.5 %)
2. Upper lobes	17 (23.2 %)
3. Intermediate bronchus	21 (28.7 %)
4. Lower lobes	26 (35.6 %)
5. Middle lobe	2 (2.7 %)
Size	
1. pT1	23.7 ± 6.4 mm
2. 2.pT2	48.9 ±10.3 mm
a. Size < 30mm	25 (34.2 %)
b. Size > 30 mm	48 (65.7 %)
Lymph nodes	
1. pN1	5 (6.8 %)
2. pN2	2 (2.7 %)
Microscopy	
1.Typical	70 (95.8 %)
2. Atypical	3 (4.1 %)
Calcification	8 (10.9 %)
Stage	
1. IA	31.5 %
2. IB	46.5 %
3. IIA	16.4 %
4. IIB	2.7 %
5. IIIA	2.7 %

Table 4. Pathological characteristics and staging

Variables	Patients (n =73)
Anatomical resection	
1. Pneumonectomy	3 (4.1 %)
2. Bilobectomy	9 (12.3 %)
3. Lobectomy	41(56.1 %)
4. Segmentectomy	4 (5.4 %)
Non anatomical resection	
1. Wedge resection	11 (15 %)
2. Endoscopic mechanical excision + Argon plasma	5 (6.8 %)

Table 5. Operative data

Outcome and follow-up.

Follow-up was from 1.5 to10 years with a mean of 5.3 ± 6.4 years. In this series all 73 patients underwent tumor resection. Sixty-eight patients had surgical resection and 5patients had endoscopic resection out of these endoscopic resection cases, 2 were referred with local recurrence after pneumonectomy elsewhere 12 and 23 months post initial procedure. During the

follow-up period 1 patient who underwent endoscopic resection had local recurrence and underwent Bilobectomy 14 months after the original procedure. Two patients in the surgical group had local recurrence 13 and 18 months after wedge resection and underwent completion lobectomy. Two patients had distant metastasis 7 and 8 months after lobectomy for atypical carcinoid with pN2. They died 4 and 6 months after discovering metastasis affecting their liver and bones. Patients with lymph nodes were referred for adjuvant chemotherapy.

Discussion

Bronchopulmonary carcinoid tumors are still debated to regard them as malignant or benign tumors. [3] The WHO/IASLC classification [2] includes typical and atypical carcinoids in the spectrum of neuroendocrine tumors but groups them separately from large cell neuroendocrine carcinoma and small cell lung carcinoma on the basis of closer histologic and biologic characters. [6,7] They are low-grade malignant tumors, which can be locally invasive or spread to lymph nodes, but distant metastases are rare.

In our study, females were more often affected than males. Others have reported this;[8] whereas some have found a male preponderance,[9] others stated that prevalence of these tumors is almost equal in male and female patients. [10] We also noted that most tracheobronchial carcinoids were typical carcinoids, as previously documented.[8,9]

The mean age of our patients was 41.9 ± 13.9 years (range 16-72 years), which is in line with other reports. [11-14]

The influence of smoking on the pathogenesis of carcinoid tumors is still debated. Fifteen patients (20.5%) in our study were smokers or ex-smokers, while other authors stated that two thirds of their patients were smokers. [15] Detection of a bronchial carcinoid may follow a variety of pulmonary symptoms, or the tumors may be found on a routine chest radiograph. Most cases in this study were misdiagnosed as tuberculosis or bronchiectasis, [16] which explains the long time needed until referral for surgery (mean 150 ± 60.3 days).

Central lesions usually present radiographically as well-defined round or ovoid endobronchial masses, nodular hilar or perihilar masses, and may be associated with atelectasis, air trapping, lung abscess and bronchiectasis, whereas peripheral bronchial carcinoids appear as solitary nodules.[16,17] Computed tomography of the chest defines these masses better, their relationship to the tracheobronchial tree and the presence of calcification. [17] The most common radiological findings were perihilar opacities in 67.1% of cases. Peripheral opacities were present in 20.5% of cases.

Bronchoscopy plays a big role in the diagnosis of carcinoids: in the majority of cases the tumor is centrally located and visible at endoscopic evaluation, in this study 53 patients had a bronchoscopy done, in 27 of those a mass was clearly visualized (52%). This complies with that described by other authors . [12,18]

In most of our cases, bronchoscopy revealed the classic picture of smooth cherry-red polypoid endobronchial nodules that sometimes appeared obviously vascular.

Some authors found bleeding to occur in two thirds of their patients and some advise against biopsy when carcinoid is suspected [6,19]; other authors disagreed, maintaining that bronchoscopic biopsy significantly increases the diagnostic yield without adding morbidity. [20] In our experience, no major bleeding was reported after endoscopic biopsy.

We encountered 9 cases of hemorrhage (17.3%) that was controlled conservatively. Hurt and colleagues[21] also reported appreciable hemorrhage in 2 cases while performing bronchoscopic biopsy, hence the surgeon must always bear in mind the risk of hemorrhage while performing this procedure. Despite this risk, endobronchial or transbronchial biopsy has been shown to give the highest yield of positive diagnoses, and is the gold standard in obtaining precise classification.[22] Endoscopic sampling suggested the diagnosis of carcinoid in 67.3% of cases, which was also reported by other investigators. [14]

The surgical management of bronchial carcinoid is guided by recurrence and survival rates as observed by other authors who agreed with us. [6,19,20,21,23,24] In patients with centrally located typical carcinoid tumor of the lung, we think that bronchial sleeve resection or sleeve lobectomy should be considered, because local recurrence is rare and survival is excellent. This was possible in 2 cases out of 68 patients (3%) operated upon in our study. Nevertheless, the most frequent surgical procedure in our study was conventional lobectomy and bi-lobectomy in 50 patients (73.7%). It should be noted that despite the low local recurrence rate, early-stage typical carcinoids should be considered to be low-malignancy neoplasms and should be managed by an anatomic resection when peripherally located (lobectomy) or lung sparing procedures as segmentectomy or wedge resection in selected cases .

Sleeve or bronchoplastic resections are preferred to more extensive resection of centrally located carcinoids.[25] Bronchial and bronchovascular sleeve resections are safe even in high-risk patients.[26] Only 2 of our patients had sleeve resection (3%). To ensure tumor-free margins in sleeve resections and accurately demarcate the base of the tumor for surgical resection or reconstruction, Saraff and colleagues[27] used a direct bronchial (epi-bronchial) ultrasound scan, rather than the traditional technique, used in our center, of palpation and making an incision to determine the position of the pedicle.

Techniques for bronchoscopic resection include electrocautery, Nd-YAG laser, and piecemeal removal with biopsy forceps.[21,28] Proximal polypoid typical bronchial carcinoid tumors can be treated effectively by a bronchoscopic

approach and simple excision with diathermy. This was used in five of our patients. Luckraz and colleagues[28] achieved complete bronchoscopic resection in 74% of patients; the remaining tumors were inaccessibly located in the segmental bronchus.

After surgery, patients with bronchial carcinoids should be followed up at least for 1 year because of the risk of recurrence.[29] We followed up our patients for a mean of 5.3 years, and two patients with atypical carcinoid and one patient with typical carcinoid suffered recurrence after 12-24 months (4.4%). Our overall survival was 97.3%. Davini and colleagues[9] reported an 8.2% rate of recurrence after 122 months, predominantly in atypical carcinoids, with overall survival of 92% and 82% at 10 and 15 years. A 15-year survival of 80% in patients with localized disease and 52% in patients with regionally advanced or metastatic disease was reported in another study.[14] Factors influencing survival have been reported to include pathologic type, distant metastasis, and mediastinal lymph node involvement.[15] Postoperative complications following surgery include atelectasis and superficial wound infection while others reported prolonged air leak, postoperative hemorrhage, chylothorax, pulmonary embolism, and late bronchial stenosis.[9,21] Tracheobronchial carcinoids have an excellent outcome following surgical resection. Parenchymal-preserving surgery should be carried out whenever possible, but some cases usually present late and complicated. Radical resection remains the predominant surgical modality of treatment.

The assessment of the biologic behavior of bronchial carcinoid tumors is not always accurate. Atypical carcinoid tumors present more often at a more advanced stage, are more likely to recur, and are associated with lower 5- and 10-year survivals than are typical carcinoids. In our study 2 out of 3 patients with atypical carcinoid histology died 12-14 months later of distant spread to liver and bones. These findings reveal the need for more accurate differentiation between histologic subtypes. Strict application of classification criteria and perhaps revision of classification criteria are mandatory to allow distinction between typical and atypical subtypes that could influence surgical management.

Conclusion

Carcinoid tumors have mostly been responsive to surgical resection with good prognosis, however pathological type and nodal status influence outcome.

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Feasibility and Outcome of Bronchotomy For Benign Bronchial Tumors: A Series of Thirteen Patients

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Objectives: **To evaluate the feasibility and outcome of bronchotomy as a surgical management of 13 patients with benign bronchial masses.**

Patients & Methods: **The study included 13 patients with sessile bronchial masses causing obstruction and easily to bleed on touch by bronchoscope. All patients underwent clinical and radiological work-up and bronchoscopy for evaluation of site and cause of obstruction, biopsy taking and/or management if possible. Through a posterolateral thoracotomy, a longitudinal bronchotomy incision was made along the long axis of the bronchus to expose the mass, which was resected surgically. Then, the bronchus was closed by interrupted PDS or Vicryl 3/0 sutures. The resected mass was sent for histopathological examination.**

Results: **CT imaging defined unilateral emphysema in all patients and localized the site of obstruction in the left main bronchus in 7 patients, in right main bronchus in 3 patients and in right upper lobe bronchus in 3 patients. Ten patients underwent successful bronchotomy, one patient had right upper lobectomy and two had left pneumonectomy and these three cases were considered as procedural failure. Mean duration of surgery was 145.2±31.7 minutes. One patient had injury of left main pulmonary artery which repaired immediately by direct closure of the injury site and passed uneventfully. Two patients had prolonged air leak for 9 and 11 days and were discharged on the 11th and 13th postoperative (PO) day; after resolution of air leak. Another two patients developed wound infection and were discharged on the 21st and 23rd PO day; after complete wound healing. Throughout follow-up one patient developed recurrent dyspnea and chest wheezes despite of disappearance of emphysema and was managed as asthmatic patient and responded to treatment.**

Conclusion: **Bronchotomy could be considered as an appropriate safe surgical modality for management of benign bronchial masses non amenable for bronchoscopic resection; with few intra and postoperative complications.**

Keywords: **Bronchotomy • Bronchial tumors • Outcome**

Primary tracheobronchial tumors are relatively rare neoplasms found in the trachea, carina and endobronchial regions. Due to their rarity and variety of histogenesis as well as the fact that they do not appear on X-ray in most cases, their clinical characteristics and operative results were variable and have not been well established.[1]

The main problem associated with these lesions is the silent presentation, despite the main presenting symptom of bronchial adenomas is obstruction of a main bronchus or bronchioles and mostly associated with either wheezes or recurrent chest infection and so were managed as either asthma or miscellaneous chest infections. However, those symptoms are unspecific and insidious, due to the slow growth demonstrated by these tumors.[2]

Descriptive data of lesion and its location in the tracheobronchial tree are the main determining factors for the appropriate line of management. Polypoid lesions that are accessible for bronchoscopic reach allow resection with hot snare ablation or electrosurgical snare followed by repeated rounds of argon plasma coagulation.[3, 4]

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The problem was magnified with obstructing sessile lesions which bleed easily on touch or lesions out of reach of bronchoscope, for such lesions the only choice for management is either lobectomy or pneumonectomy according to the site of the lesion and its effects on the obstructed segment.[5, 6] The current prospective study aimed to evaluate the feasibility and outcome of bronchotomy for management of thirteen patients with benign bronchial masses.

Patients and Methods

The present study was conducted at Department of Cardiothoracic Surgery, Benha University Hospital since Jan 2008 till Jan 2010 to allow a minimum follow-up period of 6 months for the last case operated upon. All patients attending Chest clinic at Benha University hospital were evaluated especially those presenting with symptoms suspicious of intra-bronchial lesion.

After clinical evaluation all patients underwent radiological work-up in the form of chest X-ray and chest-CT, for assessment and diagnosis. Then, selected patients underwent bronchoscopy for evaluation of site and cause of obstruction, biopsy taking and/or management if possible. Only cases had sessile lesions causing obstruction and easily to bleed on touch and appeared free of malignancy were enrolled in this study. Figure **(1):** Chest-CT shows a space-occupying lesion obstructing the left main bronchus with ipsilateral emphysema.

A double-lumen ET-tube was used for one-lung ventilation, and the operation was performed through a posterolateral thoracotomy in all patients. In cases of left main bronchus lesion, the left main pulmonary artery was pulled up by a cotton tape and the left main bronchus was pushed down by a cotton tape. In cases of right main bronchus lesion, the azygous vein arch was transected and the right main bronchus is pulled by a cotton tape. In cases of upper right lobe bronchus lesion, the right upper lobe bronchus is exposed from its posterior aspect and pulled by a cotton tape. For all cases a longitudinal bronchotomy incision was made along the long axis of the bronchus to expose the mass, which was resected surgically. Then, the bronchus was closed by interrupted PDS or Vicryl 3/0 sutures. Figure **(2)**: Shows closure of bronchotomy by interrupted sutures. The resected mass was sent for histopathological examination. Figure **(3)**: Shows a resected bronchial mass.

After assuring hemostasis, two chest-drainage tubes were inserted and intercostal nerve block was performed for postoperative analgesia. Patients were transferred to post-operative ICU for immediate postoperative care. Patients were cared in semi-setting position to allow chest drainage and lung inflation. Rescue postoperative analgesia was provided in the form of intramuscular injections of mepridine 50 mg only on request or if pain hindered respiration. Once patients were stabilized, they were transferred to Cardiothoracic Surgical Ward for completion of their hospital stay. Resumption of oral intake was allowed once patient was fully conscious and able to swallow.

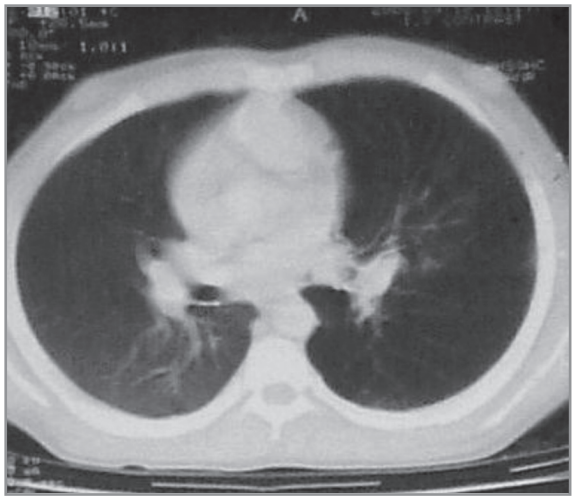

Fig. 1. Chest-CT Showing a space-occupying lesion obstructing the left main bronchus with ipsilateral emphysema

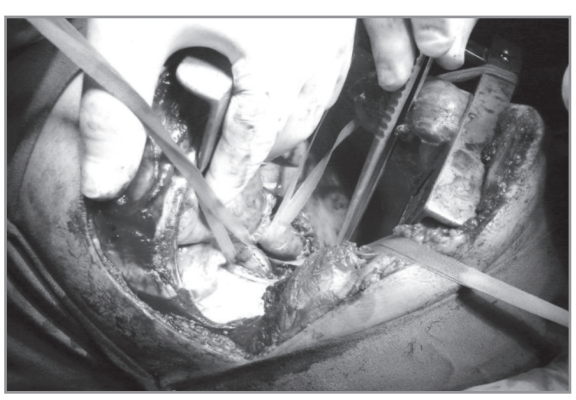

Fig. 2. Closure of bronchotomy by interrupted sutures

Fig. 3. The resected bronchial mass

Chest tubes were removed after stoppage of the air-leak and approaching minimal amount of drainage for two consecutive days. Patients were discharged after assuring absence of wound complications. Patients were asked to attend the outpatient clinic for stitch removal and 6 months after surgery for revision by bronchoscopic examination to exclude recurrence, radiological workup to assure disappearance of emphysema or development of complications.

Results

The study included 13 patients; 8 females and 5 males with mean age of 56.1±6.2; range: 48-67 years. There was non-significant difference between males and females as regards age. No patient presented with a single presenting symptom; however, 8 patients had hemoptysis as the main presenting symptom, 5 of them had associated dyspnea and 3 had recurrent chest infection. Three patients had dyspnea, persistent cough and chest wheezes. Two patients had recurrent chest infection and the lesion was discovered incidentally during routine radiological assessment for such infection. Mean duration of symptoms was significantly ($p<0.05$) shorter in patients presented by hemoptysis compared to patients free of hemoptysis. Table **(1)**: Shows patients' demographic data and presenting symptoms.

Bronchoscope was accessible in 10 cases (76.9%), but failed to define the bronchial mass in 3 cases (23.1%) wherein the masses were completely obstructing the bronchus. The visualized masses appeared sessile and easily bled on touch so were not amenable for bronchoscopic resection. CT examination defined unilateral emphysema in all patients and definitely localized the site of obstruction **(Fig. 1)**. Seven patients had obstruction of the left main bronchus, three patients had obstruction of the right main bronchus and three patients had obstruction of right upper lobe bronchus.

Ten patients underwent successful bronchotomy and mass excision then bronchial closure, while two cases required left pneumonectomy and one patient had right upper lobectomy and these three cases are considered as procedural failure. Mean duration of surgery was 145.2±31.7; range: 95-195 minutes. All surgeries passed smoothly without intraoperative complications apart from one patient had injury of left main pulmonary artery which was repaired immediately by direct closure of the injury site through direct suturing using ploypropline 6/0 suture material and passed successfully without developing related complications .

Chest tube was removed after a mean duration of drainage of 5.2±2.7; range: 3-11 days; however two patients had prolonged air leak for 9 and 11 days and the tubes were removed on the 11th and 13th postoperative day.

Two patients developed wound infection with minimal skin gaping and discharge from the wound, they were managed by antibiotics according to culture and sensitivity and by frequent

Data			Finding
Age (years)	Strata	<50 years	3 (23.1%)
		50-55 years	3 (23.1%)
		>55-60 years	3 (23.1%)
		>60 years	4 (30.7%)
	Mean		56.1±6.2 (48-67)
Gender	Males		5 (38.5%)
	Females		8 (61.5%)
Presenting symptoms	Hemoptysis	+ Dyspnea	5 (38.5%)
		+ Recurrent chest infection	3 (23.1%)
	Dyspnea, persistent cough & chest wheeze		3 (23.1%)
	Recurrent chest infection		2 (15.3%)
Duration of symptoms (months)	In cases presenting by hemoptysis		12.3±4.7 (10-17)
	In cases free of hemoptysis		26.9±5.1 (20-35)
	Mean		16.6±3.2 (13-21)

Data are presented as mean±SD & numbers; ranges & percentages are in parenthesis

Table 1. Patients' demographic data and presenting symptoms

Data			Finding
Surgical procedure	Bronchotomy		10 (76.9%)
	Left pneumonectomy		2 (15.3%)
	Right upper lobectomy		1 (7.8%)
Duration of surgery (min)			145.2±31.7 (95-195)
Duration of chest drainage (days)	Strata	<5 days	9 (69.4%)
		5-6 days	2 (15.3%)
		>6 days	2 (15.3%)
		Mean	5.2±2.7 (3-11)
Duration of postoperative hospital stay (days)	Strata	7 days	1 (7.8%)
		8 days	3 (23.1%)
		9 days	3 (23.1%)
		10-15 days	4 (30.7%)
		>15 days	2 (15.3%)
		Mean	11.6±5.1 (7-23)

Data are presented as mean±SD & numbers; ranges & percentages are in parenthesis

Table 2. Operative and postoperative data

dressing, wound healing was accomplished at the 21st and 23rd days after surgery, for a mean total duration of hospital stay of 11.6±5.1; range: 7-23 days. Table **(2)**: Shows operative and postoperative data.

Histopathological examination of the excised specimens detected 6 specimens of typical carcinoid adenoma, 4 specimens of muco-epidermoid tumor and 3 specimens of adenoma of mucous glands.

Throughout follow-up period only one patient developed recurrent dyspnea and chest wheezes despite of disappearance of emphysema and was managed as asthmatic patient and responded to treatment. For procedure evaluation; technical feasibility rate was 76.9%, intraoperative complication rate was 7.7%, immediate postoperative complication rate was 23.1% and follow-up complication rate was 7.7%.

Discussion

Through the present study, mode of presentation was mosaic, but hemoptysis was the most frequent presenting symptom. However, recurrent chest infection was also frequent and was reported in 38.5% of enrolled patients and in two of these patients, the presence of adenoma was discovered incidentally during routine radiological work-up for such recurrent chest infection. In hand with these findings; ***Hashimoto et al.***[7] reported a case of a bronchial carcinoid presented by repeated pneumonia in the lingula of the left lung and ***Couraud et al.***[8] described a case of 54-year old male, current smoker, who was admitted to the emergency unit with lingular pneumonia; follow-up chest CT and bronchoscopy showed an airway-blocking intrabronchial tumor which after surgical resection, pathological examination established the diagnosis of a bronchial mucous gland adenoma.

All patients showed obstructive manifestations as CT examination defined unilateral emphysema in all patients and definitely localized the site of obstruction. These data go in hand with ***Reechaipichitkul et al.***[9] who reported a patient who had a long-standing history of bronchial asthma and hemoptysis, CT examination detected a bronchial adenoma and concluded that bronchial adenoma should be considered in patients presenting with asthma, hemoptysis and obstructive pneumonia. ***Takeda et al.***[1] described a series of 12 patients with tracheobronchial tumors and found 11 patients had symptoms of airway obstruction and/or secondary infection or bleeding.

Fortunately, no malignant changes were detected on histopathological examination of the excised specimens as 6 specimens were of typical carcinoid adenoma, 4 specimens of muco-epidermoid tumor and 3 specimens of adenoma of mucous glands. Similarly, ***Gaissert & Mark***[10] detected that benign cystadenoma or pleomorphic adenoma as the common benign lesions among their series despite being less frequent than malignant bronchial tumors.

For procedure evaluation; technical feasibility rate was 76.9%, intraoperative complication rate was 7.7%, immediate postoperative complication rate was 23.1% and follow-up complication rate was 7.7%; these data indicated feasibility and safety of the technique with minimal controllable complication rate. In hand with such surgical decision coincided ***Deschildre et al.***[11] described 3 cases suffered from respiratory symptoms such as cough, recurrent pneumonia and/or hemoptysis for 2 to 12 months, bronchoscopy showed a mass into the left main in two cases and in the right main bronchus in one case; all of the three cases were managed surgically, left upper lobectomy in two cases and bronchotomy in one case with complete tumor removal and uneventful outcome.

Muro et al.[12] removed a benign bronchial adenoma from the left main bronchus by partial resection of the left main bronchus. Pathological examination of the resected specimen revealed a benign pleomorphic adenoma. ***Kamiyoshihara et al.***[13] reported a smooth, vascularized, whitish nodular mass obstructing the orifice of the left main bronchus, which was managed by deep wedge resection of the left main bronchus, preserving the lung parenchyma. ***Matsuura et al.***[14] described management of a bronchial tumor through bronchial resection and continuous anastomosis using an absorbable monofilament suture for bronchoplasty to treat a mucous gland adenoma in a segmental bronchus (B10).

In hand with extensive surgical decision for lesions blocking the bronchi through performing lobectomy or pneumonectomy; ***Morini et al.***[15] documented that bronchial adenomas should not be removed bronchoscopically; patients must undergo open thoracotomy for surgical excision. ***Fauroux et al.***[16] described a series of 11 cases of carcinoid and 6 cases of mucoepidermoid bronchial tumors; complete surgical resection was performed in all cases (lobectomy in 15 patients and pneumonectomy in 2 patients), and they concluded that aggressive surgical therapy for carcinoid and mucoepidermoid bronchial tumors provided excellent prognosis and long-term results.

Gaissert & Mark[10] reported that complete resection of localized tumors has excellent long-term results in symptomatic benign tumors. Also, ***Takeda et al.***[1] documented that in their study, and resection was performed in ten patients, resections included sleeve lobectomy in seven, sleeve pneumonectomy in one, circumstantial tracheal resection in one, and left main bronchus resection without lung resection in one patient. ***Lee et al.***[17] reported a case of a 51-year-old male presented with acute respiratory distress as a result of total obstruction of the right main bronchus and suffocation after massive hemoptysis; bronchotomy revealed an elongated endobronchial tumor arose from the right middle lobe bronchus with intraluminal extension upward into the right main bronchus and right middle and lower bi-lobectomy was performed and patient had a rapid and uneventful recovery. ***Rolo et al.***[18] presented a case of well-circumscribed tumor, causing total obstruction of the right middle lobe bronchus that was managed by right middle lobectomy.

The obtained results and review of literature allowed to conclude that bronchotomy is an appropriate safe surgical modality for management of bronchial adenoma non amenable for bronchoscopic resection with few intra and postoperative complications.

Follow-up of the patients for 6 months showed no recurrence of the bronchial masses. The non-recurrence proved by bronchoscopy and chest CT. Chest CT also proved the disappearance of the unilateral emphysema that was evident pre-operatively.

Conclusion

Primary tracheobronchial tumors are relatively rare neoplasms, pedunculated lesions could be removed bronchoscopicaly. Sessile masses couldn't be removed by bronchoscope and need surgical intervention. In this study, bronchotomy for removal of the mass carried a technical feasibility rate of 76.9% and so, bronchotomy could be considered as an appropriate safe surgical modality for management of benign bronchial masses non amenable for bronchoscopic resection with few intra and postoperative complications. It carries favorable short-term outcome.

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Chest Wall Reconstruction For Non-Neoplastic Lesions Using Prolene Mesh With and Without Methyl-Methacrylate

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Objectives: **To evaluate the effectiveness and early outcome of using prolene mesh with and without methyl-methacrylate for chest wall reconstruction in non-neoplastic lesions**

Patients & Methods: **The study included 19; three patients had bifid sternum, nine patients had chest trauma in the form of blast injury due to gunshot with lost part of the lateral chest wall (full thickness) and seven patients had chest trauma with flail segment of the lateral chest wall with multiple fragmented ribs. All patients received general anesthesia with endotracheal intubation. Patients with bifid sternum operated in supine position and managed by prolene mesh with methyl-methacrylate. All trauma patients managed in lateral decubitus with the affected side up, prolene mesh used in all patients and methyl-methacrylate used with the prolene mesh in patients with large defect areas.**

Results: **The study included 19 patients, 14 males and 5 females. The mean age was 39.42 years ranged from one year to 67 years. Methyl-methacrylate (bone cement) sandwiched between two layers of prolene mesh used was in 42.1% of patients, in 57.9% of patients a double layer of prolene mesh used without using methyl-methacrylate. 63.2% of patients had no postoperative complications, 10.5% of patients complicated by prolonged air-leak (> 7 days), 10.5% of patients complicated by seroma and 15.8% of patients complicated by wound infection. There was no intraoperative nor postoperative mortality.**

Conclusion: **Using a prosthesis of double layered prolene mesh if sutured under tension is an effective method of chest wall reconstruction, if the defect area is large addition of methyl methacrylate increases the hardness of the prosthesis. This method of chest wall reconstruction has few postoperative complications and favorable outcome.**

Keywords: **Prolene mesh • methyl-methacrylate • bifid sternum • flail chest • reconstruction.**

The most common indications for chest wall resection include tumors (primary, recurrent, metastatic, or locally invasive), infection, congenital abnormalities, tumor ablation (primary or recurrent), radiation injury, and trauma.[1,2]

Congenital anomalies that may need surgical management in the form of chest wall reconstruction include pectus excavatum, pectus carinaturm, Poland's Syndrome, Cantrell's Syndrome and bifid or cleft sternum.[3] Sternal cleft is a rare congenital anomaly resulting from failure of fusion of the sternal bands, it may be complete or incomplete. The commonly encountered form is cranial sternal V-shaped defect. It's observed at birth and asymptomatic. Surgery is indicated to protect the heart and major vessels from trauma, to improve respiratory dynamics and for aesthetic reasons. Several methods of correction have been described as approximation of the bifid sternal bands by relaxation of costal cartilages, using tissue grafts (cartilage, bone) and inert artificial prostheses (acrylic plaques, marlex mesh).[4,5]

Chest wall trauma may result in loss of part of the chest wall like patients with close proximity shotgun-blast injuries of the chest, these injuries were common in wars and

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suicidal attempts using shotgun, in these cases reconstruction was performed using Tantalum meshes.[6,7,8,9,10]

Chest trauma may result in flail chest, flail chest management includes observation with pain management, ventilator support and surgical management. Surgical management includes plate fixation, intramedullary device insertion, vertical bridging and wiring. However; there are several limitations to these techniques in patients with large flail segment with comminuted fractures of the ribs.[11]

Patients and Methods

The present study was conducted at Department of Cardiothoracic Surgery, Benha University Hospital since Jan 2008 till Jan 2011 to allow a minimum follow-up period of 6 months from the last case operated upon. The study included 19 patients for whom chest wall reconstruction done. Three patients had bifid sternum, **figure(1):** shows a case of bifid sternum preoperatively. And sixteen patients had chest trauma, nine of the patients with trauma had lost part of the lateral chest wall (full thickness) due to gunshot, and seven had flail segment of the lateral chest wall with multiple fragmented ribs.

In patients with bifid sternum and those with flail chest routine laboratory investigations done in the form of CBC, liver function tests, kidney function tests and complete coagulation profile. Also, radiological work-up done in the form of chest X-ray and chest-CT. In gunshot patients, samples for laboratory investigations taken while the patient in the emergency operating room and radiological work-up done post-operatively. All patients received general anesthesia with endotracheal intubation.

Patients with bifid sternum operated in supine position, vertical skin incision done from the root of the neck to the middle of the sternum to expose the sternal defect, a double layered prolene mesh with a layer of methyl-methacrylate sandwiched in between fashioned to take the shape of the defect leaving a rim of mesh to act as a sewing surface, the fashioned piece fixed to the sternal edges by interrupted prolene #0 stiches. A suction drain placed above the mesh and incision closed in layers. **Figure(2):** shows a case of bifid sternum during placement of the prolene mesh with methyl-methacrylate intraoperatively. **Figure(3):** shows a case of bifid sternum 24 hours postoperatively.

Patients with gunshot operated as emergency cases. **Figure(4):** shows a case with lost part of the lateral chest wall due to gunshot. These patients operated in lateral decubitus with the affected side up, the ipsilateral thoracic cavity explored and managed for any lesion of the lung and pleural cavity, then a chest tube inserted and connected to underwater-seal. Area deficient of ribs and intercostal muscles covered by a double layered prolene mesh which is used in all patients and stretched as possible while fixing it to the surroundings by prolene #1,

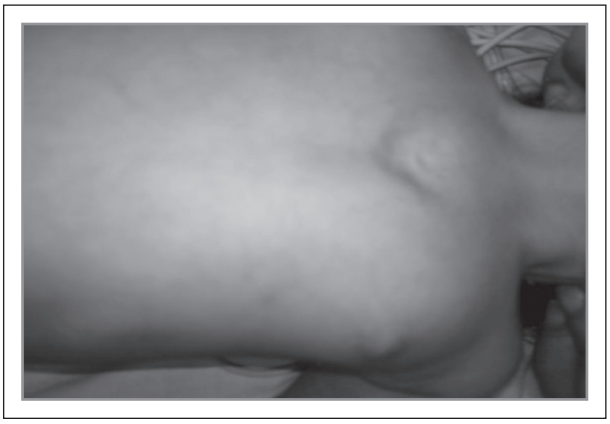

Fig. 1. Shows a case of bifid sternum preoperatively.

Fig. 2. Shows a case of bifid sternum during placement of the prolene mesh with methyl-methacrylate.

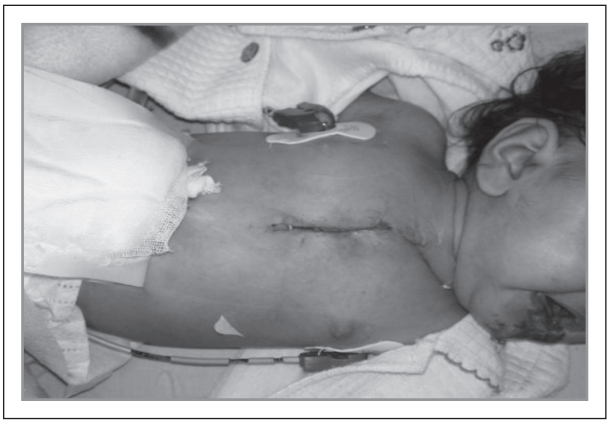

Fig. 3. Shows a case of bifid sternum 24 hours postoperatively.

if the defect area is large with loss of four ribs or more methyl-methacrylate layer added between the two layers of the prolene mesh. If methyl-methacrylate is used a rim of mesh left to act as a sewing surface which is fixed to the surroundings by interrupted prolene #1 stiches and a suction drain placed above the mesh. Extensive undermining of the surrounding muscles with pushing the ipsilateral shoulder down was sufficient to approximate edges of the muscles in all patients, edges of the muscles sutured together by vicryl #1, then completing the wound closure. **Figure(5):** shows a case with lost part of the lateral chest wall due to gunshot 24 hours postoperatively.

Patients with flail segment managed as those with gunshot except that, they were managed as elective cases, the flail segment with fragmented comminuted fracture of the ribs removed surgically with the intercostal muscles in between. There was no need for extensive undermining of the muscle layers as there was no muscle loss. **Figure(6):** shows an intraoperative case after resection of the flail segment and placement of the prolene mesh with methyl-methacrylate.

Results

This study included 19 patients, 14 (73.7%) males and 5 (26.3%) females. The age ranged from one year to 67 years with mean (SD) of 39.42 (±23.25) years, the mean age of females included is 32.4 years and the mean age of males included is 41.93 years. In three cases the lesion was bifid sternum, while in the other sixteen patients the lesions were due to chest wall trauma.

In the sixteen patients of trauma, the left side was the affected side in 62.5% (*n=10*) of patients, while the right side was the affected side in 37.5% (*n=6*). In 9 (56.3%) patients there were loss of full thickness of part of the affected chest wall, which means loss of skin, muscles and ribs (SMR) with or without affection of the ipsilateral lung. In 7 (43.7%) patients, flail segment with multiple fragmented ribs (with or without affection of the ipsilateral lung) was the indication for reconstruction. There was affection of multiple ribs, either as part of full thickness loss or by being multiple fragmented ribs. The number of affected ribs ranged from 3 to 7 with mean of 4.5(±1.21) ribs. Ipsilateral lung affection varies from pulmonary tear and contusion which occurred in 4 (25%) patients, to minor traumatic consolidation which occurred in 7 (43.8%) patients, in 4 (25%) patients there were minor contusions and in one patient (6.3%) there was major tear of the left lower lobe that necessitates left lower lobectomy. In one patient of those with pulmonary tear and contusion wedge resection done while the other three patients the lung tear treated by suturing the tear with 4/0 vicryl sutures.

Methyl-methacrylate (bone cement) sandwiched between two layers of prolene mesh used was in 42.1% (n= 8) of patients, in 57.9% (n=11) of patients a double layer of prolene mesh used without using methyl-methacrylate.

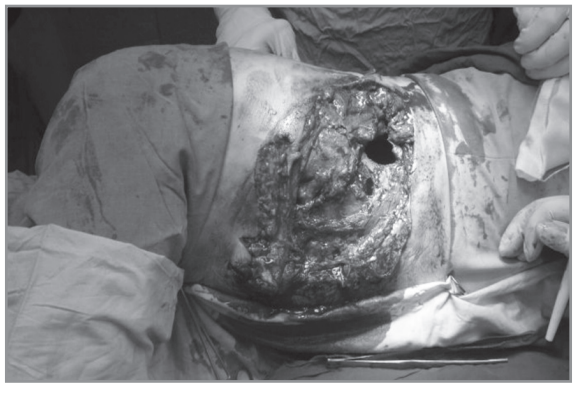

Fig. 4. Shows a case with lost part of the lateral chest wall due to gunshot.

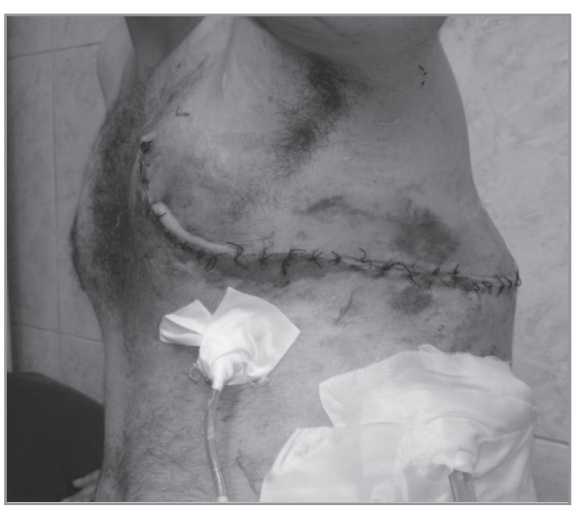

Fig. 5. Shows a case with lost part of the lateral chest wall due to gunshot 24 hours postoperatively.

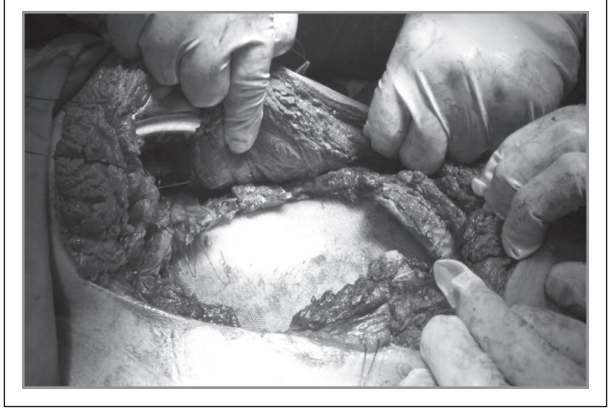

Fig. 6. Shows an intraoperative case after resection of the flail segment and placement of the prolene mesh with methyl-methacrylate.

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	Std. Deviation
chest tube stay	16	11	3	14	7.13	3.344
Hospital stay	19	10	5	15	8.79	3.310
Valid N (listwise)	16					

Table 1. Shows periods of chest tube stay and hospital stay.

63.2% (n=12) of patients had no postoperative complications, 10.5% (n=2) of patients complicated by prolonged air-leak (> 7 days), 10.5% (n=2) of patients complicated by seroma and 15.8% (n=3) of patients complicated by wound infection. No chest tubes were inserted in the three cases of bifid sternum, while in all trauma patients chest tubes were inserted. Chest tube stay ranged from 3 to 14 days with mean of 7.13(±3.34) days. Hospital stay ranged from 5 to 15 days with mean of 8.79 (±3.31) days. **Table(1):** shows periods of chest tube stay and hospital stay.

Discussion

The current study included 19 patients treated by chest wall reconstruction, three patients had bifid sternum which is a rare condition and as stated by **Roccaforte et al.,**[12] (In modern literature there are only five cases of bifid sternum reported which were successfully operated upon) and although this statement wrote in 1959, recent literatures confirms the rarity of this condition as **Acastello et al.,**[13] reported that cleft sternum represented 0.15% of 5,182 patients were seen for chest wall malformations. In these three cases with bifid sternum the defect was triangular affecting the upper part of the sternum and was not associated with ectopia cordis but the skin in the deficient area was moving-in with inspiration and crying. In all these cases the defect covered by a double layers of prolene mesh with a layer of methyl-methacrylate sandwiched in between, **Baqain et al.,**[14] described the success for use of prolene mesh in a similar case. In this study addition of methyl-methacrylate supposed to add more protection of the underlying structures and pericardium from trauma.

Sixteen of patients included in this study needed chest wall reconstruction because of chest wall trauma. In 9 patients there were loss of full thickness for part of the lateral chest wall, and the ipsilateral lung was visible clearly through the defect. In those patients the lost part was due to being shot from near, by gunshot loaded by ammo in the form of cartridges filled with a lot of little balls made of metals, all these cases operated in the emergency OR.

In our department we noted high mortality rate of old patients presented by flail chest with large flail segment even with good analgesia and positive pressure ventilation, and according to **Granetzny et al.,**[15] surgical fixation can help significantly in reducing the duration of ventilatory support and in conserving the pulmonary function. **Ahmed and Mohyuddin,**[16] in a study included 64 cases of flail chest injury, 26 were managed by internal fixation of ribs by using Kirshner wires as a method of fixation of non-comminuted fractured ribs. Each wire was passed through the cortex into the medulla 3 to 4 cm from the fracture site and driven across into the other fragment. **Haasler,**[17] described the use of multiple metallic struts as a method of open fixation of flail chest after blunt trauma also **París et al.,**[18] described the use of different types of stainless steel struts for surgical stabilization of traumatic flail chest. And as stated by **Carbognani et al.,**[19]: (The surgical stabilization of the complex post-traumatic flail chest, when indicated, can be sometimes a difficult challenge necessitating original technical solutions). **Bibas and Bibas**[20] reported the use of prosthetic mesh and methylmethacrylate as for surgical fixation of a case of flail chest.

In patients of trauma there were affection of multiple ribs, either as part of full thickness loss or by being multiple fragmented ribs. The number of affected ribs ranged from 3 to 7 with mean of 4.5(±1.21) ribs, these results are a little bit less than that obtained by **Pairolero and Arnold**[21] in a study included 205 patients surgically managed for chest wall defects, they reported a mean of 5.4 ribs were resected in 142 patients. Also, regarding this point our results are close to that obtained by **Mansour et al.,**[22] in a series of 200 patients, The 200 patients underwent chest wall resection with an average of 4 ± 2 ribs (range 2 to 9). The anterior and lateral ribs were the most commonly (72%) resected.

Immediate closure of the thoracotomy was performed for all patients even for those with SMR loss, by extensive undermining of the surrounding muscles; these results are close to that obtained by **Mansour et al.,**[22] Immediate closure was performed in 195 (98%) of the patients and 5 patients (3%) underwent delayed closure at an average of 10 days after chest wall resection. Also in patients of trauma, ipsilateral lung affection varied from pulmonary tear and contusion which occurred in 4 (25%) patients, to minor traumatic consolidation which occurred in 7 (43.8%) patients, in 4 (25%) patients there were minor contusions and in one patient (6.3%) there was major tear of the left lower lobe that necessitates left lower lobectomy. In one patient of those with pulmonary tear and contusion wedge resection done, while the other three patients

(18.9%) the lung tear treated by suturing the tear. These results were far away from that reported by **Karmy-Jones et al.,**[23] in a study included 143 patients for whom surgical treatment of the ipsilateral lung injury was in the form of suture alone in 9%, wedge resection in 30%; lobectomy in 43%; and pneumonectomy in 50%.

In all patients included in this study prolene mesh was used, methyl-methacrylate sandwiched between two layers of prolene mesh used was in 42.1% (n= 8) of patients, in 57.9% (n=11) of patients a double layer of prolene mesh used without using methyl-methacrylate. In the three patients with bifid sternum methyl-methacrylate was used, **Stanić et al.,**[24] used the same technique in a case report of sternal chondroma surgically treated by subtotal sternectomy.

In this study Methyl-methacrylate (bone cement) sandwiched between two layers of prolene mesh used in 42.1% (n= 8) of patients, in 57.9% (n=11) of patients a double layer of prolene mesh used without using methyl-methacrylate these results were far from that reported by **Mansour et al.,**[22] who reported the use of Prolene mesh in 25% (n=49), Marlex mesh 11% (n=21) and methyl-methacrylate sandwich in 6% (n=11) of patients. In this study there was no intraoperative mortality.

Only one patient (5.26%) needed postoperative mechanical ventilator for 2 days, that patient was on mechanical ventilator preoperatively for two days because of hypoxia caused by large flail segment and regarding this point our result was better than that reported by **McCormack et al.,**[25] in a study included 155 patients for whom chest wall reconstruction done, 13% (n=20) of patients needed mechanical ventilator.

There was no postoperative complications in 63.2% (n=12) of patients, two (10.5%) patients complicated by prolonged air-leak (> 7 days), two (10.5%) patients complicated by seroma and three (15.8%) patients complicated by wound infection. The percent of sermoa and wound infection in our study was higher than that reported by **Deschamps et al.,**[26] in a study included 197 patients for whom chest wall reconstruction was done. Sixty-four patients (32.5%) underwent reconstruction with polypropylene mesh, Seromas occurred in 14 patients (7.1%). Wound infections occurred in 9 (4.6%) patients.

There was no paradoxical movement noticed after surgery in all patients. The suction drain that placed above the mesh removed in the 3rd postoperative day in all patients with minimal drainage in all patients. No chest tubes were inserted in the three cases of bifid sternum, while in all patients of trauma chest tubes were inserted. Chest tube stay ranged from 3 to 14 days with mean of 7.13(±3.34) days. Hospital stay ranged from 5 to 15 days with mean of 8.79 (±3.31) days. Regarding hospital stay our results are close to that obtained by **Weyant et al.,**[27] in a study included 262 patients with chest wall resection and reconstruction with and without rigid prosthesis, the median length of stay for all patients was 7 days (range, 1 to 67).

Follow-up of patients for 6 months after discharge, in the outpatient clinic showed that all patients had returned to their normal daily activity and this result is better than that reported by **Lardinois et al.,**[28] in a study included twenty-six patients underwent chest wall reconstruction by use of mesh and methyl-methacrylate and follow-up for 6 months, nineteen patients (73%) suffered no restrictions of daily activities.

Conclusion

Prolene mesh and methyl-methacrylate are cheap relative to other prosthesis used for chest wall reconstruction, and they are available in most hospitals. Using a prosthesis of double layered prolene mesh if sutured under tension is an effective method of chest wall reconstruction, if the defect area is large addition of methyl methacrylate increases the hardness of the prosthesis. No paradoxical movement noted in our patients postoperatively. This method of chest wall reconstruction showed few and acceptable postoperative complications. Follow-up of the patients for 6 months showed favorable outcome.

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Short-Term Outcome of Thymectomy as A Therapeutic Modality For Myasthenia Gravis Patients

Ibrahim Kasb MD

Objectives: **To present a series of myasthenia gravis (MG) patients of varied severity managed surgically using either trans-sternal (TS) or video-assisted thoracoscopic (VATS) thymectomy.**

Patients & Methods: **The study included 23 MG patients; 16 females and 7 males with mean age of 40±13.6 years and mean duration of disease of 3.1±1.3 years. Twenty patients had generalized fluctuating weakness, 2 patients had dominant bulbar symptoms and one patient had pure ocular disease. Nineteen patients had positive titers. CT scan chest showed that 11 patients had normal scan findings, 8 patients had enlarged thymus, 3 had thymoma, and 1 had thymic cyst. All patients were on medical treatment for a mean duration of 22.2±12.3 months. Operative time and blood loss, post-operative (PO) drainage, incidence of crisis and hospital stay were recorded. Preoperative and PO Osserman grades were determined and compared. PO clinical outcome was identified according to the DeFilippi classification.**

Results: **Fifteen patients underwent TS thymectomy (ministernotomy) while 8 patients had VATS within mean operative time of 134.1±26.2 minutes. Mean intraoperative blood loss and PO chest drainage was significantly lower with VATS compared to TS. Histopathological diagnosis of excised specimens defined thymic hyperplasia in 17 specimens, thymoma in 4 specimens, involuted thymus in one patient and normal thymus in one patient. PO complications occurred in 5 patients, mean duration of PO hospital stay was 8.7±1.7 days and mean duration of PO follow-up was 16±6.4 months. PO Osserman grades showed significant decrease compared to preoperative grades. According to DeFilippi criteria, 7 patients had complete stable remission, 8 patients were asymptomatic and 5 patients had clinical improvement for an overall percentage of patients benefiting from thymectomy were 87%. In 2 patients disease remained unchanged and in one patient the symptom worsened.**

Conclusion: **thymectomy is a safe, effective and appropriate therapeutic modality for MG patients especially those were acetylcholine receptor antibody positive. VATS is an appropriate approach for thymectomy with significantly less intraoperative bleeding and postoperative drainage.**

Keywords: **Thymectomy, Myasthenia gravis, Mini-sternotomy, Video-assisted thoracoscopic surgery**

Myasthenia gravis (MG) is an autoimmune disorder caused, in most cases, by autoantibodies against components of the neuromuscular junction, frequently the acetylcholine receptor (Ach-R), and less often the muscle-specific kinase receptor. Patients with MG are divided into 3 groups according to type of antibodies: Ach-R antibody (Ab)-positive MG, anti-muscle specific kinase antibody-positive MG (MuSK MG), and Ach-R-negative and MuSK-negative MG (double seronegative MG). The thymus plays a major role in the pathogenesis of MG with Ach-R antibodies: it shows marked pathologic alterations (hyperplastic or tumoral) in most Ach-R-positive patients and contains the elements required to initiate and sustain an autoimmune reaction [1-3].

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Thymomas are associated with paraneoplastic autoimmune diseases at a high frequency. It is rare that four paraneoplastic autoimmune disorders may co-occur in a single patient. Myasthenia gravis, vitiligo, alopecia areata, and oral lichen planus associated with a thymoma and after thymectomy, the weakness, vitiligo, alopecia and mucocutaneous lesions were improving progressively, possibly implicating the role of thymoma in initiating these autoimmune conditions [4].

The first-line option of treatment of MG is symptomatic treatment with acetyl cholinesterase inhibitors; pyridostigmine bromide is the most commonly used drug and is most effective early in the course of MG and over time increasing tolerance to the drug develops which may necessitate dose escalation[5]. Short-term immunosuppression using corticosteroids are thought to act on the immune system by inhibiting the activation of T-cells and impairing the function of cells of the monocyte/macrophage lineage and in four large retrospective studies of generalized MG using various doses of corticosteroids and with different follow-up durations, 74% of a total of 422 patients achieved good overall improvement of muscle strength or remission [6].

Long-term immunosuppression provided efficient success rate using azathioprine [7], cyclosporine [8], cyclophosphamide[9], methotrexate[10], mycophenolate mofetil [11], Rituximab [12] and tacrolimus [13]. There is some evidence that intravenous immunoglobulin is efficacious in acute severe exacerbation of generalized MG, but the evidence is less clear in chronic cases. Intravenous immunoglobulin is typically used in acute exacerbation of MG or to optimize muscle strength before surgery [14]. Plasma exchange is commonly used in acute severe exacerbation of MG to achieve temporary improvement or as a method of optimizing MG control before surgery [15]. The choice between plasma exchange and intravenous immunoglobulin is often based on the physician's opinion or the ability of a patient to tolerate each treatment. Since intravenous immunoglobulin is easier to administer, and associated with fewer adverse events than plasma exchange, and the efficacy of the two treatments is similar, the former is usually preferred to the latter [16].

Most retrospective studies indicate a better response to thymectomy when it is performed early in the disease course of generalized MG; thus the procedure is usually recommended within the first 3 years of diagnosis. Numerous approaches to thymus removal have been advocated, but the procedure that allows the greatest removal of thymic tissue would be expected to be the preferred option [17].

The current prospective study aimed to present a series of MG patients of varied severity managed surgically using either transsternal thymectomy (mini-sternotomy) or video-assisted thoracoscopic thymectomy.

Patients and Methods

The current prospective study was conducted at Cardiothoracic Departments at Nasr Institute and Benha University Hospitals since June 2008 till Jan 2011 to allow a minimum follow-up period of 6 months for the last case operated upon. After obtaining written fully informed patients' consent, all patients with MG were enrolled in the study.

All patients underwent full history taking and medical examination including referral to neurologist for assessment of muscle power and ophthalmologist for evaluation of ocular manifestations. Chest X-ray and CT scan chest were done to confirm or exclude the presence of thymoma. Diagnosis of MG relied on typical history, physical findings, positive decremental response to repetitive nerve stimulation, high acetylcholine receptor antibodies titers and a positive neostigmine test. Indications for thymectomy included generalized symptoms of MG, ocular symptoms refractory to medical treatment, or the presence of thymoma.

All patients underwent preoperative preparation including plasmapheresis or intravenous immunoglobulin in patients with severe bulbar symptoms or respiratory muscle weakness; patients who were on steroids prior to surgery were covered with perioperative stress doses and later weaned off slowly. Preoperative disease severity was evaluated according to Osserman grades using the classification system of 0=asymptomatic, 1=ocular signs and symptoms, 2=mild generalized weakness, 3=moderate generalized weakness, bulbar dysfunction, or both, and 4=severe generalized weakness, respiratory dysfunction, or both [18].

All surgeries were conducted under general intubation inhalational anesthesia using open transsternal thymectomy or video-assisted thoracoscopic approach. The extent of resection was superiorly up to the lower pole of thyroid, inferiorly the diaphragm, and laterally the phrenic nerves, to remove all the perithymic fat of the anterior mediastinum and aorto-pulmonary window. Parts of mediastinal pleura or pericardium were also removed in the presence of infiltrating tumor. In all cases, the chest is prepared for possible median sternotomy and the patient is informed that a conversion to a full sternotomy might be necessary. All resected specimens were examined histopathologically and interpreted as hyperplastic, involuted or normal.

Operation time, operation blood loss, post-operative drainage, incidence of crisis and postoperative hospital stay were recorded. Postoperatively, all patients were started on anticholinesterase or steroids, doses of which were gradually reduced depending on the myasthenic symptoms.

Postoperative Osserman grades and were compared versus preoperative grades. Measurement of postoperative clinical outcome of the patient was identified according to the DeFilippi classification as follows: Class I: Complete remission; no medications, Class 2: Asymptomatic; on decreased medication, Class 3: Improvement in symptoms; on decreased medications, Class 4: No change in symptoms or medications and Class 5: Worsening symptoms [19].

Results

The study included 23 patients; 16 females and 7 males with mean age of 40±13.6; range: 23-67 years. Twelve patients (52.2%) were younger than 40 years, with mean age of 29.2±5.4; range: 23-39 years, while 11 patients were older than 40 with mean age of 51.7±9.1; range: 41-67 years, (Table 1).

Data			Findings
Age (years)	Strata ≤40 years	Number	12 (52.2%)
		Mean	29.2±5.4 (23-39)
	Strata >40 years	Number	11 (47.8%)
		Mean	51.7±9.1 (41-67)
	Total	Number	23 (100%)
		Mean	40±13.6 (23-67)
Gender	Males		7 (30.4%)
	Females		16 (69.6%)

Data are presented as mean±SD & numbers; ranges & percentages are in parenthesis

Table 1. Patients' enrolment data

Mean duration of disease was 3.1±1.3; range: 1-6 years. Ten patients (43.5%) had duration of disease ≤2 years, 9 patients (39.1%) had duration of disease of 3-4 years and 4 patients (17.4%) had disease duration of 5-6 years. Generalized fluctuating weakness of different severity was the most dominant presenting symptom and was reported in 20 patients (87%), two patients (8.7%) had dominant bulbar symptoms and only on patient (4.3%) had pure ocular disease. Four (17.4%) patients had negative Ach-R antibody titer and 19 (82.6%) had positive titers. CT scan chest showed that 11 patients (47.8%) had normal scan findings, 8 patients (34.8%) had enlarged thymus, (Fig. 1), 3 (13%) had thymoma, (Fig. 2) and 1 (4.4%) had thymic cyst, (Fig. 3). Thirteen patients (56.5%) were on anticholinesterase agents alone, 7 patients (30.4%) were on anticholinesterase, steroids, and the remaining 3 patients (13.1%) were on combined treatments including anticholinesterase, steroids, azathioprine, and/or cyclophosphamide. Mean duration of medical treatment was 22.2±12.3; range: 3-55 months, (Table 2).

Fifteen (65.2%) patients had thymectomy through open trans-sternal approach (mini-sternotomy), while 8 patients underwent VATS thymectomy. All surgeries were conducted safely without intraoperative complication within mean operative time of 134.1±26.2; range: 100-200 minutes. Mean intraoperative blood loss and postoperative chest drainage was significantly lower with VATS compared to open surgery, (Table 3, Fig. 4).

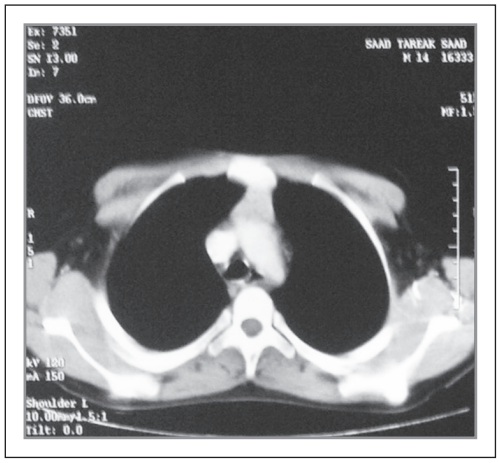

Fig. 1. Preoperative Chest CT of patient with thymic hyperplasia

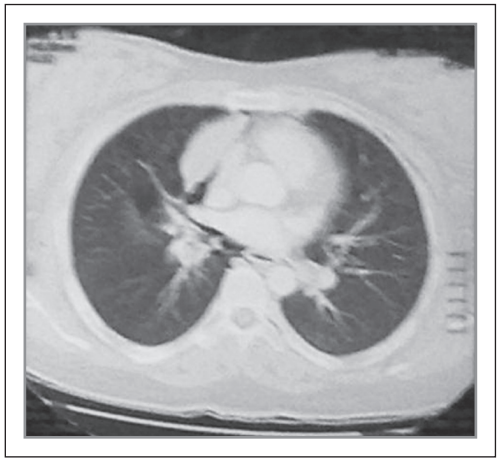

Fig. 2. Preoperative Chest CT of patient with thymoma

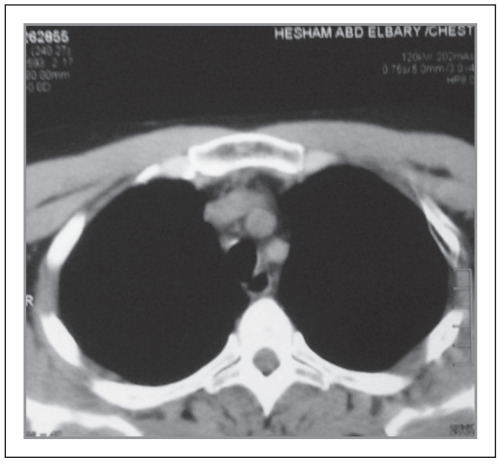

Fig. 3. Preoperative Chest CT of patient with thymic cystic lesion

Data				Findings
Duration of disease (years)	Strata	≤2 years	Number	10 (43.5%)
			Mean	1.9±1
		3-4 years	Number	9 (39.1%)
			Mean	3.6±1.8
		5-6 years	Number	4 (17.4%)
			Mean	5.3±0.5
	Total			3.1±1.3 (1-6)
Presenting symptoms	Pure ocular disease			1 (4.3%)
	Dominant bulbar symptoms			2 (8.7%)
	Generalized fluctuating weakness			20 (87%)
Ach-R antibody titer	Positive			19 (82.6%)
	Negative			4 (17.4%)
CT scan chest	Normal			11 (47.8%)
	Enlarged thymus			8 (34.8%)
	Thymoma			3 (13%)
	Thymic cyst			1 (4.4%)
Medical therapy	Ach drugs			13 (56.5%)
	Ach + Steroid			7 (30.4%)
	Ach + Steroid + azathioprine, and/or cyclophosphamide			3 (13.1%)
Duration of medical therapy	Strata	<12 months	Number	5 (21.8%)
			Mean	7.2±4 (3-11)
		12-24 months	Number	9 (39.1%)
			Mean	18.4±9.6 (14-24)
		>24-36 months	Number	7 (30.4%)
			Mean	30.7±15.1
		>36 months	Number	2 (8.7%)
			Mean	47±16.3 (39-55)
	Total		Number	23
			Mean	22.2±12.3 (3-55)

Data are presented as mean±SD & numbers; ranges & percentages are in parenthesis

Table 2. Disease data

Histopathological diagnosis of excised specimens defined thymic hyperplasia in 17 specimens (73.9%), thymoma in 4 specimens (17.4%), involuted thymus in one patient (4.3%) and normal thymus in one patient (4.3%). Postoperative radiological examination was performed for assurance of absence of chest complications prior to discharge, (Fig. 5 & 6).

Postoperative complications occurred in 5 patients (21.7%); chest infection in 2 patients (8.7%), sternal wound dehiscence in one patient (4.3%), mediastinal collection in 1 patient (4.3%) and cholinergic crisis in one patient (4.3%). Mean duration of postoperative hospital stay was 8.7±1.7; range: 5-11 days and mean duration of postoperative follow-up was 16±6.4; range: 6-30 months.

Postoperative Osserman grades showed significant decrease compared to preoperative grades, (Table 4, Fig. 7). According to DeFilippi criteria, 7 patients (30.4%) were in complete remission (class I), 8 patients (34.8%) were asymptomatic (class II), and 5 patients (21.7%) had clinical improvement (class III). Thus, the overall percentage of patients benefiting from thymectomy was 87%. In 2 patients (8.7%), disease remained unchanged (class IV) and in one patient (4.3%) the symptom worsened (class V), (Fig. 8).

Data		Findings
Surgical approach	VATS	8 (34.8%)
	Open TS	15 (65.2%)
Operative time (min)	VATS	137.3±28.3 (105-200)
	Open	128.1±22.4 (100-160)
	Total	134.1±26.2 (100-200)
Blood loss (ml)	VATS	57±8.4 (42-72)*
	Open	91.3±11.6 (80-115)
	Total	68.9±19.1 (42-115)
Postoperative drainage (ml)	VATS	119±19.5 (85-150)*
	Open	160.6±17.2 (130-185)
	Total	133.5±27.3 (85-185)

Data are presented as mean±SD & numbers; ranges & percentages are in parenthesis

Table 3. Operative and postoperative data

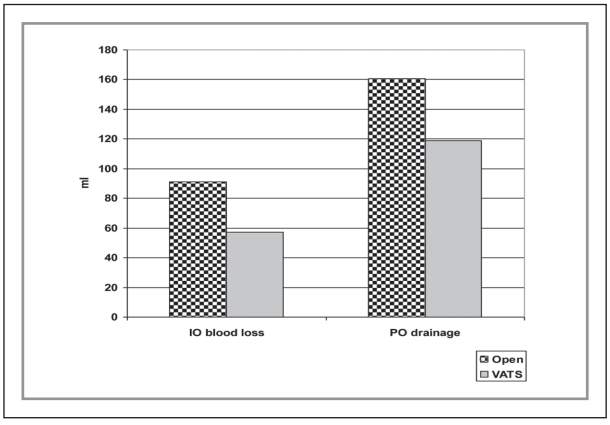

Fig. 4. Mean amount of intraoperative blood loss and postoperative chest drainage

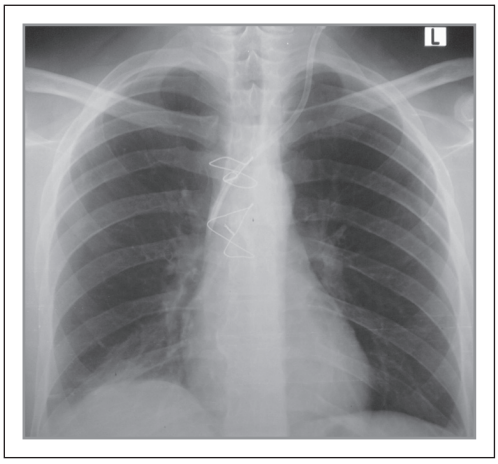

Fig. 5. Postoperative CXR-PA view after thymectomy

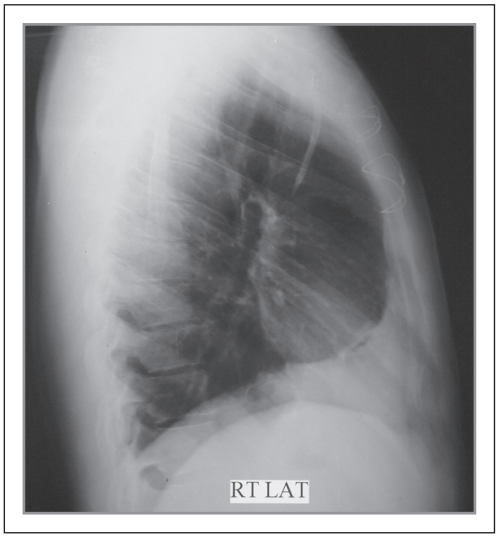

Fig. 6. Postoperative CXR-Lateral view after thymectomy

		Preoperative	Postoperative	Statistical analysis
Osserman grades	0	0	12 (52.3%)	X^2= 19.345 p<0.001
	1	1(4.3%)	7 (30.4%)	
	2	5 (21.7%)	1 (4.3%)	
	3	14 (60.9%)	1 (4.3%)	
	4	3 (13.1%)	2 (8.7%)	
Total score		2.9±0.6 (2-4)	0.65±1.2 (0-4)	t=9.219, p<0.001

Table 4. Osserman grading determined pre- and postoperatively

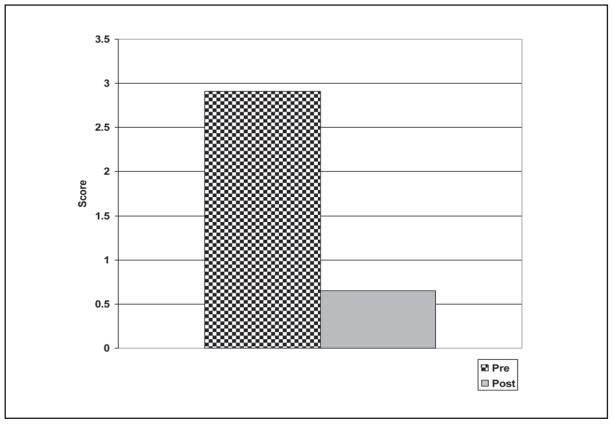

Fig. 7. Mean Ossrman grades determined pre-and postoperatively

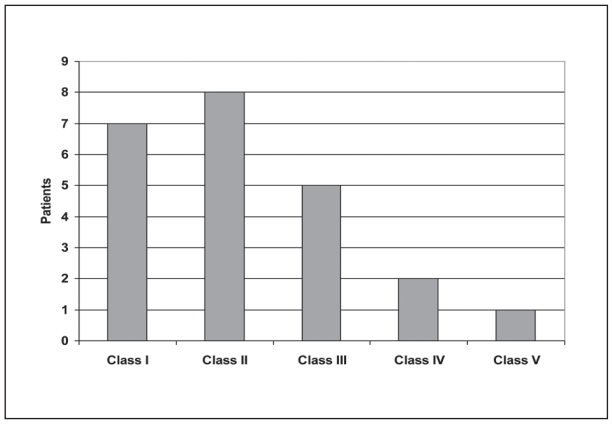

Fig. 8. Patients' distribution according to postoperative outcome determined according to DeFilippi criteria

Discussion

The study included 23 patients; 16 females (69.5%) and 7 males with mean age of 40 years and mean duration of disease was 3.1 years. Generalized fluctuating weakness of different severity was the most dominant presenting symptom and was reported in 20 patients (87%), two patients (8.7%) had dominant bulbar symptoms and only one patient (4.3%) had pure ocular disease refractory to medical treatment. Nineteen (82.6%) had positive titers, 12 patients had abnormal CT scan chest and mean duration of medical treatment was 22.2±12.3 months.

Such demographic and clinical data coincided with that previously reported by ***Suhail et al.*** [20] who described clinical manifestations of 90 cases of MG and found that their mean age was 47.5 years, 75.5% were female; 24.4% had ocular MG and 75.6% had generalized MG, 74.4% were Ach-R antibody positive, myasthenic crisis tended to develop in Ach-R antibody positive and thymic pathology was found in 72.3% of thymectomized Ach-R antibody positive patients.

According to DeFilippi criteria, 20 patients benefited from thymectomy ranging from complete stable remission to improvement, 2 patients had unchanged disease severity and in one patient the symptom worsened. The reported success figures go in hand with that previously reported; ***Kumar et al.*** [21] reported that 79.4% of patients benefited from surgery, 8.2% had unchanged disease status, and 12.3% worsened clinically and concluded that thymectomy for MG is safe and effective. ***Hennessey et al.*** [22] retrospectively reviewed all patients undergoing a thymectomy for the treatment of juvenile MG and reported remission in 62% of patients and concluded that thymectomy is effective for treating juvenile MG in selected patients.

Gilhus et al. [23] evaluated the efficacy of thymectomy in children with MG and reported an overall remission rate of 69.8% and an effective rate of 90.6% with no symptomatic relapse occurred among patients in complete stable remission and concluded that thymectomy is an effective and safe treatment in selected MG children, especially in those with shorter illness duration.

Unfortunately, the two patients had no change after thymectomy were thymoma patients, thus thymectomy could provide successful remission in thymoma patients by a ratio of 50%. Such success rate coincided with ***Romi et al.*** [24] who reported that among myasthenic patients with thymoma, 33.3% had no response, 50% had a partial response, and 16.7% achieved complete remission. ***Takeo et al.*** [25] also, reported that surgical resection of thymoma is the preferred treatment, because it is safe and effective with a low rate of recurrence and a good long-term survival with disease-free interval at 5 years was 85% for 73.9% of patients with complete resection. ***Pennathur et al.*** [26] found the cumulative probabilities of reaching complete stable remission were 37.5% in patients with MG without thymoma and 28.3% in patients with thymoma, respectively and concluded that video-assisted thoracoscopic thymectomy can produce a satisfactory long-term result. ***Okumura et al.*** [27] attributed such success to the fact that despite thymoma can be considered as an acquired thymus with insufficient function of negative selection, the resection of a thymoma is thought to terminate the production of self-reactive T cells.

Two of the studied patients had dominant bulbar MG; one responded well and showed clinical improvement, while the second had worsened clinical manifestations and developed cholinergic crisis. These data indicated the inappropriateness of thymectomy as a line of management for such cases. In hand with these data ***Nam et al.*** [28] found that the existence of preoperative bulbar symptoms seems to be a predictor for the development of postoperative myasthenic crisis in patients with MG undergoing a transsternal thymectomy.

The patient who had pure ocular MG showed clinical improvement despite not reaching complete stable remission, this finding supported that previously reported by ***Liu et al.*** [29] who reviewed a series of 115 patients had ocular MG

underwent extended transsternal thymectomy and reported complete stable remission in 26.4%, improvement in 58.2%, while 6.4% remained unchanged, and 9.1% had a worsening of their conditions.

Revising the inclusion data 17 of those 20 patients benefited from thymectomy were Ach-R antibody positive, thus indicting a close relation between thymus gland and biosynthesis of Ach-R antibodies and development of MG with subsequent alleviation of symptoms on removal of the source of these antibodies. In line with such explanation, ***Okumura et al.*** [27] reported that in Ach-R antibody-positive patients without a thymoma, abnormal germinal center formation in the thymus seems to play an essential role in the pathogenesis of MG, as specific differentiation of B cells producing anti-Ach-R antibodies takes place uniquely in the thymus, and thymectomy is thought to assist in terminating the provision of high-affinity anti-AchR antibody-producing cells to peripheral organs.

The obtained results and review of literature allowed concluding that thymectomy is a safe, effective and appropriate therapeutic modality for MG patients especially those were Ach-R antibody positive. VATS is an appropriate approach for thymectomy with significantly less intraoperative bleeding and postoperative drainage.

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Radiopaque Foreign Bodies Inhalation in Children and Adolescents

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Mohamed El-Mahdy MD*

Objectives: **This retrospective study aimed to determine the frequency and management of inhaled radiopaque foreign bodies (FB) among a population of patients of age group of 10-20 years.**

Patients & Methods: **The study design included verification of data extracted from patients' files admitted for retrieval of inhaled radiopaque FB. Inclusion criteria included age range; 10-20 years and the files must contain all needed data and patients were managed according to a protocol including: rigid bronchoscopy (RB) under general anesthesia that was repeated 1-3 days thereafter if the first trial failed. If recurrent failure occurred, a trial with fiberoptic bronchoscope (FOB) was done, but in case of failure thoracotomy and bronchotomy was performed.**

Results: **The study included 321 patients; 274 females and 47 males with mean age of 13.2±1.9 years and 292 patients were early presenters and 29 were late presenters. Females are significantly frequent among early presenters compared to males. Only 57 patients presented with either dry irritating cough or bloody tinged sputum, while 264 patients were asymptomatic with non-significant difference between males and females. Left bronchial tree FB were detected in 167 patients (52%), 137 FB (37.7%) were in right bronchial tree, while 33 FB (10.3%) were in the trachea with significant difference between males and females as regards the location of the inhaled FB. Seventeen patients of early presenters had spontaneous FB retrieval. A total of 216 patients underwent successful first trial RB, 58 patients had successful redo RB, 7 patients had successful FOB and 23 patients underwent thoracotomy. A total of 422 bronchoscopic trials were conducted; 392 trials using RB and 30 using FOB. Considering shift to thoracotomy as a failure of bronchoscopic retrieval, bronchoscopy provided a total success rate in studied patients' population of 92.8%; 90.7% for RB and 23.3% for FOB. Mean theater time for bronchoscopy was 33 minutes and mean hospital stay was 2.1 days, while mean post-thoracotomy hospital stay was 6.1 days. Eleven patients developed complications after bronchoscopy for a complication rate of 2.6% for bronchoscopic trials and 3.6% for patients.**

Conclusion: **Inhaled radiopaque FB is not uncommon event in patients of age group 10-20 years and the applied management protocol provided bronchoscopic retrieval of FB with a total success rate of 92.8% and minimal complications.**

Keywords: **Inhaled radiopaque foreign body, Bronchoscopy, Thoracotomy, Children, Adolescents.**

Foreign body aspiration is defined as the introduction of a large particulate material into the tracheobronchial tree. Such event is frequent during early childhood when the baby can move and pick up things and as they accustomed introduce objects into mouth so it can easily aspirated or inhaled. Also, elderly people are vulnerable to the same event because of associated cognitive disease and muscle weakness leading to misuse of object [1, 2].

The religious rules in Moslem Countries obliged young girls to be veiled using headscarves which necessitate multiples pins to be fixed in position, the young inexperienced girl may put the headscarf pin in her mouth and during laughing or shouting the pin may be aspirated or inhaled into the tracheobronchial tree. On the

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other side, low financial strata which is progressing strata in underdeveloped or developing countries obliges young children of age of primary and preparatory school to undergo manual works for getting money as assistants or helpers in workshops and were continuously handling pins, metal objects and accustomed to put it in the mouth to be nearby their hands so accidental inhalation is not uncommon [3, 4].

This age group ranging between 10 and 20 years represent a high risk group for committing inhalation of foreign bodies into the trachobronchial tree, thus the current retrospective study aimed to determine the frequency and management of inhaled radiopaque foreign bodies among a population of patients among age group of 10-20 years.

Patients and Methods

The present retrospective study was conducted at Thoracic Surgery and Chest departments at Nasr Institute, Cairo since May 2007 till Jan 2011. The study design included verification of data extracted from patients' files admitted for extraction of inhaled radiopaque FB. The inclusion criteria included age range between 10 and 20 years and the files must contain all need data; any file with missed data was excluded from the study.

The protocol of management of cases of inhaled FB was firstly full history taking including time lapsed since inhalation so as to define early (within 24 hours of the onset of symptoms) and late (more than 24 hours after the onset of symptoms) presentation [5] and the presenting symptoms. Then, radiological examination was performed for assurance of inhalation and localization of the inhaled FB. All patients underwent rigid bronchoscopy (GU- Negus – London) at the operating room under general anesthesia with the patient in supine position with table shift for 25o in Trendlenburg position. In case of failure of retrieval of the inhaled FB, chest x-ray was repeated after 1-3 days and another attempt with rigid bronchoscope was tried. If recurrent failure occurred, a trial with fiberoptic bronchoscope was done. If unfortunately failed thoracotomy and bronchotomy was performed for direct extraction of FB. In case of failure of FB visualization by endoscope or if the FB was unreachable C-arm (Philips- Japan) image was used for direct visualization and extraction. All patients had bronchoscopy, irrespective of outcome, had given intravenous steroids and nebulizer.

All enrolled patients must follow this protocol; collected data included age, gender, duration of illness, location of the FB, lines of management and its outcome, complications and hospital stay duration.

Statistical analysis

Obtained data were presented as mean±SD, ranges, numbers and percentages. Results were analyzed using Wilcoxon's Ranked test for unrelated data and Chi-square test. Statistical analysis was conducted using the SPSS (Version 15, 2006) for Windows statistical package. P value <0.05 was considered statistically significant.

Results

The study included 321 patients; 274 females (85.4%) and 47 males (14.6%) with mean age of 13.2±1.9; range: 10-20 years. All patients had fulfilled the criteria of inclusion in the study. Females were non-significantly (Z=1.061, p>0.05) older than males. Despite the majority of patients were in age group of 12-15, there was non-significant difference (X^2=2.152, p>0.05) between males and females as regards the age strata, (Table 1).

	Males (n=47)	Females (n=274)	Total (n=321)
10 years	3 (6.4%)	7 (2.6%)	10 (3.1%)
11 years	6 (12.8%)	28 (10.2%)	34 (10.6%)
12 years	9 (19.1%)	71 (25.9%)	80 (24.9%)
13 years	11 (23.3%)	87 (31.8%)	98 (30.6%)
14 years	6 (12.8%)	34 (12.4%)	40 (12.5%)
15 years	2 (4.3%)	17 (6.2%)	19 (5.9%)
16 years	3 (6.4%)	10 (3.6%)	13 (4.1%)
17 years	3 (6.4%)	9 (3.3%)	12 (3.7%)
18 years	2 (4.3%)	6 (2.2%)	8 (2.5%)
19 years	1 (2.1%)	3 (1.1%)	4 (1.2%)
20 years	1 (2.1%)	2 (0.7%)	3 (0.9%)
Mean age (years)	13.2±1.8	13.5±2.4	13.2±1.9

Data are presented as mean±SD & numbers; percentages are in parenthesis

Table 1. Patients' distribution among age strata

Concerning time lapsed till presentation; 298 patients (92.8%) presented early after FB inhalation; 260 females (94.9%) and 38 males (80.9%), while 23 patients (7.2%) presented late; 14 females (5.1%) and 9 males (19.1%). Females are significantly frequent (X^2=3.362, p<0.05) among early presented patients compared to male patients, (Fig. 1). Only 57 patients (17.8%) presented with either dry irritating cough or bloody tinged sputum, while 264 patients (82.2%) were asymptomatic. There was non-significant (X^2=0.619, p>0.05) difference between males and females as regards the mode of presentation. Left bronchial tree FB were detected in 167 (52%), (Fig. 2 & 3), 137 FB (37.7%) were in right bronchial tree (Fig. 4 & 5), while 33 FB (10.3%) were in the trachea. There was significant (X^2=5.689, p<0.05) difference between males and females as regards the location of the inhaled FB, (Table 2, Fig. 6).

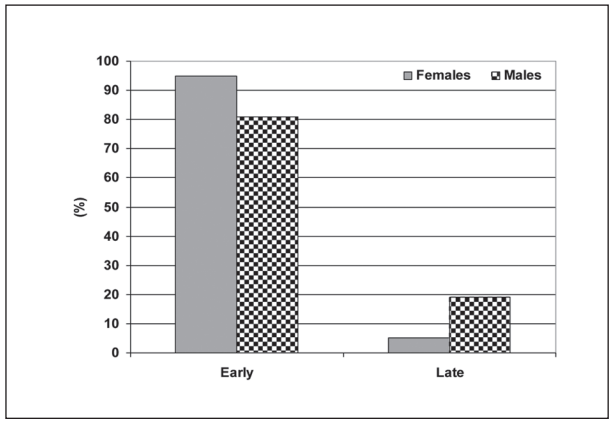

Fig. 1. Patients' distribution according to time of presentation

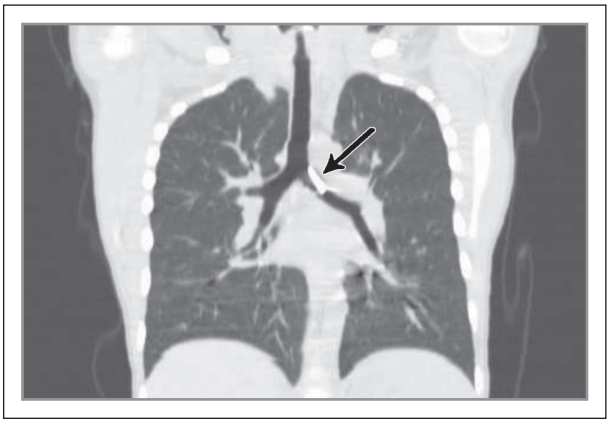

Fig. 2. Chest CT image showing an inhaled FB into the left main bronchus in a 17-years old boy

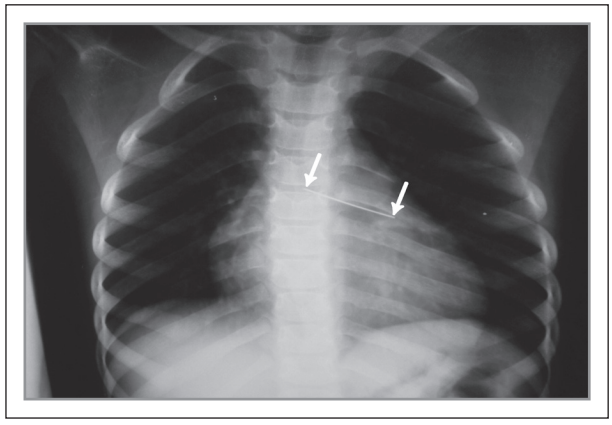

Fig. 3. Plain x-ray chest showing a pin inhaled into the left bronchial tree in a 13-years old girl

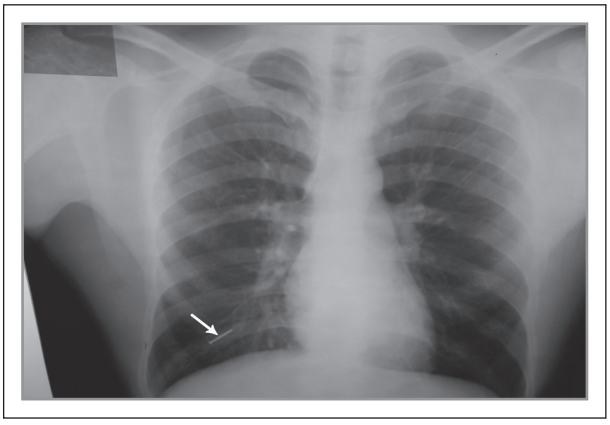

Fig. 4. Plain x-ray chest after first trial (RB) showing a screw inhaled into the right bronchial tree in a 14-year old boy

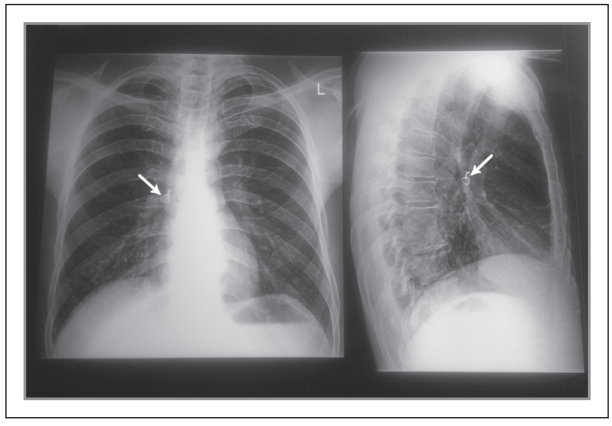

Fig. 5. Plain x-ray chest showing an inhaled FB into the right bronchial tree in a 15-years old boy

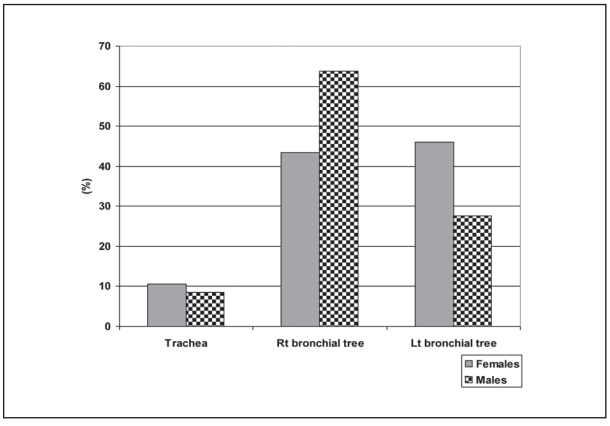

Fig. 6. Patients' distribution according to location of the inhaled FB

		Males	Females	Total
Time of presentation	Early	38 (80.9%)	260 (94.9%)*	298 (92.8%)
	Late	9 (19.1%)	14 (5.1%)	23 (7.2%)
	Statistical difference	X^2=3.362, p<0.05		
Mode of presentation	Asymptomatic	40 (85.1%)	224 (81.8%)	264 (82.2%)
	Dry cough	5 (10.6%)	37 (13.5%)	42 (13.1%)
	Blood tinged sputum	2 (4.3%)	13 (4.7%)	15 (4.7%)
	Statistical difference	(X^2=0.619, p>0.05)		
Localization of the FB	Tracheal	4 (8.5%)	29 (10.6%)	33 (10.3%)
	Right bronchial tree	30 (63.8%)*	107 (43.4%)	137 (37.7%)
	Left bronchial tree	13 (27.7%)	154 (56.2%)*	167 (52%)
	Statistical difference	X^2=5.689, p<0.05		

Data are presented as numbers; percentages are in parenthesis **: significant difference*

Table 2. Patients' distribution according to clinical data

Fortunately, 17 patients of early presenters had spontaneous retrieval of the inhaled FB; 15 females (5.5%) and 2 males (4.3%) and those were excluded from the statistical analysis of outcome of bronchoscopy. These 17 patients underwent chest x-ray for assurance of extraction and received their medical treatment at home after immediate discharge from the emergency department.

Thus, 304 patients underwent management at the hospital. All of these 304 patients underwent rigid bronchoscopy under general anesthesia; FB retrieval was successfully conducted for 216 patients for a success rate of first RB of 71.1%. The remaining 88 patients (28.9) underwent a second trial RB which succeeded to retrieve the inhaled FB in 58 patients for a success rate for redo RB of 65.9% and a total success rate for RB of 90.1%. Fiberoptic bronchoscopy was tried in the remaining 30 patients but succeeded in only 7 patients for a success rate of 23.3%. Twenty-three patients underwent thoracotomy for FB extraction for a surgical interference rate of 7.6%. Thoracotomy had succeeded in extraction of 18 FB (78.3%) without the need for C-arm imaging, while the remaining 5 FB (21.7%) required extraction under visual control using the C-arm imaging, (Table 3).

Line of management			Outcome	Females (n=274)	Males (n=47)	Total (n=321)
Spontaneous retrieval				15 (5.5%)	2 (4.3%)	17 (5.3%)
Interference (n=304)	Rigid bronchoscopy (n=304)	1st trial (n=304)	Success	192 (70%)	24 (51.1%)	216 (67.3%)
			Failure	67 (24.5%)	21 (44.6%)	88 (27.4%)
		2nd trial (n=88)	Success	48 (17.5%)	10 (21.3%)	58 (18.1%)
			Failure	19 (6.9%)	11 (23.4%)	30 (9.3%)
		Total (n=304)	Success	240 (87.6%)	34 (72.3%)	274 (85.4%)
			Failure	19 (12.4%)	11 (23.4%)	30 (9.3%)
	Fiberoptic bronchoscopy (n=30)		Success	5 (1.8%)	2 (4.3%)	7 (2.2%)
			Failure	14 (5.1%)	9 (19.1%)	23 (7.2%)
	Thoracotomy (n=23)	Without C-arm		10 (3.6%)	8 (17%)	18 (5.6%)
		With C-arm		4 (1.5%)	1 (2.1%)	5 (1.6%)

Data are presented as numbers; percentages are in parenthesis

Table 3. Patients' distribution according to applied line of management

For evaluation of outcome; a total 422 endoscopic trials, irrespective of type of bronchoscope, were conducted and success was obtained in 281 trials for endoscopic success rate of 66.6%. Considering type of bronchoscope, a total of 392 trials of RB were conducted of which 274 trials were succeeded for a total success rate of RB of 69.9%, of trials. On contrary, FB achieved success rate of only 23.3% of trials. Considering shift to thoracotomy as a failure of bronchoscopic retrieval, bronchoscopy provided a total success rate in studied patients' population of 92.8%; 90.7% for RG and 23.3% for FOB, (Table 4, Fig 7).

	Success	Failure	Total
Fiberoptic bronchoscopy	7 (23.3%)	23 (76.7%)	30 (100%)
Rigid bronchoscopy	274 (69.9%)	118 (30.1%)	392 (100%)
Total	281 (66.6%)	141 (33.4%)	422 (100%)

Data are presented as numbers; percentages are in parenthesis

Table 4. Bronchoscopic outcome among trials conducted

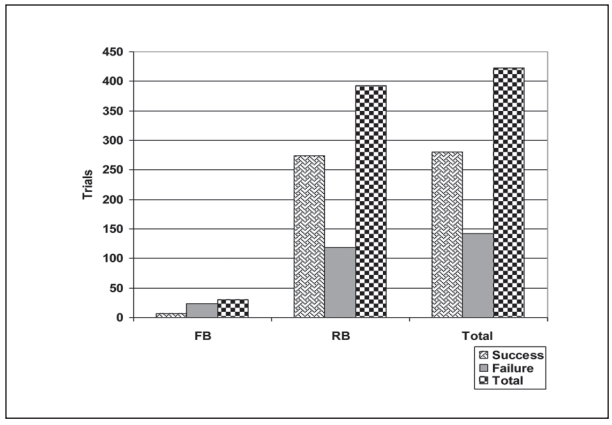

Fig. 7. Outcome of endoscopic trials for retrieval of inhaled FB categorized according to type of bronchoscopy

Mean duration of bronchoscopic extraction was 33±8.2; 15-45 minutes. The majority of bronchoscopic examinations (n=199) were conducted within the range of 30-45 minutes, 74 bronchoscopic examinations were conducted within the range of 20-30 minutes and only 8 examinations were conducted within 15 minutes.

Eleven patients developed complications after bronchoscopy for a complication rate of 2.6% for bronchoscopic trials and 3.6% for patients underwent bronchoscopy. Three patients developed pneumothorax that required insertion of underwater chest tube, pneumothorax resolved and tube was removed after 3 days in one patient and after 5 days in the other two patients. Five patients developed surgical emphysema which was managed conservatively for 48 hours and patients were discharged. Three patients developed blood tinged sputum and were managed conservatively and discharged on the second day after bronchoscopy. Mean duration of hospital stay for patients had bronchoscopy was 2.1±0.8; range: 1-5 days. The majority of patients (n=135) stayed for 2 days, 78 patients for 3 days, 65 patients stayed for one day and only 2 patients stayed for 5 days.

Two patients (8.3%) developed surgical wound infection that was managed conservatively without the need for wound drainage. Mean duration of postoperative hospital stay for patients had thoracotomy was 6.1±1.7; range: 4-8 days, (Table 5).

	Duration	Number	(%)
Duration of bronchoscope (min)	15	8	2.8
	20	29	10.3
	25	45	16
	30	32	11.4
	35	82	29.3
	40	45	16
	45	40	14.2
Duration of hospital stay after bronchoscope (days)	One	65	23.2
	Two	135	48.2
	Three	78	27.9
	Five	2	0.7
Duration of hospital stay after thoracotomy (days)	Four	3	12.5
	Five	4	16.6
	Six	7	29.2
	Seven	7	29.2
	Eight	3	12.5

Table (5): Patients' distribution according to duration of bronchoscope and hospital stay

Discussion

The current retrospective study relied on selective rules for inclusion only for patients' file containing full required data, and for patients in age group of 10-20 years and must be managed according to the assigned protocol applied in the institute. Throughout the study period, 321 files were chosen

for inclusion of which 274 files were for female patients and 47 files for males for a female to male ratio of 5.8:1. This feminine preponderance could be attributed to the widespread use of headscarf since young age and indicated the disuse of fixing pins which may be explained by their deficient experience in usage of these pins in that young age.

These observations supported that previously reported by ***Hebbazi et al.*** [6] who presented a series of 16 cases of inhaled scarf pins, all were veiled young girls with a mean age of 16.6 years, and patients put the pin between their lips while fixing their scarves so accidental inhalation occurs. Also, ***Albirmawy & Elsheikh*** [7] studied a series of patients older than 10 years and found that females were affected more than males by a ratio of 40.5:1 and headscarf pins were the predominant foreign bodies inhaled.

Moreover, the frequency of females among early presenters was significantly higher compared to males and this could be attributed to work circumstances which may prevent early presentation of males and to the hurries of females, their parents or school health provider to attend to the hospital because the accident usually occurs early in morning during preparation for going to the school or during school time.

The majority of patients were presented asymptomatic depending on the history of inhalation and because of early presentation prior to development of manifestations. In addition to the fact that the scarf pin usually does not cause obstruction and so no respiratory complaints. However, about 17.8% of patients presented with dry cough and blood tinged sputum and those mostly late presenters and males.

As regards location of the FB, gender-related difference is evident. Males had significantly more right bronchial tree FB (63.8%), while females had significantly more left bronchial tree FB (56%). This could be attributed to the difference in the type of inhaled FB and to anatomy of both bronchial trees. Anatomically, the right main bronchus is more vertical and in line with the trachea, so most probably inhaled FB will be in lodged in right bronchial tree as reported in the current study in the total patients' population and in males where the heavier and shorter inhaled FB as screw pins mostly lodge directly in right bronchial tree and coughing could not mobilize it to the left. On the other hand, the head of the scarf pin was mostly peripheral in position, while the pointed tip is the more central and when the anxious female patients is continuously coughing, the pin was pushed with its pointed tip towards the left angulated bronchus to get impacted in its wall. In line with the obtained results, Al-***Lawatey et al.*** [8] in their series retrieved 39 pins of which 22 pins (56.4%) were in left bronchial tree. ***Al-Halfawy et al.***, [9] reported that 19 out of 32 pins (59.4%) in their series were found in the left bronchus. Also, ***Rizk & Rassi*** [10] retrospectively studied 106 children under the age of 15 years had inhaled FB and found that in 60% of cases, the FB was bronchial, and slightly more frequently on the right side, 51% presented within 24 hours, while 49% were seen later than 72 hours and rigid bronchoscopy was preceded by flexible bronchoscopy in only 12% of cases.

Seventeen patients could spontaneously expel the inhaled FB which most probably was located in upper trachea and could be expelled during an attack of coughing. Similarly, ***Pan et al.*** [11] reported that out of 368 patients inhaled foreign body, three coughed out the foreign body before operation.

Bronchoscopic retrieval was accomplished in 92.8% of patients; 90.7% using RG and 23.3% using FOB, while thoracotomy was required for management of 23 patients. These data indicated the beneficial role of bronchoscopy for management of such cases and that bronchoscopy could allow sparing of surgery in most cases. In line with these data, ***Hasdiraz et al.,*** [12] reported success rate of 88.6% for pin retrieval using RB. ***Jiaqiang et al.*** [13] retrospectively reviewed medical records of 34 patients had inhaled FB and found age range was 6 to 14 years, pen caps were most frequently found in the right main stem bronchus (76.4%), a history of an episode of foreign body inhalation (100%) and acute cough (28 cases, 82.3%) were the most common presenting findings and all inhaled pen caps were successfully removed by reverse grasping forceps during rigid bronchoscopy.

Hamad et al. [14] reviewed the records of 73 female patients who underwent bronchoscopy for scarf pin inhalation and reported the following data: mean age was 13.4 years, time lag before admission was <12 h for 59 (81%) patients, FB were seen in left bronchial system in 50.7% of patients, in right bronchial system in 32.9% and in the trachea in 16.4% of patients and in 90.4% of patients, FB was removed in the first bronchoscopic trial; a second trial was needed in 6.8% of patients, and thoracotomy was performed in 2.8% of patients and concluded that headscarf pin aspiration occurs in adolescent Islamic girls and rigid bronchoscopy is the preferred treatment modality.

El Koraïchi et al. [15] described a series of 36 pin inhalation and reported that age varied from 10 to 15 years, symptoms are dominated by coughing and stinging sensation, the pin is lodged in the right airways, left airways and at the trachea, in that order of frequency, pin extraction was done safely by rigid bronchoscopy under general anesthesia. ***Cutrone et al.*** [16] retrospectively reviewed 310 cases of foreign body inhalation and reported that rigid bronchoscopy under general anesthesia is an extremely accurate surgical technique to identify, localize and remove airway foreign body. ***Korlacki et al.*** [17] assessed bronchoscopy usefulness for diagnosis and treatment in children younger than 14 years with suspected of foreign body aspiration and found that bronchoscopy is the best diagnostic and therapeutic method in all suspicions of foreign body and in children rigid bronchoscopy is still the method of choice.

Mean theater time was about 33 min for bronchoscopy and mean hospital stay was about 2 days. These findings go in hand with ***Maddali et al.,*** [18] who found 30 minutes as duration of bronchoscopic procedure as ideal and beyond it complication

rate may increase. On contrary, ***Korlacki et al.*** [17] reported that operating time was from 5 to 90 min, average time was noted to be 24 min and average time of hospital stay was 2-3 days. Eleven patients developed complications after bronchoscopy for a complication rate of 2.6%/endoscopic trial and 3.6%/ patient. Such frequency of complications coincided with that previously reported by ***Albirmawy & Elsheikh*** [7] who reported complications such as laryngotracheal edema in 16.6% and pneumothorax in 2.3% of their series of bronchoscopy.

It could be concluded that inhaled radiopaque FB is not uncommon event in patients of age group 10-20 years and the applied management protocol provided bronchoscopic retrieval of FB with a total success rate of 92.8% and minimal complications.

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Early Outcomes of Surgical Treatment of Empyema in Children

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Background: **Empyema thoracis is defined as an accumulation of pus within the pleural cavity. While the morbidity and mortality of this condition have undoubtedly improved over recent years, debate continues regarding the nature and timing of surgical intervention.**

Methods: **This study was carried out in Cardiothoracic Surgery Department, Faculty of Medicine, Menoufia University from Januray 2010 to January 2012. It included 50 children (less than 12 years) who had thoracic empyema. Patients were treated first by tube thoracostomy with or without intrapleural fibrinolytics. Thoracotomy was used when indicated.**

Results: **Chest tube was the definitive treatment in 40 (80%) cases, while more aggressive surgical management with thoracotomy was done in 10 (20%) cases. Fibrinolytic therapy with streptokinase (STK) was used in 16 cases (32%). Its usage resulted in total lung inflation in 12 cases, while 4 cases showed non inflated lung (treated by open drainage). The chest tube duration ranged from 2 – 41 days (16.62 ± 9.05 days) and the postoperative hospital stay ranged from 2 – 42 days (16.80 ± 9.17 days). Four cases (8%) had wound infection, 1 case (2%) had wound dehiscence and 1 case (2%) had scoliosis. Mortality occurred in only 1 patient.**

Conclusion: **Surgical procedures for treatment of empyema in children are safe and effective with low morbidity and mortality. Early cardiothoracic surgical consultation in cases of parapneumonic effusion may improve the outcome and decrease the need for more advanced surgical procedures.**

Empyema thoracis is defined as an accumulation of pus within the pleural cavity. While the morbidity and mortality of this condition have undoubtedly improved over recent years, debate continues regarding the nature and timing of surgical intervention **(Rees et al., 1997)**. The incidence of parapneumonic effusion and empyema is approximately 3.3 cases per 100,000 children. It has been estimated that 1 in every 150 children hospitalized with pneumonia will develop an empyema **(Hardie et al., 1996)**.

Empyema may follow secondary infection of a traumatic hemothorax or lung contusion **(Mandal, 1997)**. Occasionally secondary Empyema follows a penetrating injury of the chest or after infection in the pleural space following thoracotomy. More commonly secondary empyema invariably follows intrathoracic rupture of the esophagus **(Avanoglu et al., 1998)**.

The goals of empyema treatment as expressed by Mayo and associates are saving the life of the patient, eliminating empyema, re-expanding the lung, restoring mobility of the chest wall and diaphragm, restoring normal respiratory function, eliminating complications, reducing the length of hospital stay, and preventing recurrence **(Rachel et al., 2002)**.

Patiets and Methods

This study was carried out in Cardiothoracic Surgery Department, Faculty of Medicine, Menoufia University from Januray 2010 to January 2012. It included 50 children (less than 12 years) who had thoracic empyema.

Cardiothoracic Surgery Department, Faculty of Medicine – Menoufia University

** Public Health and Community Medicine, National Liver Institute – Menoufia University

Codex : o5/12/1204

The diagnosis of empyema was established by pleural fluid analysis revealing one or more of the following criteria; grossly purulent pleural fluid aspirate, positive gram stain or culture, pleural fluid glucose level less than 40 mg/dl, pleural fluid pH level less than 7.00, pleural fluid lactic dehydrogenase (LDH) more than 1000 IU/l.

Patients were treated first by tube thoracostomy under general anesthesia. If pus was very thick or discontinued to flow with persistent lung border in the chest x-ray without air leak, pleural irrigation was tried by warm saline to break down and dissolve any thick debris to help drainage.

If chest tube drainage stopped or became minimal with persistent lung border and no air leak for 4 days and the CT chest revealed pleural loculations, intrapleural injection of streptokinase was done on the 5th day. A Streptokinase vial containing 1.5 million IU was used. The dose was 10.000 IU/kg with a maximum dose 250.000 IU/dose. The calculated dose was diluted in 30 ml normal saline and injected via the chest tube. The chest tube was clamped for 4 hours after instillation then opened to allow drainage. This was done once daily for three successive days, provided that no complications occurred, then chest x-ray was done to demonstrate the effect (Figure 1).

Decortication was done in cases that did not improve clinically or radiologically despite of IV antibiotics, patent draining chest tube, and pleural irrigation or fibrinolytics. This was done by minimal muscle-sparing thoracotomy (Figure 2).

Pulmonary resection, an intraoperative decision, was made in some cases according to the lung condition (Figure 3), lung sparing was the main target but in some case when the lung was too damaged and its repair was not a satisfactory decision, lobectomy was done.

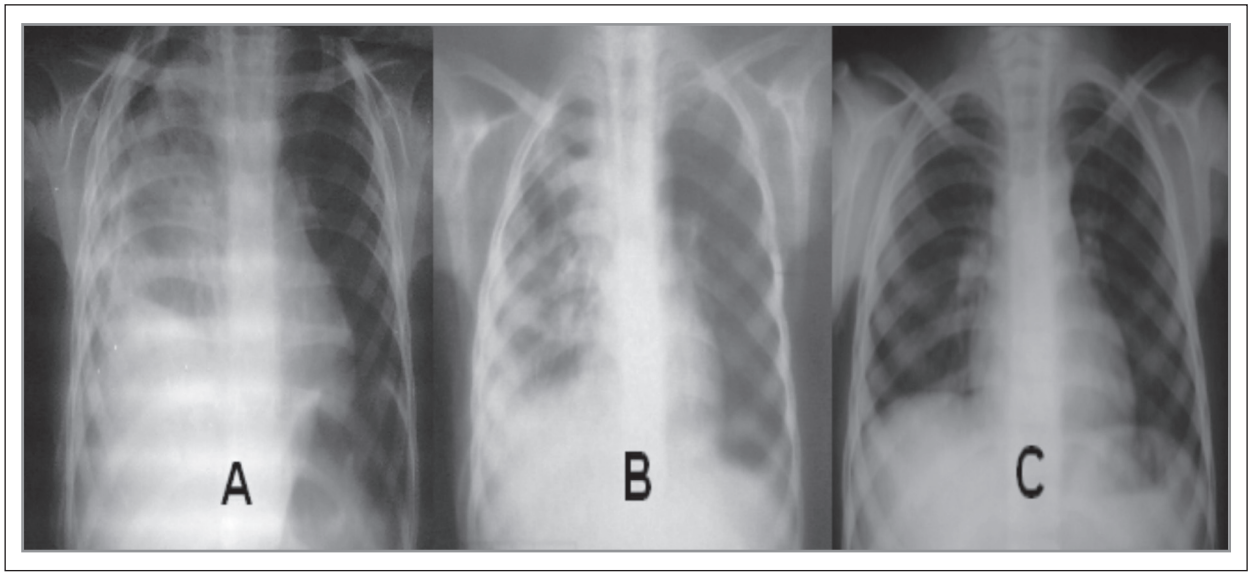

Fig 1. Fibrinolytic therapy, A) Before injection; B) Immediately after injection; C) Follow up after 6 months

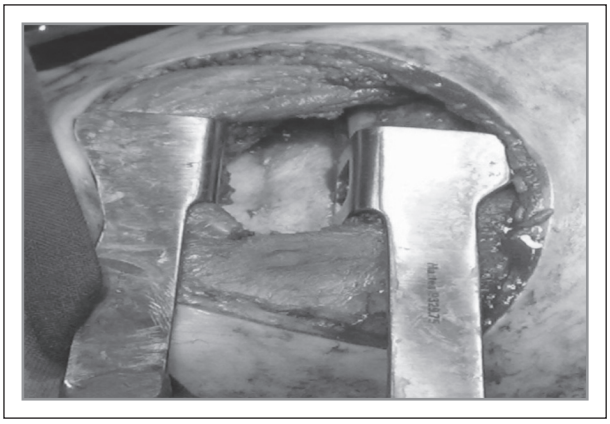

Fig 2. Muscle sparing thoracotomy with very thick pleural peel

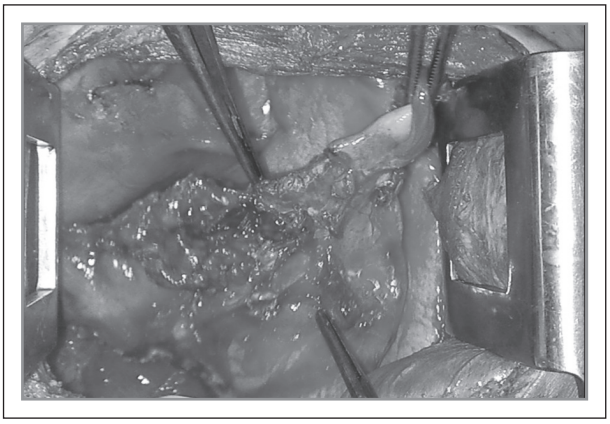

Fig 3. Destroyed right lower lobe necessitating lobectomy.

Results

This study included 50 children who had thoracic empyema (Table 1), they were 22 males (44%) and 28 females (56%). Their ages ranged from 1-142 months (45.54 ± 38.24 months).

Table 1: Patients` characteristics

Variable		Patients (n=50)
Age (months)		45.54 ± 38.24
Female sex		28 (65%)
Fever		39 (78%)
Cough		44 (88%)
Dyspnea		37 (74%)
Duration of complaint (days)		10.80 ± 4.86
History of repeated chest infection		22 (44%)
Side	Right	21 (42%)
	Left	29 (58%)
X-ray	Pleural effusion	38 (76%)
	Hydropneumothorax	12 (24%)
Chest CT	Pleural effusion	24 (48%)
	Encysted pleural effusion	16 (32%)
	Hydropneumothorax	10 (20%)
Leucocytic count (cells/cmm)		14.74 ± 3.55
Hemoglobin (gm/dl)		10.03 ±1.41
LDH (IU/L)		523.32 ± 263.26
Protien (gm/dl)		6.52 ±0.46
ESR (mm/h)		99.92 ± 22.06
CRP (mg/l)		89.56 ± 19.62

Regarding the chief complaints, fever was present in 39 patients (78%), while productive cough was present in 44 patients (88%) and dypsnea occurred in 37 patients (74%).

The duration of complaint (the period from starting complaining till cardiothoracic surgical consultation) ranged from 3-30 days (10.80 ± 4.86 days). The past history was negative in 21 cases (42%), repeated chest infection was present in 22 cases (44%), and miscellaneous history was present in 7 cases (14%) including; meningitis, kerosene swallow, iatrogenic pnemothorax with chest tube insertion, hepato-splenomegaly, chylothorax with chest tube insertion, chest trauma, and smoking.

Pre-operative imaging revealed that 38 patients (76%) were having pleural effusions, while 12 (24%) patients showed hydro-pnemothorax in their chest X-Ray. When CT chest was used, 24 patients (48%) had pleural effusion, 16 patients (32%) had encysted pleural effusion and 10 patients (20%) had hydro-pnemothorax.

Preoperative routine laboratory investigations revealed that the total leucocytic count (TLC) ranged from 4.7 – 25.7 cells/cmm (14.74 ± 3.55 cells/cmm), haemoglobin level (Hb) ranged from 7.3 – 13.5 gm/dl (10.3 ± 1.41 gm/dl), serum lactatic dehydrogenase enzyme level ranged from 212 – 1545 IU/l (523.32 ± 263.26 IU/l), serum protein ranged from 5.4 – 8.1 gm/dl (6.52 ± 0.46 gm/dl), erythrocyte sedimentation rate (ESR) test at the 1st hour ranged from 35 – 140 mm (99.92 ± 22.06 mm), and C-reactive protein level (CRP) level ranged from 12 – 124 mg/l (89.56 ± 19.62 mg/l).

Regarding pre-operative pleural fluid analysis, the studied group number was 48 as thoracic aspiration was negative in two cases (Table 2), pH ranged from 6.5 – 7.4 (6.87 ± 0.21), lactic dehydrogenase enzyme (LDH) level ranged from 7 – 24478 IU/l (4074.62 ± 5235.63 IU/l), glucose level ranged from 10 – 55 mg/dl (27.72 ± 9.0 mg/dl), and protein level ranged from 0.7 – 18.7 gm/dl (5.40 ± 2.74 gm/dl). Pleural fluid pH level was less than 7 in 30 cases (62.5%), from 7.0 – 7.2 in 15 cases (31.3%) and more than 7.2 in 3 cases (6.3%). Pleural fluid LDH level was less than 900 IU/L in 9 cases (18.8%) and more than 900 IU/L in 39 cases (81.2%). Pleural fluid Glucose level was less than 40 mg/dl in 44 cases (91.7%), and more than 40 mg/dl in 4 cases (8.3%).

Variable	Patients (n=48)
pH	6.87± 0.21
LDH (IU/L)	4074.62 ±5235.63
Glucose (mg/dl)	27.72 ± 9.0
Protien (gm/dl)	5.40 ± 2.74
Positive culture	21 (43.75%)

Table 2. Pleural fluid analysis

Culture of pleural fluid showed positive bacterial growth in 21 cases and no growth in 27 cases while bacterial culture couldn't be assessed in 2 cases as aspiration was negative. Infection was by single organism in 19 cases (90.5%) and mixed infection in 2 cases (9.5%). The most identified organism was Streptococcus Pneumoniae (28.6%), where Staphylococcus Aureus was the second common cultured organism (23.8%).

Chest tube was the definitive treatment in 40 (80%) cases, while more aggressive surgical management with thoracotomy was done in 10 (20%) cases. Lobectomy was done in 6 cases, decortication alone was done in 2 cases and decortication with repair of broncho-pleural fistula was done 2 cases.

Fibrinolytic therapy with streptokinase (STK) was used in 16 cases (32%). It was stopped because of complications in 3 cases, bleeding in 2 cases and allergy in 1 case. Its usage resulted in total lung inflation in 12 cases (75%), while 4 cases (25%) showed non inflated lung (treated by open drainage).

The chest tube duration ranged from 2 – 41 days (16.62 ± 9.05 days) and the postoperative hospital stay ranged from 2 – 42 days (16.80 ± 9.17 days). Four cases (8%) had wound infection, 1 case (2%) had wound dehiscence and 1 case (2%) had scoliosis. Mortality occurred in only 1 patient. He was a 1 month age boy. He died from severe septicemia on the second day of hospital admission after insertion of the chest tube which drained 300 cc of pure pus.

Follow-up CT chest with contrast was done six months after discharge. It showed complete lung inflation without recurrence of empyema in all cases. Mild residual pleural thickening was detected in 21 cases (42.85%).

Variable		Patients (n=50)
Definitive treatment	Chest tube	40 (80%)
	Thoracotomy	10 (20%)
Using fibrinolytics		16 (32%)
Chest tube duration (days)		16.62 ± 9.05
Postoperative hospital stay (days)		16.80 ± 9.17
Morbidity		6 (12%)
Mortality		1 (2%)

Table 3: Operative and postoperative data

Discussion

With the advances in medical technologies and effective antibiotics, the rate of mortality from empyema has dropped from 29% to 0.46% in the latest series **(Wexler et al., 2006)**. Thoracic empyema in the pediatric age group is a complication of bacterial pneumonia in 50% to 75% of cases. Low socioeconomic status, inappropriate antibiotic use, malnutrition, and delay in seeking treatment are contributing factors to the development of empyema in patients with pneumonia **(Wozniak et al., 2009)**.

Our study included 50 children (less than 12 years) who had thoracic empyema. Regarding the chief complaint, cough was the most common symptom as it occurred in 88% of cases, followed by fever which occurred in 78% of cases and dypsnea that occurred in 74% of cases. This coincides with the results obtained by Aydoğan et al **(2008),** as cough was the most common symptom (87%), followed by fever (85%) on their study on 56 child diagnosed to have empyema. But our results disagree with Çekirdekçi et al **(2000)** as they reported that fever was the most common symptom (93%), followed by dypsnea (81%) and cough (70%).

The mean duration of complaint in our study was 10.8 days. This is very close to that encountered by Aydoğan et al **(2008)** (11.4 days), but it is longer than the results obtained by Grewal et al **(1999)** (7.4 days).

We found that 76% of cases had pleural effusion in their preoperative chest x-ray, while 24% of cases had hydropneumothorax. These results are similar to that obtained by Grewal et al **(1999)** as they recorded that 72% of their cases had pleural effusion and (28%) had loculated effusion with air fluid level. When CT chest with contrast was used we found that 48% of cases had pleural effusion, 32% had encysted pleural effusion and 20% of cases had hydropneumothorax. This coincides with Ozel et. al. **(2004)** who recorded that 53% of cases had pleural effusion, 31% had encysted pleural effusion, and 14% had hydropnemothorax.

Biochemical analysis of pleural fluid in our cases (Table 2) was close to that obtained by Aydoğan et al **(2008)**, as their ph was 6.96, glucose was 30.9 mg/dl, LDH was 3282 IU/l and protein was 4.1 g/dl. Grewal et al **(1999)** recorded a higher pH (7.8) and glucose level (35 mg/dl) and a lower LDH level (2769 IU/l).

The most common cultured organism in our study was Streptococcus Pneumoniae (28.6%). Saglani et al **(2005)**, Le Monnier et al **(2006)**, and Eastham et al **(2004)** reported a similar results but in a higher percentage (44%, 51%, and 66% respectively).

In our study, chest tube was the definitive treatment in 40 cases (80%) and thoracotomy was the definitive treatment in 10 cases (20%). These results are similar to that of Ozel et al **(2004)** as they recorded that chest tube was the definitive treatment in 78.5% of patients and thoracotomy was the definitive treatment in 21.5% of patients. Our results are also close to those obtained by Çekirdekçi et al **(2000)** as they reported on their study on 53 children that chest tube was the definitive treatment in 39 cases (74%) and thoracotomy was the definitive treatment in 14 cases (26%).

Fibrinolytic therapy was used in 16 cases. Its use resulted in total lung inflation in 12 cases (75%), while failure of inflation occurred in 4 cases (25%). These results coincide with those obtained by Çekirdekçi et al **(2000)** as they reported that after streptokinase usage on 17 children, 13 of them (76%) showed lung inflation, while 4 cases (24%) failed. Our results are also similar to those obtained by Aydoğan et al **(2008)** on their study on 14 children, 12 of them (84%) showed lung inflation after streptokinase usage, and 2 cases (16%) failed to achieve lung inflation.

In our study, the mean chest tube duration was 16.62 days. This is longer than that obtained by Ozel et al **(2004)** and Avansino et al **(2005)** (10.1 and 10.6 days, respectively). The mean postoperative hospital stay was 16.8 days. This is longer than that obtained by Aydoğan et al **(2008)** and Çekirdekçi et al **(2000)** (9.7 and 12 days, respectively).

Morbidity occurred in 6 cases (12%). This is close to that obtained by Rodriguez and Catalan **(2006)** (10%), but is larger than that reported by Avansino et al **(2005)** (5.6%). Mortality occurred in 1 case (2%), which is close to that reported by Avansino et al **(2005)** and Çekirdekçi et al **(2000)** (3.3% and 1.9%, respectively).

Conclusion

Surgical procedures for treatment of empyema in children are safe and effective with low morbidity and mortality. Early cardiothoracic surgical consultation in cases of parapneumonic effusion may improve the outcome and decrease the need for more advanced surgical procedures.

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