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Submit Manuscripts: Editorial office
330 ElSudan Street, Embaba, Egypt
Email : jegyptscts@gmail.com
Tel.33038054 -Mob.01002327650

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THORACIC

Guidelines For Authors

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

Editorial Office

Please address all correspondence to:

Mohamed Abdel Raouf Khalil, MD, Editor

Journal of the Egyptian Society of Cardio-thoracic Surgery

330 El-Sudan St., Imbaba, Cairo, Egypt.

Telephone: (+202) 3303 6634

Fax: (+202) 3303 8054

E-Mail: jegyptscts@gmail.com

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.

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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.

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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.***

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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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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.*

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THE EGYPTIAN SOCIETY OF CARDIO-THORACIC SURGERY

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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* (JESCTS) 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.

Recovery of Left Ventricular Functions After Aortic Valve Replacement For Patients with Severe Aortic Stenosis and Poor Left Ventricular Ejection Fraction

Cardiovascular

Ahmed Labib Dokhan,

Montaser Elsawy Abd Elaziz,

Mohammed Gamal Hagag

Objectives: **The aim of this study was to evaluate the early influence of aortic valve replacement (AVR) on reversibility of left ventricular functions for patients with severe AS and left ventricular dysfunction.**

Methods**: Between October 2012 and January 2015, this multicenter prospective observational study included forty patients with severe AS and left ventricular dysfunction (Ejection Fraction <40%). Patients were classified into two groups, group A(High Pressure) with pressure gradient >40 mmHg, and group B (Low Pressure) with pressure gradient <40 mmHg. All patients underwent conventional AVR using cardiopulmonary bypass. Left ventricular function was evaluated 6-months postoperatively by transthoracic echocardiography.**

Results**: Our study included 26 males and 14 females with mean age of 65.55±5.1 years and mean Eurscore II of 1.6. The mean cardiopulmonary bypass time of 116.8±30.2 minutes and mean cross clamp time of 74.13 min. Postoperative course was with mean ICU stay of 3.7 days, we detected statistically significant improvements for both groups in left ventricular dimensions and systolic function in postoperative follow-up echo after 6 months**

Conclusion**: Surgical AVR is still the gold standard management, for severe AS even in the risky subgroup of patients with left ventricular dysfunction and low gradient, due to its effect on the left ventricular function improvement.**

KEY WORDS: **Aortic Stenosis, Aortic Valve Replacement, Left Ventricular Dysfunction**

Valvular heart disease is now presenting in older patients, frequently associated with multiple comorbidities, frailty and the risks of intervention are increasing [1]. Aortic stenosis is a common form of heart disease. The prevalence of aortic stenosis (AS) has been estimated to be 0.3-0.5% in the general population and to be markedly higher in the elderly, with a prevalence estimate of 2-7% in individuals over 65 years [2].

Degenerative calcific aortic stenosis is the most common cause of AS in industrialized nations but in developing countries in Africa, Asia, and South America, rheumatic valve disease remains the common cause [3]. For optimal clinical decision making, comprehensive diagnostic evaluation of patients with aortic valve disease requires assessment of the valve morphology , severity of the valve lesion, Aortic size, systemic arterial afterload, impact on LV size and function, consequences of abnormal LV function and hemodynamics on pulmonary artery pressures. Echocardiographic data should be integrated with the clinical features of a patient, other imaging, when needed, catheterization findings in order to approach AS in a systematic fashion [4].

It is well recognized that severe AS carries poor prognosis if left untreated. Despite this recognition, many patients are inappropriately denied surgery for perceived risk[3]. In real practice, a considerable number of patients with severe AS are managed medically for reasons such as advanced age, high procedural risk and multiple comorbidities, although current guidelines give a class IA recommendation on surgical treatment in patients with symptomatic severe AS [5].

Department of Cardiothoracic Surgery, Faculty of Medicine, Menoufia University, Egypt.

Corresponding Author:

Montaser Elsawy Abd Elaziz

mnt_swy@yahoo.com

Codex : o3/01/1510

The objective of our study was to evaluate the early outcome, including response of left ventricular functions, morbidities and mortalities, to surgical aortic valve replacement in patients suffering from isolated severe aortic stenosis associated with left ventricular dysfunction and low transvalvular gradient.

Materials and Methods

Study Design

After approval of Ethics committee for the study proposal and between October 2012 and January 2015, this prospective observational study was conducted in multiple centers including Menoufia University Hospital and Nassir Institute, Forty patients with isolated severe aortic stenosis (AVA < 1cm2), low ejection fraction (EF < 40%), were included in the study. They were divided into two groups: group A (high pressure) included 20 patients with transvalvular mean pressure gradient > 40 mmHg, and group B (low pressure) included 20 patients with mean pressure gradient < 40 mmHg. Patients with coronary artery disease, mitral or tricuspid valve disease, redo cases were excluded. Each patient was examined preoperatively by transthoracic echocardiographic including measurement of: Left Ventricular End Diastolic Diameter (LVEDD), Left Ventricular End Systolic Diameter (LVESD), Ejection Fraction (EF), Aortic Valve Area (AVA), and mean transvalvular pressure gradient. Predicted operative mortality was calculated preoperatively using online calculator of The European System for Cardiac Operative Risk Evaluation (EUROSCORE II).

Operative Steps

All patients were operated under general anesthesia, with conventional median sternotomy incision; cardiopulmonary bypass was instituted through aorto-atrial cannulation and right superior pulmonary vein venting. After antegrade cardioplegia, Aortotomy was done, followed by excision of calcified aortic valve and annular decalcification. In our study, 21 mechanical valves and 19 biological valves were inserted with variable sizes as one valve was 19 size, 21 valves were 21 size, and 18 valves were 23 size. The new aortic valve was implanted using interrupted non-absorbable suture. Closure of aortotomy, weaning from bypass and closure of sternotomy were done sequentially, patient transferred to ICU sedated and intubated. We followed patients in hospital until recovery of acceptable physical activity then discharged. Follow up outpatient clinic was carried at 1 week, 1 month, 3 months, and 6 months interval with transthoracic echocardiography at 6-months visit to assess change in left ventricular dimensions and systolic function.

Statistical Analysis

All preoperative data, operative, postoperative and outpatient follow up data were collected. Quantitative variables were expressed as mean (M) and standard deviation (SD) while qualitative data was expressed as either number (n), ratio, or percentage (%) according to relevance. Statistical significance was tested using IBM compatible computer and IBM SPSS statistics version 19. Significance of quantitative variable was tested using paired student's t test. We considered probability values < 0.05 as statistically significant.

Results

Table. 1 illustrates the preoperative data. Classic demographics of severe aortic stenosis patients were observed and no significant difference between both groups as regard, the age, sex ratio, and body mass index. There was no statistical significant difference between both groups as regard comorbidities such as diabetes mellitus, hypertension, dyslipidemia, and smoking, There was no statistical significant difference in incidence of all symptoms between both groups. The classic triad of aortic stenosis symptoms of chest pain, dyspnea, and syncope were studied. The predominant symptom at the time of presentation to health care services was chest pain in 18(45%) of cases. The mean Euroscore II value was not significantly different between both groups.

Table 2 illustrates the preoperative echo findings of studied patients. There was no statistical significant difference between both groups regarding all parameters except that of AVA (p-value=0.02).

Table 3 demonstrates all patients underwent AVR with important operative indicators as cardiopulmonary bypass time and aortic cross-clamp time without significant difference in two parameters between both groups. For the mean cross clamp time in minutes, in group A it was longer than that in group B but no statistical significant difference.

The postoperative ICU course was remarkable with higher mean postoperative ventilation time in group B, and total ICU mean stay in days was nearly equal in both groups. 3(7.5%) cases required reopening for high drainage (1 in group A, 2 in group B). 3(7.5%) cases died.

The 6-month follow up echo for our 37 survivors was interestingly reporting improvement in left ventricular dimensions and systolic function in both groups, the difference in mprovement was only significant in EF (p= 0.049) table 4.

Table.5 shows left ventricular response to AVR for the 19 survivors in group A, comparing preoperative mean LVEDD to mean postoperative LVEDD detected highly significant relationship (p=0.000). By comparing mean preoperative LVESD to the lower postoperative mean, A highly significant difference noticed (p-value=0.000). Finally the higher postoperative mean EF than the preoperative one achieved high statistical significance (p-value=0.000).

Left ventricular response after AVR for the 18 survivors in group B, we compared postoperative mean LVEDD, LVESD to preoperative means, A significant statistical relationship reported (P=0.004, 0.000 respectively). Mean postoperative EF of 36.22±6.72 compared to preoperative EF of 31.6±5.7, reporting statistically significant relationship (P-value = 0.008) Table .6.

Variable	Group A n=20	Group B n=20	P-value
Demographic Data			
Age (M±SD)	66.35±6.2	64.75±3.8	0.33
Sex (M:F)	3:2	7:3	0.74
BMI (M±SD)	29.88±3.8	31.04±3.7	0.33
Comorbidities			
Diabetes n(%)	6(30)	4(20)	0.71
Hypertension n(%)	11(55)	13(65)	0.75
Dyslipidemia n(%)	3(15)	4(20)	1
Smoking n(%)	5(25)	4(20)	1
Symptoms			
Chest pain n(%)	8(40)	10(50)	0.75
AF n(%)	5(25)	4(20)	1
Dyspnoea n(%)	4(20)	3(15)	1
Syncope n(%)	2(10)	3(15)	1
Euroscore ll (M±SD)	1.57±0.8	1.62±1.35	0.88

BMI: Body Mass Index, AF: Atrial Fibrillation

Table. 1 Preoperative Data

Variable	Group A(HP) n=20	Group B(LP) n=20	P-value
LVEDD (M±SD)	7.92±0.9	7.97±0.93	0.86
LVESD (M±SD)	6.67±0.75	6.75±0.82	0.76
EF(M±SD)	31.7±4.14	30.85±6.12	0.61
AVA(M±SD)	0.63±0.14	0.73±0.13	0.02*

HP:High Pressure, LP:Low Pressure, LVEDD:Left Ventricular End Diastolic Diameter, LVESD:Left Ventricular End Systolic Diameter, EF:Ejection Fraction, AVA:Aortic Valve Area

Table. 2 Preoperative Echo-data:

Variable	Group A n=20	Group B. n=20	P-value
Bypass Time /hour (Mean±SD)			
Cross-clamp time	78.65±20.2	69.6±16.3	0.13
Total bypass time	120.03±30.7	113.3±3	0.47
Circulation and ventilation support			
M.Ventilation/h	16.95±12.97	21.15±24.15	0.63
IABP n(%)	2(10)	4(20)	0.66
Morbidity and Mortality			
ICU stay/day	3.8±1.2	3.6±1.4	0.5
Arrhythmias n(%)	4(20)	5(25)	1
Reopen. n(%)	1(5)	2(10)	1
Wound Infection	2(10)	3(15)	1
Mortality n(%)	1(5)	2(10)	1

Table 3. Operative and Postoperative Data

Variable (Mean±SD)	Group A (HP) n=19	Group B (LP) n=18	P-value
LVEDD	7.55±0.86	7.59±0.61	0.88
LVESD	6±0.77	6.2±0.51	0.31
EF	40.9±7.14	36.22±6.74	0.049*

HP: High Pressure, LP:Low pressure, LVEDD:Left Ventricular End Diastolic Diameter, LVESD:Left Ventricular End Systolic Diameter, EF: Ejection Fraction

Table 4. Postoperative Echo-data

Variable (Mean±SD)	Preop-Echo n=19	Post-Echo n=19	P-value
LVEDD	7.93±0.93	7.55±0.86	0.000*
LVESD	6.66±0.77	6±0.77	0.000*
EF	32.1±3.8	40.9±7.1	0.000*

Preop-Echo:preoperative Echo, post-Echo:postoperative Echo, LVEDD:Left Ventricular End Diastolic Diameter, LVESD: Left Ventricular End Systolic Diameter, EF: Ejection Fraction

Table 5. Post-AVR response of left ventricle in group A

Variable (Mean±SD)	Preop-Echo n=18	Post-Echo n=18	P-value
LVEDD	7.93±0.83	7.59±0.86	0.004*
LVESD	6.68±0.76	6.2±0.51	0.000*
EF	31.6±5.7	36.22±6.7	0.008*

Preop-Echo:preoperative Echo, post-Echo:postoperative Echo, LVEDD:Left Ventricular End Diastolic Diameter, LVESD:Left Ventricular End Systolic Diameter, EF: Ejection Fraction

Table 6. Post-AVR response of left ventricle in group B

Discussion

Patients with severe aortic stenosis and impairment of left ventricular function constitute a high-risk group for aortic valve replacement. They are also a challenging group because of their heterogeneous response. Ventricular hypertrophy is also a negative factor. The association of both factors may influence surgical outcome [6]. Therefore, the question arises as to whether the left ventricle can return to normal dimension and how rapidly myocardial hypertrophy and LV dysfunction regress after aortic AVR [7].

The American College of Cardiology/American Heart Association guidelines recommended AVR for severe AS patients with LV dysfunction, the recommendations are not clear in those with low transvalvular gradient [8]. So, the management of patients with classical low-flow, low gradient AS (valve area <1 cm2, EF < 40%, mean gradient < 40 mmHg) is more difficult. If depressed EF is predominantly caused by excessive afterload (afterload mismatch), LV function usually improves after surgery. Conversely, improvement in LV function after AVR is uncertain if the primary cause is scarring due to extensive myocardial infarction or cardiomyopathy [9].

Our study aimed at evaluating the surgical aortic valve replacement as treatment option for that risky group of patients with severe aortic stenosis associated with left ventricular function and low gradient. In addition, evaluating whether patients will get benefits regarding recovery of left ventricular functions that can outweigh the procedure risk.

Mean age of patients in our study was 65.55±5.1 years, and similar to Levy et al. [10] who reported, in his study of 217 patients with severe AS, Low EF, and Low gradient, mean age of 71±8. Tribouilloy et al.[11] reported, in his study of 81 patients, mean age of 71±10. This can be explained by the process of calcific degeneration of aortic stenosis that progresses more with increasing age to get the reported incidence of aortic stenosis of 2-7% at population > 65 years. Concerning the sex distribution, males were predominant in total study group as 26(65%) were males, which is near to results of Flores-Marin et al.[12] reporting 74.4% males. We found in group A, 60% were males, while 70% were males in group B without statistical significance, the same as reported by Borowski et al.[13] who found 52.9% males in high gradient group and 84.6% males in low gradient group.

This agreement of studies upon male sex predominance of AS was the reason of many researchers to suggest that AS is similar to atherosclerosis as they share the same risk factors of old age, male sex predominance, and higher prevalence of diabetes mellitus and dyslipidemia.

Tibouilloy et al.[11] reported lower hypertensive patients as 24% hypertensive but the near incidence of diabetes as 15% diabetic. These risk factors shared in the studies more emphasizing the degenerative theory of aortic stenosis that in many ways resemble atherosclerosis but its distribution differs from region to another according to quality of life, dietary habits, and daily physical activity.

Our patients' presentation was angina like chest pain in 18 (45%) of cases, dyspnea in 7(17%) of cases, syncope in 5(12.5%) of cases and AF in 9(22.5%) of cases. Levy et al.[10] reported in their study 27% of cases with AF. These symptoms represent the classic triad of aortic stenosis symptoms of chest pain, dyspnea, and syncope.

Levy et al.[10] calculated mean euroscore for their patients of 8.9±2.7, which was higher than our patients' calculated mean euroscore of 1.6±1.1. This big difference may be contributed to our inclusion criteria of electively operated isolated aortic stenosis in contrary to patients included in levy et al.[10] study with other cardiac procedures including emergency operations and coronary artery bypass grafting.

Preoperative echo confirmed our selection criteria of severe aortic stenosis as mean total AVA was 0.68±0.14 and the low EF with mean total of 31.27±5.18. Mean total LVEDD of 7.94±0.9 and mean LVESD of 6.71±0.78. For comparison of both groups in our study, the mean LVEDD in group A was 7.92 that is nearly the same as mean LVEDD of 7.97 in group B without statistical significance (p-value=0.86) that differs from Borowski et al.[13] who reported mean of 6 in high gradient group and 7 in low gradient group. Also comparison between both groups in our study regarding preoperative LVESD was with no significant difference, and the same with EF.

We detected statistical significance between both groups in AVA with mean of 0.63±0.14 and 0.73±0.13 for group A and B respectively (p-valve= 0.02) denoting higher valve area in low gradient group. The same reported by Ben-Dor et al.[14] of getting statistical significance (p-valve<0.001) with low gradient group mean AVA of 0.8±0.16 that is larger than high gradient group mean AVA of 0.66±0.17. This large valve area explains the low gradient.

Mean cardiopulmonary bypass time of 120.3±30.7 in group A, and 113.3±30 for group B, with no statistical significant difference, and higher than Wang et al.[15] who reported 102±27 , 102±40 minutes for both groups. Our mean cross-clamp time was 78.65±20.2 in group A and 69.6±16.3 in group B which was similar to Levy et al.[10] by mean of 73±34 minutes.

Postoperatively, the mean ICU stay was 3.7±1. Wang et al.[15] reported, in their study of 35 patients underwent AVR before 2011, a similar mean ICU stay of 3.6±6 but in the same study they reported 33 patients underwent AVR after 2011 with mean ICU stay of 1.4±0.8. This can arouse mind that with more experience in care for those critical patients and advances in medical technology the ICU stay that we achieve in our study can improve to lower rate by time as Wang et al.[15] reported this difference before and after 2011.

Wang et al.[15] noticed in their study incidence of postoperative morbidities as reopening in 3 (8.6%) cases and 2 (6.1%) cases for patients before and after 2011 respectively. We get near result of 3(7.5%) cases of reopening. Concerning wound infection, Wang et al.[15] reported 1 (2.9%) case and no cases for patients operated before and after 2011 respectively. But we noticed in our study higher incidence of 5 (12.5%) cases of wound infection (2 in group A, 3 in group B). We reported One (5%) patient required permanent pacemaker out of 5 (25%) cases manifested postoperative arrhythmias in group B, while 4(20%) in group A manifested by postoperative arrhythmias.

That in agreement with Wang et al.[15] in their study with 2 (5.7%) cases and 2 (6.1%) cases required permanent pacemaker in patients before and after 2011 respectively. This can be claimed to the possible injury to conductive system during valve decalcification process that surgeons usually done with caution to minimize the incidence to the lowest possible. Mortality rate was total 3(7.5%) of these one(5%) patient in group A and 2(10%) in group B. Despite the low mean euroscore preoperatively that was 1.6±1.1 in our study that was near to Carrascal et al.[16] who reported rate of 8% and lower than that reported by Levy et al.[10] of 16%. This entire rate, despite its annoying effect for new patients being referred for surgery, is still accepted outcome for that risky group of patients. The reported rate in previous studies as noted by Levy et al.[10] is 11-21%. In conclusion, mortality rates of AVR are improving with time as our study and Carrascal et al.[16]

study reported lower rates in recent years. However, we noticed in our study the misleading underestimating euroscore that was much lower than actual mortality rate which makes use of this score questionable and requiring more justification. With occurrence of previous comorbidities and mortality rate noted during initial phase, This was dramatically changed after follow up of survivors with improvement of their symptoms, increasing exercise tolerance which was superadded by the 6-months follow-up echo results with documented improving left ventricular dimensions and systolic function.

For the 6-months follow up echo, By comparing both groups, we found mean LVEDD of 19 survivors in group A to be 7.55±0.86 that is nearly the same as 18 survivors in group B, of 7.59±0.61 without statistical significance (p-valve =0.88). Mean LVESD in group A was 6±0.77 compared to 6.2±0.51 in group B also without statistical significance. Mean EF of group A was 40.9±7.14, which was higher than group B mean of 36.22±6.74 with statistically significant difference (p-valve =0.049). This was in agreement with Vaquette et al.[17] who noted left ventricular systolic dysfunction was more likely to recover rapidly when preceded by high mean preoperative transaortic gradient and with smaller degree of cardiomegaly.

For the LV response after AVR for the 19 survivors in group A, we compared preoperative mean LVEDD of 7.93±0.93 to mean postoperative of 7.55±0.86 to detect highly significant relationship (p-valve =0.000). When we compared mean preoperative LVESD of 6.66±0.77 to the lower postoperative mean of 6.0.77, we got again highly significant relationship (p-valve =0.000). Finally the higher postoperative mean EF of 40.9±7.1 than the preoperative mean of 32.1±3.8 achieved another high significant relationship (p-valve =0.000).

About the influence of AVR on LV in the 18 survivors of group B, mean postoperative LVEDD of 7.57±0.61 compared to preoperative mean of 7.93±0.83 highly significant statistical relationship noticed (P-value = 0.004). Also mean postoperative LVESD of 6.2±0.51 compared to preoperative LVESD of 6.68±0.76 got highly significant statistical relationship (P-value = 0.000). The most important finding to all patients and investigators was the improvement in EF as mean postoperative EF of 36.22±6.72 when compared to mean preoperative EF of 31.6±5.7, statistically significant relationship was found (P-value = 0.008). These observations are consistent with earlier reports of reversibility of LV dysfunction with mean preoperative gradient > 30 mmHg. This was also reported by Clavel et al.[18] that at the 1- year follow-up, 20% of patients with AVR had normalization of LVEF(>50%). It was also associated with improvement in LVEF of 4:10% in the subset of patients with low-flow, low-gradient AS defined by AVA <1cm², mean gradient <40mmHg, and LVEF <40%. These ensuring the real advantages and effect of AVR in stopping and reversing the ongoing process of left ventricular hypertrophy and dysfunction, furthermore giving chance for remodeling and restoration of systolic function.

Conclusion

Improvement in left ventricular dimensions and systolic function outweigh the reported comorbidities for surgical aortic valve replacement for isolated severe aortic stenosis with low EF (< 40). At last, the improved quality of life and reversibility of left ventricular functions postoperatively emphasize the surgical AVR as the effective standard treatment for severe aortic stenosis.

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Coronary Artery Bypasses Grafting in Awake Patients Using High Thoracic Epidural Analgesia

Fouad Rsaekh, MD,

Passant Hassan MD*

Background: **Prolonged postoperative mechanical ventilation and failure to wean from mechanical ventilation especially in COPD patients with chest infection is one of the most annoying problems in elderly and COPD patients undergoing coronary artery bypass graft surgery).**

Patients and Methods: **between February 2012 and September 2014 in Cardiac Surgery Department, Luxor International Hospital, 12 patients of awake 'off-pump' (without cardiopulmonary bypass (CPB)) coronary artery bypass graft surgery were performed, facilitated by thoracic epidural analgesia (TEA), Surgery was performed with a conventional median sternotomy. Analgesia was provided with TEA at T2-3interspace, using bupivacaine 0.5%, lidocaine 2% and fentanyl2mcg/ml until T1–10 dermatomal block was achieved, then maintained at 2–14 ml litre−1 throughout surgery. Successful awake surgery, avoiding general anesthesia (GA) with adequate surgical conditions, without CPB was the primary end point.**

Results: **Fifteen men, mean (SD) 55 years (range 47–65 years), weight mean (SD) 78 kg (range 70-85), underwent surgery. 2 patients (16%) needed conversion to GA: one patient due to insufficient thoracic analgesia, patient become in pain and irritable and the other one the left internal mammary artery (LIMA) was dissected and we were unable to use it and we went to the leg to harvest saphenous vein graft to use it instead of LIMA. The two patients were successfully extubated immediately after surgery. Awake surgery was successful without complications in 84% of cases.**

Conclusions: **TEA is an easy and simple anesthetic technique, and is feasible, for cardiac surgery. However, certain technical limitations need to be overcome to evaluate the full potential of 'awake' cardiac surgery.**

General anesthesia (GA) remains the preferred anesthetic technique for coronary artery bypass grafting (CABG). Procedures to reduce anesthetic or surgical mortality and morbidity during open heart surgery have continually evolved and new strategies in cardiac anesthesia now enable immediate extubation (ultra-fast-track anesthesia) [3, 10].

The perioperative use of high thoracic epidural anesthesia TEA as an adjunct to GA has been shown to be beneficial in patients with coronary artery disease but it is important to make sure that patient had stop antiplatelet drugs at least one week before surgery to avoid spinal cord hematoma [2,5,6].

Pain control with TEA improves pulmonary function and reduces postoperative pulmonary dysfunction, allowing earlier extubation with less respiratory complications. Intraoperative hemodynamic stability may be improved through stress response modulation and reduced risk of myocardial ischemia [1, 10].

Benefits of TEA cannot persist for a long time into the postoperative period as all patients will receive prophylactic low molecular weight heparin 12 hours after surgery if there was no postoperative bleeding. The off-pump coronary artery grafting (OPCAB) technique allows reduced heparin doses, possibly also reducing perioperative epidural hematoma risk [4,7, 8].

Cardiothoracic Surgery Department, Cairo University.

* Anesthesia.

Corresponding Author:
Fouad Rasekh
frassekh@yahoo.com

Codex : o3/02/1510

Awake cardiac surgery was first described in 2000 by Karagoz and colleagues,13 in which CABG was performed in awake patients without GA using only TEA. Various operative techniques for awake cardiac surgery have been described [1].

Patients and Methods

From February 2012 and September 2014 in Cardiac Surgery Department, Luxor International Hospital and After having informed written consent, 12 male adult patients with symptomatic coronary artery disease were prospectively enrolled in our study and underwent OPCAB without GA. Patients were considered eligible if they had no contraindications to TEA, and if coronary artery anatomy was favorable for OPCAB, thus were at a reduced risk of conversion to cardiopulmonary bypass (CPB) and need a single graft only LIMA to left anterior descending artery (LAD). Exclusion criteria were multivessel coronary artery disease needs more than one coronary artery bypass graft, congestive heart failure, preoperative hemodynamic instability or intra-aortic counter pulsation, emergency surgery, acute myocardial infarction (MI, previous cardiac surgery, or patient refusal. The presence of obesity, diabetes, advanced age, chronic renal failure, or any other co-morbidity did not affect the patient selection. Antiplatelet stopped at least 7 days before surgery.

Epidural catheters were inserted immediately before surgery in the anesthetic preparation room. A peripheral venous line was placed and the patients received light sedation (midazolam 3-5 mg). A TEA was placed at T2-3interspace, by the midline approach in the sitting position and the catheter secured. After an initial 10 ml bolus, more than 1 h, of bupivacaine 0.5%, lidocaine 2% and fentanyl 2mcg/ml, dermatomal block was achieved. Thereafter, the epidural was continued at 2–14 ml/ h. immediately after surgery, bupivacaine 0.06% and fentanyl 3 μg ml–1 would be infused at 6–14 ml h–1 until the second postoperative day.

The patient was transferred to the operating room (OR). Routine standard monitoring included a five-channel ECG direct arterial and central venous pressure, pulse oximetry, urinary catheter including temperature monitoring, and oxygen face mask applied.

Sternotomy was then performed in a standard fashion, during the inspiratory phase of respiration (asking patient to hold respiration during the inspiratory phase). Then, the pericardium was opened to inspect the heart and LAD target vessel. LIMA graft harvested, at any time during the procedure, accidental pleural opening was immediately repaired if the opening is small but if big opening the pleura is completely opened and in both cases intercostal chest tube in the 5th intercostal space is inserted to avoid a pneumothorax and subsequent pulmonary dysfunction. Anticoagulation was performed at least 4 h after the epidural puncture, using non-fractionated heparin 150 IU kg–1 (activated coagulation time >250 s) appropriate for OPCAB.

To stabilize the heart for OPCAB, we used suction stabilizer over the epicardium at the planned site of anastomosis in LAD. LAD temporarily occluded with atraumatic vessel loops for proximal and distal flow occlusion. End-to-side technique was used with a running 7-0 polypropylene suture. After completion of the anastomosis, mediastinal tubes 36 F were inserted and heparin reversed with protamine. Temporary pacing wire was inserted in the right ventricle, complete hemostasis achieved, then the sternum and skin closed in the standard fashion, then patient transferred to intensive care unit (ICU).

Results

Twelve men with symptomatic coronary artery disease underwent OPCAB, mean (SD) 55 years (range 47–65 years), weight mean (SD) 78 kg (range 70-85). 10 patients were actively smoking with 6 of them with FEV1 between 50 to 70% (COPD), six patients were diabetic, eight patients had treated high arterial pressure and eight had dyslipidemia. Midline sternotomy and harvesting of LIMA were successful in all patients, but only in one patient LIMA was dissected and we did not use it. Mean operative time was 140 min. Two patients (16%) out of the twelve patients were converted to GA, one of them because of inconvenient analgesia and the other one because LIMA was dissected and could not be used, so saphenous vein conduit was harvested to use it instead of LIMA, in both cases GA used with insertion of endotracheal tube, both of them were immediately extubated after surgery before transfer to ICU.

Patients *(n)*	12
Age (year)	47- 65 (±55)
Weight (kg)	70-85(±78)
LVEF (%)	35-55% (± 46)
Smokers *(n)*	10
High arterial pressure (*n*)	8
Dyslipidemia (*n*)	8
Diabetes (*n*)	6
COPD (*n*)	6
Patients with GA	2

Table 1. Patient characteristic.

Postoperative analgesia was achieved using TEA with bupivacaine 0.05% and fentanyl 2.5 μg ml–1 at 4–12 ml h–1 for 12 hours postoperative until starting the low molecular weight heparin. All patients were transferred to the ICU and then to the cardiac ward. The TEA was removed on second day postoperative. The mean hospital length of stay was 5 to 8days (±6). There was no mortality or major morbidity, and no complication related to TEA.

Discussion

The advantages of awake OPCAB have already been reported by Karagoz et al. The effects on hemodynamics are depression on heart rate and blood pressure and stabilizing the cardiac function after blocking the sympathetic nerve cardiac branch. It makes a stress-free situation on patients during the surgery; therefore, there is heart rate and systemic blood pressure depression, this further depresses the double product. Accordingly, cardiac oxygen consumption will be lowered, and coronary artery and internal mammary artery become dilated. With the focus on vasodilating effect and inhibition of sympathetic nerve fore in TEA, this TEA is the ideal anesthesia for CABG [1,9].

Furthermore, ensuring consciousness will be a good monitoring for cerebral perfusion, which allows early detection on neurological complications and enables proper treatment. This procedure is effective for cases with high-risk cerebral ischemia. It is also good for cases where general anesthesia needs to be avoided, such as in respiratory insufficiency cases or where there is a high probability of complication [1,6].

In the 'limited' awake cardiac surgery literature, several approaches to deal with pneumothorax are described. One is to leave the pleural space widely open whenever a hole in its integrity is detected, another technique implies closure of the pleural space with or without insertion of thoracic drains whenever this occurs. Preparation of the left internal mammary artery is considered more demanding without opening the pleural space [4,9].

However, our cardiac surgeons noticed that the lung is more retracted into the pleural space during spontaneous respiration, than during intermittent positive pressure ventilation (IPPV). This actually made mammary artery preparation easier, which has been noted previously. In 'Conventional' cardiac surgery and in more than 20% of awake OPCAB cases presented so far, the pleural space may be opened at any stage of surgery, making it necessary to insert thoracic drains at the end of surgery [1,4,7].

Maintenance of body temperature is a key aspect to facilitate immediate extubation. This was performed in the routine way: elevated OR temperature and heating blankets for lower body. Body temperature should be maintained above 36° during surgery in all patients [2,5].

A study done by N. Noiseux and colleges in Montreal cardiac surgery department, Quebec, Canada in 2007, where 15 patients underwent awake CABG using TEA combined with Femoral nerve block for saphenous vein harvesting to do multivessel disease CABG and their results were more or less similar to our study, among the 15 patients 3 of them converted to GA, while the other 12 patients went smoothly without serious complications3,8.

To determine the safety of this technique in comparison with OPCAB under general anesthesia, many more patients need to be studied. In addition, future studies should focus on the impact of awake cardiac surgery on cognitive assessment and recovery, its relation to neuro-hormonal responses during surgery. Owing to unresolved problems with on-pump awake cardiac surgery, especially temperature management and apnea at the beginning of extracorporeal circulation, OPCAB seems to be the main domain for this technique [1,7].

Conclusion

CABG in awake patients using Thoracic epidural anesthesia is safe and easy procedure unless TEA is contraindicated; it is also very effective in patients with respiratory problems and COPD patients as it avoids the complications of positive pressure ventilation in those patients.

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Combined Antegrade And Retrograde Surgical Pulmonary Embolectomy in Acute Massive and Submassive Pulmonary Embolism: Our Early Results

Hesham Alkady, MD

Ahmed Abdelrahman, MD

***Background*: Acute massive and submassive pulmonary thromboembolism is a life-threatening disorder, which necessitates prompt treatment. We analyzed the outcome of pulmonary embolectomy for massive pulmonary embolism in order to detect the efficacy and safety of this treatment modality.**

***Methods*: 9 patients were included in this study who received surgical pulmonary embolectomy in Cairo university hospitals. 6 patients were females (66.7%) and 3 were males (33.3%) with a mean age of 46 ± 17 years. All patients presented with variable degrees of chest pain and dyspnea functional class IV. Cardiogenic shock was present in 7 patients (77.8%). Indications of surgery included: recent major surgery in two patients (22.2%), severe hemodynamic compromise in 4 patients (44.4%). One patient had a recent history of bleeding peptic ulcer (11.1%). Two patients (22.2%) received thrombolytic therapy but showed no clinical or echocardiographic improvement.**

***Results*: All the patients showed thrombi in the main pulmonary artery with variable degrees of extension to one or both main branches. One patient (11.1%) died from refractory right sided heart failure on the third postoperative day. One patient (11.1%) was re-explored due to postoperative bleeding. One patient (11.1%) developed acute renal failure. Two patients (22.2%) developed superficial wound infection. Before discharge from hospital all patients received CT chest with contrast and showed no residual gross clots in the pulmonary vasculature.**

***Conclusion*: Surgical pulmonary embolectomy combined by the retrograde technique, is a safe and effective method in massive and submassive pulmonary embolectomy. More prospective studies with midterm and long-term results are needed to compare results of medical versus surgical therapies in order to re-evaluate current guidelines in the management of massive and submassive pulmonary embolism.**

***KEY WORDS*: Pulmonary embolism, Cardiogenic shock, Surgical Pulmonary embolectomy.**

Pulmonary embolism (PE) is a common clinical condition, with a reported incidence rate up to 2.3 per 10. 000 [1] and an overall 3-month mortality rate of 17.4% [2].

PE can be classified into non-massive, sub-massive and massive according to the degree of hemodynamic compromise. Massive PE can be also defined from pulmonary CT angiography as >50% occlusion of the central pulmonary vasculature or occlusion of two or more lobar arteries.

Acute non-massive pulmonary embolism in most of cases can be well-tolerated with supplementary oxygen, anticoagulation with a vitamin K antagonist (e.g. warfarin) after initial unfractionated heparin or LMWH, intravenous fluids and if necessary vasopressin administration with careful attention to RV functions. On the other hand, massive PE, especially if bilateral, is an emergency situation which necessitates special management. [3]

Department of Cardiothoracic Surgery, Cairo University

Corresponding Author:
Ahmed Abdelrahman
ahmedgawad98@gmail.com

Codex : o3/03/1510

Management of massive PE is still challenging and debatable. Although some recent studies show good results following surgical embolectomy (SE), yet current guidelines recommend thrombolytic therapy (TL) as the first line of treatment, while embolectomy (surgical or interventional) being reserved for (i) critical patients with hemodynamic instability especially if death is likely to occur in few hours before fibrinolysis can clear clots (e.g. cardiopulmonary resuscitation), or (ii) in whom thrombolysis is absolutely contraindicated (up to one third of cases) (iii) or has failed (persistent clinical instability). [4-6]

Catheter embolectomy has a higher incidence of distal showering of emboli, recurrence and incomplete embolectomy (risk of pulmonary hypertension) than with surgical embolectomy, therefore is recommended by the American College of Chest Physicians (ACCP) in carefully selected patients with hemodynamic compromise who fail or are unable to receive fibrinolytic therapy, and where surgical embolectomy is unavailable.[7]

Surgical embolectomy has been performed since decades through suction of thrombi from the main pulmonary artery together with compression of the lungs repeatedly to remove the peripherally lodged emboli. Nowadays, this antegrade technique is still performed in many centres with the modifications of avoidance of lung compression (may cause vascular and bronchial wall injury) and removal of clots under direct vision using a flexible angioscope to minimize the risk of pulmonary-artery injury[8]. Retrograde pulmonary embolectomy through flushing of the pulmonary veins although was first introduced long ago, but has now gained re-attention as an adjuvant technique for removal of clots in pulmonary vasculature in addition to the conventional antegrade one. [9]

In this study, we present our experience with a combined approach for pulmonary embolectomy using both antegrade and retrograde techniques in patients with acute massive and submassive pulmonary embolism.

Patients and Methods

9 patients are included in this study who received surgical pulmonary embolectomy in the period between February 2012 and April 2015 in Cairo university hospitals. Among these patients, 2 cases (22.2%) underwent surgery after failed lysis (TS) with streptokinase.

6 patients were females (66.7%) and 3 were males (33.3%) with a mean age of 46 ± 17 years.

Deep venous thrombosis could be detected in 5 patients preoperatively using lower limb venous coloured Doppler. 8 patients showed risk factors for pulmonary embolism and in the remaining patient (11.1%) no risk factors could be detected. Some patients showed multiple risk factors. These risk factors included: morbid obesity in 6 patients (66.7%), cancer in one patient (11.1%), prolonged recumbency following major surgery in two patient (22.2%), pregnancy in one patient (11.1%) and hypercoagulabe state due to systemic lupus in one patient (11.1%). Table 1 shows summary of preoperative risk fators

Risk factors	Number of patients
Obesity	6
Malgnancy	1
Prolonged recumbancy	2
Pregnancy	1
Hypercoagulabe state	1

Table 1: Preoperative risk fators

All patients presented with variable degrees of chest pain and dyspnea functional class IV. All patients received bedside Echocardiography preoperatively. Signs of right ventricular dysfunction detected from echocardiography by ratio of right-to-left ventricular end-diastolic diameter >1 were found in 7 patients (77.8%). Preoperative mean pulmonary artery pressure was 50 ±15mmHg. All patients received pulmonary CT angiography to confirm the diagnosis (see picture 1). Cardiogenic shock (defined as systolic blood pressure <90 mmHg and tachycardia >90 bpm associated with signs of organ hypoperfusion, syncope and PaO2 without O2 therapy of <55 mmHg) was present in 7 patients (77.8%).

Indications of surgery included: recent major surgery in two patients (22.2%), severe hemodynamic compromise in 4 patients (44.4%). Actually 2 patients arrested preoperatively and were operated upon immediately after resuscitation and 6 patients (66.7%) were already on inotropic support before surgery. One patient had a recent history of bleeding peptic ulcer (11.1%). Two patients (22.2%) received thrombolytic therapy but showed no clinical or echocardiographic improvement. Table 2 summarizes surgical indications

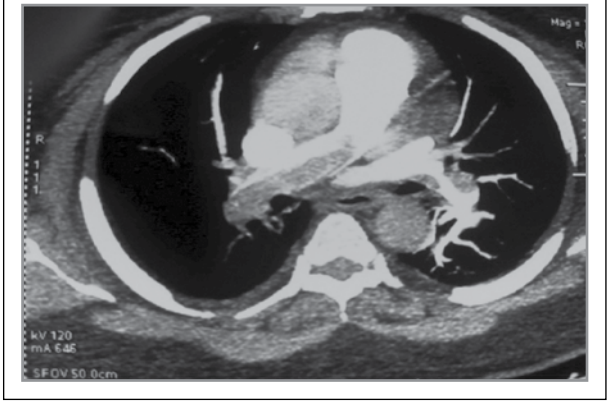

Fig 1. Preoperative CT pulmonary angiography showing bilateral emboli (thrombi) in both right and left pulmonary arteries

Surgical indications	Number of patients (%)
Recent major surgery	2 (22.2%)
Severe hemodynamic instability	4(44.4%)
Recent bleeding peptic ulcer	1 (11.1%)
Failed thrombolytic therapy	2 (22.2%)

Table 2. Summary of surgical indications

Surgical technique

Through a median sternotomy using mild hypothermic cardiopulmonary bypass with aorto-bicaval cannulation (CPB). The main pulmonary artery is opened longitudinally distal to the pulmonary valve and incision may be extended into the right or left pulmonary artery branches as necessary (See picture 2). The thrombi are extracted gently using a forceps assisted by suction from the left and right pulmonary artery branches as distal as possible. (Antegrade Embolectomy)

Then through a right atriotomy, the right atrium and ventricle are explored routinely and if clots are found they are extracted in a similar way (See picture 3)

The aorta is now cross-clamped and cardioplegia is given. The interatrial septum is opened through an incision in the fossa ovalis. To ensure complete clot removal, oxygenated blood is now infused from the pump through a Folly's cathter with inflated cuff into each one of the pulmonary vein orifices in the left atrium at a mean pressure of 30 mmHg (1.2 Liter/min per m^2) for 2 minutes to each pulmonary vein. Blood and small thrombi fragments are noted coming out of the pulmonary artery and are washed out. (Retrograde Embolectomy as described by Zarrabi et al.)[9]

The atrial septal defect followed by the right atrium are finally closed. The pulmonary arteriotomy is closed with a 4/ 0-running suture, and the patient is weaned from CPB.

Post-operative anticoagulation protocol

All patients received intravenous heparin infusion 4 hours after surgery to achieve an activated partial thromboplastine-time ratio of at least twice the control value. Starting from the second day, patients received oral anticoagulation therapy and continued for at least 1 year with an International Normalized Ratio range between 2 and 3.

Statistical analysis

Data are expressed as means ±SD. Microsoft Excel was used for data collection and SPSS® v 10.0 was used for analytical statistics.

Results

Intraoperatively, all the patients showed thrombi in the main pulmonary artery with variable extensions to one or both main branches.

The mean operative time, CPB time and cross-clamp time were 183±17 minutes, 42±11minutes and 22±8minutes respectively. Mean ventilation time excluding the dead patient was 19±8 hours. The mean inotropic support, ICU stay and hospital stay were 38±26 hours, 86±21hours and 11±3 days respectively.

One patient (11.1%) died from refractory right sided heart failure on the third postoperative day. One patient (11.1%) was re-explored due to postoperative bleeding. This patient received streptokinase preoperatively. One patient (11.1%) developed acute renal failure due acute tubular necrosis after preoperative cardiac arrest and received multiple sessions of dialysis until restoration of kidney functions. Two patients (22.2%) developed superficial wound infection and were managed with antibiotics and repeated dressing.

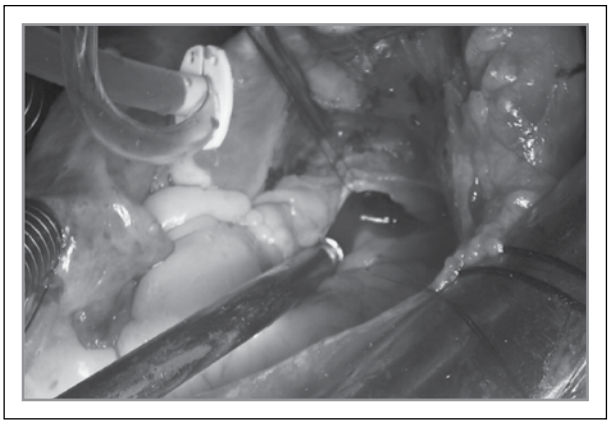

Fig 2. Removal of clots from main pulnoary arter using a forceps and suction

Fig 3. Aremoved huge saddle-shaped thrombus from both right and left pulmonary arteries

Before discharge from hospital all patients received CT chest with contrast and showed no residual gross clots in the pulmonary vasculature. Table 3 shows postoperative data

Postoperative data	
In-hospital Mortality	1 (11.1%)
Re-exploration due to bleeding	1 (11.1%)
Acute renal failure	1 (11.1%)
Superficial wound infection	2 (22.2%)
Mean ventilation time	19±8 hours
ICU stay	86±21hours
Hospital stay	11±3 days

Table 3. Postoperative data

Discussion

Owing to advances in diagnosis and recognition of predictors of mortality such as right ventricular stress on echocardiography, the results of surgical pulmonary embolectomy have improved as appeared from declining mortality rates from 57% in the 1960s to 26% in 1990s and 6—8% in 2000s.[10] The Mortality rates for SE increase to 30—45% when surgery is performed on critically ill patients and may reach up to 60—80% in patients who develop cardiac arrest before operation.[8] This dramatic rise in deaths may be attributed to delaying surgery as the last resort to patients in severe shock, often after failure of TL, which contributes to right-heart failure secondary to persistent pulmonary hypertension. In addition bleeding complications are significantly higher among patients treated initially with lysis and then converted to SE.[11-12] In our study one patient died from refractory right sided heart failure and the patient who was re-explored due to bleeding received streptokinase preoperatively. The in-hospital mortality (11.1%) in this study matches that of previously published reports using similar technique [11].

The improved results of surgical embolectomy demonstrated by recent studies debates the traditional recommendation of current guidelines for surgical therapy of massive PE in patients in whom thrombolysis is absolutely contraindicated or has failed. This has encouraged some centers now to add patients with patent foramen ovale and intracardiac thrombi to the list of patients indicated for surgery [12]. Hence the need for revising current guidelines according to multicentric studies comparing the outcome of surgical and medical therapies in the management of pulmonary embolism [13-14]

Since the introduction of antegrade surgical embolectomy in 1961, some modifications to the original procedure have been made to minimize the risk of pulmonary artery and bronchial wall injury including avoidance of lung compression and direct visual clot removal.[15]

Retrograde pulmonary embolectomy although was first performed in 1966, yet was not widely used till 2004, when some reports were published [16-18].Retrograde pulmonary embolectomy through flushing the pulmonary veins has the advantage of dislodging clots in distal pulmonary vasculature not directly visualized, thus preventing the consequent development of pulmonary hypertension [11] (more effective than passive filling of the left atrium suggested by some authors). It also may minimize the risk of distal air embolism, as proposed by Spagnolo et al. as a possible cause of lung injury.[18]

In our series we used a cuffed Foley's catheter connected with a line to one of the heads of the heart lung machine to flush the pulmonary vein orifices gently without injuring the delicate walls of the pulmonary veins.

Conclusion

We conclude from this study that surgical pulmonary embolectomy combined by the retrograde technique, is a safe and effective method in massive and submassive pulmonary embolectomy. More prospective studies with midterm and long-term results are needed to compare results of medical versus surgical therapies in order to re-evaluate current guidelines in the management of massive and submassive pulmonary embolism.

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Functional Moderate Mitral Regurge in Patients Undergoing AVR

Alaa Omar

Abdullah Osama Mahfouz

Objectives: **Functional Mitral regurgitation (MR) is common in patients with severe aortic pathology and can predispose to atrial fibrillation, heart failure, and a need for mitral valve surgery during aortic valve replacement (AVR). Co existent mitral regurgitation may adversely influence both the morbidity and mortality in patients undergoing aortic valve replacement. It is accepted that concomitant mitral surgical intervention is required in severe, symptomatic mitral regurgitation. However , in cases of moderate non-structural mitral regurgitation, improvement may be seen following aortic valve replacement only, avoiding the increased risk of double valve surgery. The precise benefit of such a conservative approach is yet to be adequately quantified. In our study we used to compare results of mitral valve repair versus the conservative approach by leaving the mitral valve without intervention in patients with moderate functional mitral regurgitation in the setting of AVR.**

Methods: **Between April 2012 and March 2014, 32 patients underwent aortic valve replacement with mechanical valves and had moderate functional mitral regurgitation were classified into 2 groups , group A 16 patients underwent concomitant mitral valve repair with Carpentier rigid ring , group B 16 patients underwent only AVR without approaching mitral valve. All Patients had severe aortic pathology candidate for AVR and have grade 2 functional mitral regurge. Patients with Mitral regurge due to primary valvular etiologies, Mitral regurge grade 3 or 4 or Redo cases were excluded.**

Results: **30 days post-operative survival was 100 % . At 1 year postoperative follow-up only 2 patient in group B were in NYHA class III (12%) and both were AF pre-operatively. Only one patient in group B (6%) needed re-hospitalization for symptoms of congestive heart failure. No patients in both groups required re-operation during the 1-year follow up period. There was a tendency for better MR regression in group A compared to group B but without statistical significance.1 year Post-operative follow-up data showed no significant statistical difference between both groups (p value > 0.05) .**

Conclusion: **Management of moderate functional MR in setting of AVR is still controversial, the conservative approach seems acceptable with no deleterious effects on survival and regression of MR was sufficient. However, mitral annuloplasty was associated with early perfect results, presence of AF may be an indication for mitral intervention in this cohort of patients.**

Key words: **AVR – FMR- AF- Mitral Annuloplasty.**

AVR: Aortic Valve Replacement.

FMR: Functional Mitral Regurge.

AF: Atrial Fibrillation.

Lecturer of Cardiothoracic Surgery-Cairo University

Lecturer of Cardiothoracic Surgery, Fayoum University

Corresponding Author:
Abdullah Osama Mahfouz
abdullahmahfouz@icloud.com

Codex : o3/04/1510

Mitral regurgitation (MR) is a common finding in patients undergoing aortic valve replacement (AVR) with an incidence of more than half of patients being evaluated preoperatively. Functional Mitral regurgitation (MR) is common in patients with severe aortic pathology and can predispose to atrial fibrillation, heart failure, and a need for mitral valve surgery during aortic valve replacement (AVR). Co-existent mitral regurgitation may adversely influence both the morbidity and mortality in patients undergoing aortic valve replacement [1]. It is accepted that concomitant mitral surgical intervention will be required in severe, symptomatic mitral regurgitation, however in cases of moderate non structural mitral regurgitation, improvement may be seen following aortic valve replacement only, avoiding the increased risk of double valve surgery. The precise benefit of such a conservative approach is yet to be adequately quantified. Some studies suggested that coexistent moderate MR may significantly increase both early and late mortality after AVR, studies also suggested that concomitant mitral surgical intervention should be considered even in the presence of moderate MR, whatever the aetiology of MR is. However, several lines of evidence have documented that MR often occurs as a result of altered ventricular performance and hemodynamics associated with aortic valve disease and that improvement in the degree of MR can occur after isolated AVR [2]. Functional MR is a common finding in patients with severe aortic pathology, with an incidence more than 60%. Its management, therefore, is of great importance as simultaneous repair or replacement of MR maybe associated with higher postoperative morbidity and mortality according to some investigators [3]. In our study we used to compare results of mitral valve repair versus the conservative approach, by leaving the mitral valve without any surgical intervention in patients with moderate functional mitral regurgitation in the setting of AVR.

METHODS

Study Population

Between April 2012 and March 2014, 32 patients with severe AR and moderate MR were operated upon in Kasr Al Ainy Hospital, 32 patients underwent aortic valve replacement with mechanical valves and had moderate functional mitral regurgitation were classified into 2 groups , group A 16 patients underwent concomitant mitral valve repair with Carpentier rigid ring, group B 16 patients underwent only AVR without approaching mitral valve. FMR was graded preoperatively by echocardiography into 4 grades by measurement of absolute regurgitant jet area, and/or regurgitant jet area relative to left atrial size. The severity of mitral regurgitation (MR) was graded as: mild, 1+ (jet area/left atrial area <10%); moderate, 2+ (jet area/left atrial area 10–20%); moderately severe, 3+ (jet area/left atrial area 20–40%); and severe, 4+ (jet area/left atrial area >40%). Based on regurgitant jet area, moderately severe FMR was defined as grade 3 with regurgitant jet area equal or more than 7cm.

Inclusion criteria

- Patients with severe aortic pathology candidate for AVR and have grade 2 functional mitral regurge.

Exclusion criteria

- Mitral regurge due to primary valvular etiologies.
- Mitral regurge grade 3 or 4.
- Redo cases.

End points

Primary end points: 30 days post-operative survival .

Secondary end points: 1-year survival, need for re-hospitalization and degree of mitral regurgitation.

Surgical technique

Conventional median sternotomy, standard cardiopulmonary bypass . Myocardial protection was achieved using antegrade intermittent cold cardioplegia. Standard Aortic valve replacement was performed using bileaflet mechanical valves, in patients who underwent mitral valve surgery had mitral repair with rigid Carpentier ring through classical left atriotomy incision.

Follow-up

Patients were seen and followed-up in an out patient clinic with physical examination, electrocardiography and echocardiography. All patients had an echocardiographic assessment at 1-year follow-up.

RESULTS

The mean age of the patients was 39 ± 11.5 yrs. The mean ejection fraction (EF) was 49±7.8 % . Most of the patients were in sinus rhythm (81 %). All patients were in NYHA grade I- II (100%). Table 1 summarizes the preoperative patient characteristics.

All patients (n=32) underwent aortic valve replacement by a mechanical bi-leaflet valve. Three sizes were used, size 23 in 21 patients (66%) , size 25 in 8 patients (25%) and size 27 was used in 3 patients (9%). Concomitant mitral valve ring annuloplasty was performed in all patients of group A , rigid Carpentier ring size 30 was used in 7 patients (44%), size 32

was used in 7 patients (44%) and size 34 was used in 2 patients (12%) . mean cross clamp time was 73±16 minutes in group A compared to 48±17minutes in group B with statistically significant difference (p value 0.05). The base line clinical and echocardiographic characteristics, together with the relevant operative data are summarized in table 1.

Age (mean ± SD)	29 ± 9.5 yrs
EF %	49±7.8 %
LVEDD (mm)	68 ± 3.4
LVESD (mm)	54 ± 4.6
PAP (mmHg)	36 ± 10.5
AF (%)	6 (9%)
Aortic valve size 23	21 (66%)
Aortic valve size 25	8 (25%)
Aortic valve size 27	3 (9%)
Mitral ring size 30 in group A	7 (44%)
Mitral ring size 32 in group A	7(44%)
Mitral ring size 34 in group A	2(12%)

AF: atrial fibrillation; EDD: left ventricle end diastolic dimension; EF: ejection fraction; ESD: left ventricle end systolic dimension; NYHA: New York heart association; PAP: pulmonary artery pressure;

Table 1. Preoperative and operative patient characteristics

30 days post-operative survival was 100 %. At hospital discharge there was no significant difference in NYHA functional class compared to preoperative values . All patients were NYHA class I- II (100%).

The Echocardiography study done at 1-year post-operative period showed decreased left ventricular dimensions (EDD 54±3.7, ESD 35±3.1) as compared to the preoperative values(EDD 68 ± 3.4, ESD 54 ± 4.6) with statistically significant difference (p=0.03). Nevertheless, there was a significant improvement in EF at 1- year follow-up it went up from a mean of 49±7.8 % to a mean of 59% ± 6.7 (p=0.04).

At 1 year postoperative 5 patients were not able to come for follow up (2 in group A and 3 in group B). Only 2 patient in group B were in NYHA class III (12%) and both were AF pre-operatively. Only one of these two patients needed re-hospitalization for symptoms of congestive heart failure. He had chronic AF. The patient was admitted to the hospital at 9 months for de-compensated heart failure, received intravenous diuretics and was later discharged after 6 days after losing the excess edema fluid and improvement of his clinical condition.

The NYHA class of the patients at 1-year did not differ much as compared to hospital discharge data. Other than the single patient who needed re-hospitalization for CHF, no other patient needed re-hospitalization. No patients in both groups required re-operation during the 1-year follow up period. There was a tendency for better MR regression in group A compared to group B but without statistical significance. 1 year postoperative follow-up data showed no significant statistical difference between both groups (p value > 0.05).

Table 2 reports postoperative data at 1-year follow up.

	Group A	*Group B*
Death	*0 (0%)*	*0 (0%)*
NYHA class		
I-II	*14(100%)*	*11(85%)*
III	*0(0%)*	*2(15%)*
Re-hospitalization for HF	*0(0%)*	*1 (6 %)*
EF %	*61 ± 7.1*	*58.2 ± 6.7*
LVEDD (mm)	*53 ± 4.2*	*56 ± 4.0*
LVESD (mm)	*34 ± 3.0*	*37 ± 4.1*
Trivial MR	*9(63%)*	*4(38%)*
Grade 1 MR	*5(37%)*	*7(50%)*
Grade 2 MR	*0(0%)*	*1(6%)*
Grade 3 MR	*0(0%)*	*1(6%)*

EF: ejection fraction; HF: heart failure; LVEDD: left ventricle end diastolic dimension; LVESD: left ventricle end systolic dimension; NYHA: New York heart association

Table 2. 1-year follow-up data :

Statistical Methods

Data were statistically described in terms of mean± standard deviation (±S.D), frequencies (number of cases) and percentages when appropriate. Comparison of numerical variables between the study groups was done using Student t test for independent samples. For comparing categorical data, Chi square (l^2) test was performed. Exact test was used instead when the expected frequency is less than 5. p-values less than 0.05 was considered statistically significant. All statistical calculations were done using computer programs SPSS (Statistical Package for the Social Science; SPSS Inc., Chicago, IL, USA) version 15 for Microsoft Windows.

Discussion

Mitral valve regurgitation is usually associated with severe aortic valve pathology, Double valve surgery is indicated when there is associated severe MR, but unlike with aortic valve replacement alone, the mortality rate associated with this procedure is higher[4]. Controversy in the literature is still present as whether to operate or not on the mitral valve in patients with moderate MR associated with aortic valve pathology requiring Aortic valve replacement. Many authors have concluded that only patients with functional MR might improve after aortic valve replacement, in patients who underwent isolated aortic valve replacement, it was found that when moderate MR is associated with the aortic pathology, improvement of MR was eminent only in patients with a functional aetiology, while MR due to other aetiologies (rheumatic, calcific, ischaemic, myxomatous) remained the same or even worsened [5]. It was found that moderate MR was an independent risk factor affecting the long-term survival in patients undergoing aortic valve replacement. In a systematic literature review and meta-analysis of 3053 patients undergoing aortic valve replacement with co-existing MR, it was found that moderate to severe MR adversely affects both early and late mortality rates following aortic valve replacement , therefore a concomitant mitral intervention should be considered in the presence of moderate MR whatever the aetiology is [3]. Conversely, others from the Mayo clinic found that, in 686 patients with at least moderate MR undergoing aortic valve replacement, moderate functional MR improved in the majority of patients after aortic valve replacement and that residual MR did not affect survival irrespective of left ventricular function[6]. There is evidence suggesting that relief of the aortic valve disease results in some reduction in MR without mitral valve surgery. The regression of left ventricular size and resolution of volume overload may promote further reduction in MR. Several studies demonstrated that functional MR have decreased in the majority of patients postoperatively [7]. In our study, the primary end point regarding 30 day postoperative mortality showed no difference between both groups as we had no mortalities in both groups, however echocardiography results at time of discharge showed early perfect correction of MR in patients who underwent mitral annuloplasty . At 1 year postoperatively, our secondary end point showed no difference in survival as both groups showed no mortalities. Only one patient in group B needed re-hospitalization for symptoms of congestive heart failure for 6 days , salt and fluid restriction with intravenous diuretics and atrial fibrillation rate control were sufficient to improve his condition. Echocardiography was done at 1 year postoperatively, 5 patients (2 in group A and 3 in group B) were missing in the setting of echocardiogram. Most patients in group A showed regression of MR degree to trivial or grade 1, most patients in group B showed regression of their MR degree with only 2 patients who did not show any regression and even one patient showed progression to grade 3 MR and experienced symptoms of congestive heart failure, there was no statistical significant difference between both groups regarding improvement of the degree of MR, however there was a tendency for better results for the annuloplasty group even as early as the time of discharge from the hospital. Our results were convenient with Gonçalo F. Coutinho et al, who concluded that without mitral valve surgery, secondary MR improved after AVR. Concomitant mitral surgery had no significant impact on survival but was significantly associated with greater improvement of postoperative MR [8]. On the other hand, Ramdas G. Pai et al, concluded that MR is a common finding in patients with severe AR. It is an independent predictor of reduced survival. Performance of AVR together with mitral valve repair is associated with better survival. Development of MR should be considered as an indication for AVR even in asymptomatic patients[9]. In many studies AVR was followed by significant reverse cardiac remodeling regardless of mitral valve surgery being performed or not. However, the degree of improvement was greater in those who had mitral valve surgery. Cardiac remodeling and improvement of MR after surgery are directly related to each other and go hand in hand. It was documented that the decrease in MR observed in most patients after AVR was associated with the degree of left ventricular reverse remodeling [10]. We found that preoperative AF was associated with poor and unfavorable outcome in group B, Matsumura and Gilinov also found that the presence of long term AF was an independent predictor of the severity of postoperative MR. This delineates the importance of taking this pathology into serious consideration during the decision making regarding moderate functional MR in the setting of AVR[11].

In conclusion, management of moderate functional MR in setting of AVR is still controversial, conservative approach seems acceptable with sufficient regression of MR as well as no deleterious effect on survival. However, mitral annuloplasty was associated with early perfect results as proven by echocardiography . The presence of AF may be an indication for mitral intervention in this cohort of patients.

LIMITATIONS OF THE STUDY

1. Longer period of follow up may be needed to collect more precise data.
2. Lack of precise guidelines in the literature regarding clear indications for management of functional MR in the setting of AVR.

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Inomminate Artery Cannulation for Cardiopulmonary Bypass and Ante grade cerebral perfusion using Arterial Cannula

Fouad Rsaekh, MD.

Background: **Prolonged cardiopulmonary bypass with deep hypothermic circulatory arrest in ascending aortic surgeries require an arterial access rather than the ascending aorta like femoral artery, auxiliary artery or Inomminate artery Cannulation to establish cardiopulmonary bypass. With femoral or axiliary artery Cannulation the cerebral protection during the deep hypothermic circulatory arrest will via retrograde cerebral perfusion while with Inomminate artery Cannulation it will be via ante grade cerebral perfusion.**

Methods: **Between April 2012 and December 2014, the technique of direct arterial Cannulation of the Inomminate artery using arterial Cannula size 18 F was used in 28 patients (21 males and 8 females) with age of patients between 32 and 65 years old, those patients were subjected to aortic surgeries at Cairo University Hospitals and postoperative neurological complications were noted.**

Results: **Hospital Mortality was 5 patients (17.8%), 4of them (14.2%) died intraoperative, 3of them (10.7%) died due to bleeding, 1 of them (3.57%) died due poor myocardial contractility and failure to wean from cardiopulmonary bypass and 1 of them (3.57%) died 3weeks postoperative due to deep wound infection and mediastinitis. 2 patients (7.1%) had delayed recovery with weaning from mechanical ventilation 2 days postoperative and 1 patient (3.5%) developed stroke in the form of right sided hemiplegia.**

Conclusion: **Inomminate artery Cannulation is an easy procedure allows establishing cardiopulmonary bypass with the advantage of ante grade cerebral perfusion during the deep hypothermic circulatory arrest.**

Inomminate artery Cannulation became widely used in many cardiac surgery centers all over the worlds in cases of aortic surgery with need of deep hypothermic circulatory arrest[2,4].

Establishing cardiopulmonary bypass using Inomminate artery Cannulation can be done from the same sternotomy incision without need to other incisions as in femoral or auxiliary artery Cannulation [13].

Cannulation of the Inomminate artery can be made easily with routine aortic Cannula size 18 F as it is sizable artery which make the procedure easy without need to synthetic grafts to cannulate as in case of femoral or axillary arteries Cannulation[1,7].

The only obstacle to cannulate the Inomminate artery in cases of type A aortic dissection that involving the Inomminate artery and the great vessels otherwise Inomminate artery Cannulation can be done safely[3].

Vascular complications due to direct Inomminate artery Cannulation like direct injury or dissection is serious complication as it may fatal, however this complications is more likely to occur in diseased and calcified vessels, so duplex ultrasound for Inomminate artery preoperatively is mandatory[1,5,6].

Objective: This study done to assess the value and effectiveness of ante grade cerebral perfusion with deep hypothermic circulatory arrest in ascending aortic

Cardiothoracic Surgery Department, Cairo University.

Corresponding Author:
Fouad Rsaekh, MD.
frassekh@yahoo.com

Codex : o3/05/1511

surgeries and also to establish cardiopulmonary bypass from the same sternotomy incision without need other access outside the main sternotomy incision.

Patients and methods

From April 2012 to December 2014, we used the technique of direct Inomminate artery Cannulation to establish cardiopulmonary bypass in 28 patients who were subjected to ascending aortic surgeries at Cairo University Hospitals.

All patients were operated through median sternotomy and cardiopulmonary bypass established using Inomminate artery inflow with common atrial venous drainage.

Myocardial protection was done using systemic cooling, intermittent cold blood cardioplegia and local ice slush.

Hypothermic circulatory arrest with ante grade cerebral perfusion was used in all cases.

Surgical technique

Median sternotomy, pericardium opened, removal of the thymus to insert a nylon tape around the left Inomminate vein, proper dissection as high as possible to identify the arch and the Inomminate artery, a nylon tape inserted around the Inomminate artery, 2 purse string prolene 4/0 applied over the anterior surface of the Inomminate artery as high possible to allow applying a vascular clamp between the aortic arch and the Inomminate Cannula.

After heparinaization, 18 F aortic Cannula inserted in the Inomminate artery within the purse string, common atrial venous Cannula inserted and vent is inserted in right upper pulmonary vein.

During the cardiopulmonary bypass the blood flow in the arterial Cannula will pass freely ante grade to head and retrograde to the other great vessels and down to lower half of the body.

During the deep hypothermic circulatory arrest a vascular clamp applied to the Inomminate artery Cannula and the aortic arch so the blood flow will pass ante grade in the Inomminate artery, so the aortic clamp can be removed to repair the distal part of the ascending aorta, maintain the pressure between 40 to 50 mmHg measured by right radial arterial Cannula.

Results

28 patients were involved in this study (21 males and 7 females) ranging from age 32 years to 65 years (mean44)

22 patients (78.5%) had acute type A aortic dissection, 4 patients (14.2%) had chronic type A aortic dissection and 2 patients (7.1%) had ascending aortic aneurysm.

AORTIC PATHOLOGY	N= 28	%
Acute type A aortic dissection	22	78.5%
Chronic type A aortic dissection	4	14.2%
Ascending aortic aneurysm	2	7.1%

Table 1. Aortic pathology

Supracoronary replacement of the ascending aorta done in 16 patients (57.1%) , Bentall procedure done in 10 patients (35.7%) and Cabriole procedure done in 2 patients (7.1%).

SURGICAL PROCEDURE	N=28	%
Supracoronary replacement	16	57.1%
Bentall	10	35.7%
Cabriole	2	7.1%

Table 2. Surgical procedures

Cardiopulmonary bypass ranged from 120 to 480 min (mean 180 min), deep hypothermia at temperature 22 C and circulatory arrest with ante grade cerebral perfusion done in all patients with time ranging from 10 to 66 min (mean 29 min).

Mortality was 5 patients (17.8%), 4of them (14.2%) died intraoperative, 3of them (10.7%) died due to bleeding, 1 of them (3.57%) died due poor myocardial contractility and failure to wean from cardiopulmonary bypass and 1 of them (3.57%) died 3weeks postoperative due to deep wound infection and mediastinitis. 2 patients (7.1%) had delayed recovery with weaning from mechanical ventilation 2 days postoperative and 1 patient (3.5%) developed stroke in the form of right sided hemiplegia.

No complications related to the direct Cannulation of the Inomminate artery was reported either intraoperative or postoperative as the only case of right sided hemiplegia, the preoperative duplex ultrasound showed 80% stenotic lesion in the left internal carotid artery.

CAUSES OF MORTALITY CASES	N=5	%
Intraoperative bleeding	3	10.7%
Poor myocardial contractility	1	3.57%
Deep sterna wound infection	1	3.57%

Table 3. Causes of mortality.

Discussion

In aortic surgery, the most widely used Cannulation strategies are direct ascending aortic and femoral artery Cannulation and direct axillary artery Cannulation or indirect Cannulation using a side graft; Cannulation of the innominate artery is a less common approach 2,10.

The optimal Cannulation site is a subject of continuous debate among experienced aortic surgical groups. In patients with severe atherosclerotic disease, direct aortic Cannulation can cause serious embolization. Moreover, in acute type 1 aortic dissection, direct aortic Cannulation can cause malperfusion or extension of the dissection. Despite these risks, the safety of direct aortic Cannulation has been confirmed by several groups[8, 13].

When Cannulation of the ascending aorta poses a prohibitive risk, femoral artery Cannulation is often used. Experienced surgeons routinely use femoral artery Cannulation for thoracic aortic surgery with excellent results. Nevertheless, in cases of acute type 1 aortic dissection, femoral artery Cannulation can result in malperfusion. Also, in patients with descending and extensive thoracoabdominal aneurysms, femoral Cannulation can increase the risk of aortic dissection and retrograde embolization secondary to dislodged atheromas [4,9,12].

These complications, along with the inability to deliver ante grade cerebral perfusion, have led to the widespread use of axillary artery Cannulation as an alternative approach in patients with ascending aortic and arch pathologic findings. A key advantage of axillary artery Cannulation is the ability to deliver ante grade cerebral perfusion, which allows complex aortic repair [5, 11].

At Texas heart institute, the Cannulation strategies for proximal aortic surgery have evolved toward the routine use of axillary artery Cannulation in elective and emergent cases with good outcomes. Although axillary artery Cannulation is usually well tolerated, various complications have been reported, including brachial plexus injury, localized dissection, arm ischemia, inadequate cardiopulmonary flow, and malperfusion[4,12].

The use of a side graft for axillary artery Cannulation might reduce morbidity. Another alternative Cannulation site is the innominate artery; however, the published data contain fewer reports about this approach than about axillary or femoral Cannulation. Compared with axillary or femoral artery Cannulation, innominate artery Cannulation has several advantages. First, there is no need for an additional incision; thus, the operative time is potentially shorter. Second, because the Cannulation site remains under the surgeon's direct vision at all times, additional blood loss and possible kinking of the cannula can be avoided. Third, Cannulation is technically easier to perform in obese patients. Fourth, the risk of brachial plexus injury, arm claudication, or ischemia (associated with axillary Cannulation) is eliminated. Fifth, unlike femoral Cannulation, innominate artery Cannulation prevents malperfusion and retrograde cerebral atheroembolism and to deliver ante grade cerebral perfusion. Finally, postoperatively, patients can undergo early ambulation and physical therapy (which might not be possible with femoral Cannulation) [1,7,11].

Since June 2005, Baylor College has used innominate artery Cannulation in proximal aortic repairs when we thought this approach would be safe and appropriate. Manipulations around the innominate artery are not without risk, because the phrenic nerve and sympathetic chain might be close, depending on the anatomy. We did not encounter any injury or bleeding in any of our patients with regard to the Cannulation site. Knowledge of the anatomic structures is imperative. We have shown that innominate artery Cannulation is safe in a variety of proximal aortic procedures and does not compromise the ability to provide ante grade cerebral perfusion [10].

Other surgical groups have also obtained excellent results with innominate artery Cannulation. Huang and colleagues used a side graft technique to cannulate the innominate artery in 46 patients. Postoperatively, 5 of the patients (10.9%) had temporary neurologic dysfunction, just as in our series. No stroke was reported, and the 30-day mortality rate was 6.5%. In 55 patients [2].

Di Eusanio and colleagues used a similar side graft technique to cannulate the innominate artery and used ACP during circulatory arrest. One patient (1.8%) had transient neurologic dysfunction, and the overall hospital mortality rate was 3.6%. In contrast, Ji and colleagues cannulated the innominate artery directly in 68 patients. The cannula tip was oriented toward the aortic arch during the initial period of cooling and final rewarming, and it was turned gently toward the patient's head during systemic circulatory arrest. No neurologic event was reported, and the 30-day mortality was 2.9% [4].

Conclusions

Innominate artery Cannulation is a safe, effective alternative to femoral or axillary Cannulation for arterial inflow in proximal aortic surgery. An individualized approach is critical to ensure patient safety.

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Outcome of Moderate Functional Tricuspid Regurge Using Tricuspid Valve Suture Annuloplasty vs. Conservative Approach in Patients Undergoing Mitral Valve Replacement

Alaa Omar

Abdallah Osama Mahfouz

Objectives **: We investigated the early outcome in patients with moderate tricuspid regurge undergoing mitral valve surgery and at 1year after operation to assess weather suture annuloplasty was associated with better results than conservative technique or not.**

Methods**: We reviewed patients, prospectively, who underwent suture tricuspid annuloplasty (n=34) versus those who had conservative approach(n=34) by leaving the tricuspid valve un attacked in the settings of concomitant mitral valve surgery for rheumatic valve disease with a mean follow up of 12 months.**

Results: **Thirty day mortality was zero in both groups, tricuspid regurge grade was lower for both groups after 12 months follow up by echocardiography with no significant statistical difference , there was no need for reoperation for tricuspid regurgitation in both groups by the end of the first year post operatively.**

Conclusion**: Conservative approach was associated with acceptable results, the annuloplasty group showed a tendency for better results in the early post-operative course and for prolonged follow-up periods.**

Key words**: functional tricuspid regurgitation – suture annuloplasty – rheumatic mitral valve**

Significant mitral valve pathology can produce right ventricular pressure and volume overload, leading to right ventricular enlargement and tricuspid annular dilatation resulting in functional tricuspid valve regurgitation. The incidence of functional TR in patients undergoing left heart valve surgery is around 30%[1]. Some reports suggest that tricuspid regurgitation can resolve after the diseased mitral valve has been replaced based on well known post-operative regression of pulmonary hypertension [2]. Others suggest that ignoring a tricuspid valve disease at the time of surgery for left sided pathology can affect the eventual outcome of the patient, and it may be associated with an increase in morbidity and mortality[3]. Surgical management of moderate to severe TR is widely recommended now to achieve better early and late clinical outcomes[4]. Moderate tricuspid regurge may be controversial during mitral valve surgery, some investigators consider it may regress after successful mitral valve surgery alone while others showed that it may increase in severity later with high possibility of isolated tricuspid intervention with increased morbidity and mortality[5]. In this study we investigated the early postoperative outcome up to 1 year after tricuspid suture annuloplasty for moderate functional TR associated with rheumatic heart disease necessitating valve surgery versus the conservative approach by leaving the tricuspid valve without intervention.

MATERIALS AND METHODS

Patient population:

From September 2012 to August 2014, sixty eight patients underwent mitral valve surgery with or without concomitant tricuspid valve repair. We excluded patients

Lecturer of Cardiothoracic Surgery-Cairo University

Lecturer of Cardiothoracic Surgery-Fayoum University

Corresponding Author:

Abdallah Osama Mahfouz

abdullahmahfouz@icloud.com

Codex : o3/06/1511

with organic tricuspid valve disease. Patients undergoing concomitant CABG, aortic aneurysm and root surgery, infective endocarditis cases, low EF, together with redo cases were also excluded.

Tricuspid regurgitation was scored as follows:

Grade 1: mild regurge

Grade 2: moderate regurge.

Grade 3: moderate-to-severe regurge.

Grade 4: severe regurge.

End points:

The primary end points were:

Postoperative hospital mortality

The degree of tricuspid regurgitation (TR) upon discharge, and at 12 months follow up.

Secondary end points were:

One year survival

Hospital readmission for right-sided heart failure

Need for reoperation for severe TR

Surgical Technique

Conventional median sternotomy, standard cardiopulmonary bypass using bicaval cannulation. Myocardial protection was achieved using antegrade intermittent cold cardioplegia. Mitral valve replacement was performed with preservation of posterior leaflet in all patients. Tricuspid valve annuloplasty was performed under cardiac arrest. Standard DeVaga annuloplasty was done in 20 patients, while segmental annuloplasty was done in 14 patients. 2/0 Ethibond sutures were used in all cases of suture annuloplasty group.

Saline infusion test was used to confirm adequate leaflet co-aptation and competent valve. Postoperative transthoracic echo-cardiography was performed upon discharge and 1 year later.

Statistical Methods

Data were statistically described in terms of mean ± standard deviation (± S.D), frequencies (number of cases) and percentages when appropriate. Comparison of numerical variables between the study groups was done using Student *t* test for independent samples. For comparing categorical data, Chi square (l^2) test was performed. Exact test was used instead when the expected frequency is less than 5. *p*-values less than 0.05 was considered statistically significant. All statistical calculations were done using computer programs SPSS (Statistical Package for the Social Science; SPSS Inc., Chicago, IL, USA) version 15 for Microsoft Windows.

RESULTS

Preoperative characteristics

Preoperative demographics, NYHA class and echocardiography data showed no statistical difference between the 2 groups (Table 1).

	Suture group (n=34)	Conservative group (n=34)	p Value
Age (yrs)	39±12	37±11	0.85
Gender			
Male	16 (47%)	19 (56%)	0.7
Female	18 (53%)	15 (44%)	0.6
CPB Time (Min)	80± 27	64± 23	0.15
Cross-Clamp Time (Min)	64 ± 23	50 ± 22	0.1
NYHA Functional Class	3.2± 0.6	3± 0.9	0.5
PAP (mmHg)	67 ± 18	64 ± 29	0.7
Right vent. diameter	23±6	23±5	0.9
EF	64±4.5	63±5	0.8

Table 1. Pre-operative patients characteristics

Endpoints:

Primary endpoints**:**

Hospital mortality:

All patients in both groups were discharged from hospital in a good condition with no hospital mortality.

Postoperative TR grade:

There was significant improvement of TR grade postoperatively in group A compared to group B. The mean TR at discharge for the suture group was 1.1± 0.33 and the mean TR grade for the conservative group was 1.9 ± 0.43 (p value 0.045).

Suture group (n=34)		
TR grade	At discharge (n=34)	12 month post op (n=28)
1	27	12
2	7	14
3	0	2
Mean ± SD	1.1± 0.33	1.7±0.55

Table 2. PostoperativeTR grade for suture annuloplasty group

Conservative group (n=34)		
TR grade	At discharge (n=34)	1 yr post op (n=27)
1	6	6
2	28	18
3	0	3
Mean ± SD	1.9 ± 0.43	2.14 ± 0.79

Table 3. Highlights TR grades at time of discharge and at 1 year for conservative group.

The mean TR grade for the suture group at 12 months was1.7±0.55 , and for the conservative group was 2.14 ± 0.79 with statistically significant difference between the 2 groups (p value 0.04). Tables 2 and 3 capture the detailed hospital discharge and 12 months TR grades for both groups.

	Suture group (n=34)	Conservative group (n=34)	p Value
NYHA Functional Class	1.4± 0.6	1.6± 0.9	0.5
PAP (mmHg)	33 ± 18	38 ± 29	0.1
Right vent. diameter	21±6	22±5	0.3
EF	65±4	63±6	0.7

Table 4. Post-operative patients characteristics

Secondary endpoints:

12 months survival:

1 patient in the suture group died . patient died due to massive retro- peritonel hemorrhage complicating warfarin toxicity 8 weeks after discharge).

In the conservative group 2 patient died. One patient 3 weeks after discharge. The patient was admitted in the ER suffering from cardiac tamponade and an INR of 8. He went rapidly into cardiac arrest with failed attempts of resuscitation. The other patient died from prosthetic valve endocarditis 3 month after surgery.

Hospital readmission for right-sided heart failure:

Over the 12 months period of the study, none of the patients in both groups needed to be readmitted to the hospital to control right-sided heart failure.

Re-operation:

After 1 year follow up and despite that some patients had tricuspid regurge grade 3 there was no need for reoperation and patients were compensated on anti-failure measures.

DISCUSSION

The incidence of moderate functional TR in patients undergoing left heart valve surgery is 27 – 30% [6]. Functional TR occurs primarily due to annular dilatation and subsequently failure of leaflet coaptation. Annular tricuspid dilatation occurs mainly in its anterior and posterior aspects, which may cause significant functional TR as a result of leaflet mal-coaptation. [7]. In the setting of severe functional TR surgery for tricuspid valve is highly recommended by surgeons and guidelines. Many authors suggested that tricuspid annular dilatation is an ongoing pathology that once the tricuspid annulus is dilated, its size may not spontaneously return to normal and may dilate further [8]. They advise early surgical correction regardless of the severity of TR. This is due to the fact that uncorrected TR even without severe annular dilatation may worsen or persist after mitral valve surgery, which leads to progressive heart failure and poor survival[3].

In the setting of moderate functional TR it remains controversial , some authors find annuloplasty is a better option to avoid late progression to severe regurge with increased morbidity and mortality specially if a redo isolated tricuspid surgery become mandatory[3] , others stated that moderate functional TR is well tolerated after correction of the mitral valve pathology in long standing affection as post-operatively there was a marked reduction in pulmonary arterial pressures and pulmonary vascular resistance, and an improvement in cardiac indices and NYHA status [2],[13]. Few surgeons suggest that even in presence of mild TR surgery is recommended if a patient has atrial fibrillation or pulmonary hypertension[9]. Some investigators see that complete right ventricular remodeling may not occur, and normalization of pulmonary arterial pressures alone may be insufficient to eliminate functional TR [10]. Severe functional TR requires intervention during surgery of the mitral valve, and this is a class I indication. The current ESC guidelines (2012) have been modified and suggest that 'surgery should be considered in patients with moderate secondary TR with dilated annulus (>40 mm) undergoing left-side valve surgery' (Class IIa indication, level of evidence C)[11].

The American Heart Association/American College of Cardiology (AHA/ACC) guidelines (2014) give very similar recommendations, in addition indicating that 'tricuspid valve repair may be considered for patients with moderate functional TR and pulmonary artery hypertension at the time of left-side valve surgery' (Class IIa indication, level of evidence C) [12]. In case of moderate functional tricuspid regurge there are no strict guidelines and it remains controversial.

In our study we found that annuloplasty had better immediate and 1-yaer post-operative follow up results regarding the degree of TR echocardiographically. However, clinically no patient required re-hospitalization for management of considerable heart failure and there was no indication for re-operation in both groups.

And although a higher proportion of patients in the conservative group was in grade 2 or 3 tricuspid regurge compared to the annuloplasty group, all of them were kept compensated on small doses of anti failure measures.

This was convenient with data obtained by Yilmaz, et al. and who concluded that TV annuloplasty is rarely necessary for MV disease because TR progression after MV surgery is unlikely. They insisted that progression of TR was clinically insignificant and did not lead to the risk of further surgery [13]. Those patients often require substantial doses of diuretics to maintain Euvolemia[8].

There were no differences in survival and freedom from major cardiac or cerebro-vascular adverse events between the two groups.

Nath et al. found that The 1-year survival rates for patients were 90.3% with mild TR, 78.9% with moderate TR and 63.9% with severe TR. Patients with moderate and severe functional TR had a 15 and 30% lower 1-year survival, respectively, than those without secondary tricuspid regurge, independent of left ventricular ejection fraction or pulmonary arterial pressures[14]. Kim *et al*. found that in patients with moderate functional TR who underwent isolated mechanical MV replacement for the first time with a median follow-up of 48.7 months, freedom from moderate-to-severe TR at 5 years was 92.9±2.9% in the repair group, and 60.8 ± 6.9% in the conservative group[5].

Matsuyama found that repair of moderate functional tricuspid regurge in the setting of mitral valve surgery is better, in order to avoid future progression specially in the presence of atrial fibrillation and a huge atrium [15].

Limitations

Small number of patients.

Short period of follow up.

Single institution experience .

There was no chance to examine effect and results of ring annuloplasty which is considered 1ry level of care to repair tricuspid valve.

CONCLUSION

Conservative approach in cases of moderate functional tricuspid regurge in the settings of mitral valve surgery is an accepted option in terms of immediate and 1-year post-operative follow up with tendency for better results in cases of concomitant suture annuloplasty for prolonged follow up period on a larger cohort of patients to confirm.

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Postoperative Complications and Predictors of Mortality in Patients With Penetrating Cardiac Injuries

Mohamed M Aboel-Nasr, MD. PhD;

Ehab Abdel Moneim Wahby, MD. PhD.

Background: **Penetrating cardiac injuries is one of the most challenging injuries in the field of trauma surgery. Survival rate showed some improvement in the last decade. Our aim is to detect postoperative complications and predictors of mortality in those patients. This may help for more improvement in survival rate with better outcome.**

Methods**: This is a prospective study including 68 patients with penetrating cardiac injuries and needed surgical intervention during the period from January 2013 till August 2015. All patients were analyzed regarding age, sex, time of transfer, mechanism of trauma, hemodynamic status, hemoglobin level, type of incision, operative finding, postoperative complications and outcome.**

Results: **In our study, 86.8% patients survived and 13.2% died. Surgical wound infection was the most common complication. There was statistical significant relationship between mechanism of injuries and mortality rate. Patients with sinus rhythm, cardiac tamponade, measurable blood pressure and high hemoglobin level had more survival rate. However, site of incision, time of transfer, anatomical site of injuries and amount of blood transfusion were not predictors of survival of penetrating cardiac injury patients. The logistic regression analysis identified that only preoperative low hemoglobin level is consistently a predictor of mortality.**

Key words: **Trauma, penetrating cardiac injuries, emergency thoracotomy**

Conclusion: **Penetrating cardiac injuries are salvageable injuries with good survival rate and minimal postoperative complications. Mechanism of injuries, cardiac tamponade, sinus rhythm, hemodynamic status of patients and hemoglobin level could predict survival. Low hemoglobin level was the only independent risk factor of death.**

Penetrating cardiac injuries could be considered as one of the most challenging injuries in the field of trauma surgery. Their management often requires adequate and rapid diagnosis, perfect surgical technique and good postoperative critical care [1]. Clarke et al. found that the mortality rate of penetrating cardiac injuries is still high [2] and varies between 15-40% in one literature review [3]. The cause of death is mainly related to cardiac tamponade, exsanguination or coronary artery injury [4]. However, the survival rate of penetrating cardiac injuries was noted to be increased because of improvement in prehospital care (PHC), fast transportation to trauma centres, and advances in perioperative trauma surgery [5]. In addition, there are many factors that could influence outcome of patients with penetrating cardiac injuries including mechanism of injury, hemodynamic stability of patients on admission, cardiac tamponade, extent of cardiac injuries and associated acute complications and injuries [6].

Lecturer of Cardiothoracic Surgery, Faculty of Medicine, Tanta University

Cardiothoracic Surgery Department, Faculty of Medicine, Tanta University

Corresponding Author:

Mohamed M Aboel-Nasr

dr_mmaboelnasr@yahoo.com

Codex : o3/07/1512

Aim of The Study

The aim of our study is to identify risk factors that could predict mortality in patients presented with penetrating cardiac injures needing immediate surgical intervention and to identify possible postoperative complications encountered in those patients.

Patients and methods

It is a prospective study conducted during the period from January 2013 till August 2015 on 68 patients presented with penetrating cardiac injuries and required immediate surgical intervention in Tanta University emergency hospital and private centre. All patients were subjected to advanced trauma life support (ATLS) protocol for emergent resuscitation of patients including airway, breathing and circulation. They were examined for mechanism of injury and time of transport to hospital. Vital signs of all patients were assessed and they were divided into 4 groups according to their hemodynamics based on division given by Arreola-Risa et al [7].

Stable patients with systolic blood pressure > 90 mmhg

Patients with SBP <90 mmhg

Immeasurable blood pressure

Patients arrested before thoracotomy

Victims who reached hospital dead were excluded from the study.

Patients were subjected to arterial blood gas sample analysis, hemoglobin level, ABO grouping and matching, Chest x-ray and bedside echocardiography. Unstable patients were transferred immediately after resuscitation into operating room where echocardiography was done. Presence of pericardial effusion by echocardiography was sufficient to proceed patients to surgery. In our study, no emergency room thoracotomy was done and all patients were opened by cardiac surgeons. Type of incision was either median sternotomy in clinically stable patients and anterolateral thoracotomy in clinically unstable patients. After opening pericardium, the heart was assessed for presence of tamponade and sinus rhythm. Injuries in heart were sutured using polypropylene 3/0 with or without Teflon. Other lesions like lung tear or internal thoracic artery injury were dealt with by suturing and ligation respectively. All patients were closed with retrocardiac and retrosternal chest tubes. Chest tubes were placed separately when pleura was opened. All patients were admitted into surgical intensive care unit (ICU) postoperatively. Follow up echocardiography was done before discharge in clinically stable patients.

For all patients, number of units of transfused blood was recorded. All patients were followed up for possible postoperative complications including: residual hemothorax, pneumonia, empyema, atelectasis, surgical wound infection, acute arrhythmia and pulmonary embolism. All patients were subjected to postoperative echocardiography before discharge from hospital.

Statistical analysis was performed using Statistical Package for Social Science (SPSS version 19). Data were expressed in terms of frequencies (number of cases) and percentages for categorical variables and mean±standard deviation (±std) for continuous variables. For comparing categorical data, Chi-square (X2) test was performed. Fisher's exact test was used when at least 1 cell had expected count less than 5. A two-tailed t test was used to compare means. A logistic regression was performed to determine the association between mortality and clinical predictors. P values of <0.05 were considered statistically significant.

Results

This is a prospective study on 68 patients having penetrating cardiac injuries and needed surgical intervention. Fifty nine patients (86.8%) survived and 9 patients (13.2%) died (Fig. 1). All patients were male. The mean age in the study was 31.57± 9.59 years**.** Stab wound constituted the main mechanism of injury in 61 patients. Left intercostal tube was inserted in 30 patients with evident hemothorax by chest x-ray . The majority of patients had measurable blood pressure on arrival with 36.8% had systolic blood pressure > 90 mmhg and 33.8% had systolic blood pressure <90 mmhg. Cardiac tamponade was found in 55.9% of patients. Sinus rhythm was present in 69.1%. Thirty patients had right ventricle affection and 52.9% of patients were subjected to sternotomy. The mean preoperative hemoglobin level was 10.08± 1.44. All patient characters are shown in table 1.

Postoperative complications were surgical wound infection in 11 patients, atelectasis in 4 patients, residual hemothorax in 2 patients, and cerebral infarction in 2 patients as shown in table (2).

In our study, mortality rate was 13.2% as 9 patients died, with intraoperative mortality in 7 patients and postoperative in 2 patients. Six patients needed postoperative mechanical ventilation, 4 of them were weaned successfully from mechanical ventilator. Length of hospital stay was from 5 days to 19 days.

By analyzing available data, we found that there was statistical significant relationship between mechanism of injuries and mortality rate as gunshot injuries had much worse outcome than stab injuries as out of 7 patients with gunshot wounds, 3 died (42.86%). Patients with sinus rhythm, cardiac tamponade, measurable blood pressure and high hemoglobin level had more survival rate. However, site of incision, time of transfer, anatomical site of injuries and amount of blood transfusion were not predictors of survival of penetrating cardiac injury patients as shown in table 3.

Despite the previous results, the logistic regression analysis identified that only preoperative low hemoglobin level was consistently predictor of mortality with odds ratio 0.347 and p value 0.03.

	N (%)
Age (yrs) (mean± std)	**31.57± 9.59**
Mechanism of injury	
Gun shot	7 (10.29%)
Stab	61 (89.71%)
Time to transfer	
<1 hour	7 (10.29 %)
1-2 hour	11 (16.18%)
2-4 hour	25 (36.76%)
4-6 hour	14 (20.59%)
> 6 hour	11 (16.18%)
Hemodynamic status	
SBP>90 mmHg	25 (36.8 %)
SBP<90 mmHg	23 (33.8 %)
Immeasurable	12 (17.6 %)
Arrested before thoractomy	8 (11.8 %)
Sinus rhythm	
Present	47 (69.1%)
Absent	21 (30.9 %)
Cardiac tamponade	
Present	38 (55.9 %)
Absent	30 (44.1%)
Site of incision	
Median sternotomy	36 (52.9%)
Anterolateral thoracotomy	32 (47.1%)
Anatomical site of injury	
Right ventricle	30 (44.1%)
Left ventricle	26 (38.2%)
Right atrium	2 (2.9%)
SVC	1 (1.5%)
Pulmonary artery	2 (2.9%)
Coronary arteries	2 (2.9%)
Multiple chambers	5 (7.5%)
Preoperative Hb (gm/dl)	10.08± 1.44
Amount of blood transfused (unit)	4.32±1.09

Table 1. Patients characters

Postoperative complications (11/61, 18.03%)	N
Surgical wound infection	9
Atelectasis	4
Residual haemothorax	2
Cerebral infarction	2

NB:
The percentage is calculated after exclusion of intraoperative non survivor cases.
One may have more than one complication.

Table 2. Postoperative complications:

		Survivors (N=59)	Non survivors (N=9)	P value
Age (yrs)	**Mean ± std**	**32.17±9.79**	**27.67±7.45**	**0.192**
Mechanism of injury	**Gunshot (n=7)**	4 (57.14%)	3 (42.86%)	**0.0439***
	Stab (n=61)	55 (90.16%)	6 (9.45%)	
Time to transfer	**<1 hour (n=7)**	5 (71.43%)	2 (28.57%)	**0.494**
	1-2 hour (n=11)	11 (100%)	0 (0%)	
	2-4 hour (n=25)	22 (88%)	3 (12%)	
	4-6 hour (n=14)	12 (85.71%)	2 (14.29%)	
	> 6 hour (n=11)	9 (81.82%)	2 (18.18%)	
Hemodynamic status	**SBP>90 mmHg (n=25)**	25 (100%)	0 (0%)	**0.006***
	SBP<90 mmHg (n=23)	21 (91.31%)	2 (8.69%)	
	Immeasurable (n=12)	8 (66.67%)	4 (33.33%)	
	Arrested before thoractomy (n=8)	5 (62.5%)	3 (37.5%)	
Site of incision	**Median sternotomy (n=37)**	35 (85.37%)	2 (14.63%)	**0.069**
	Anterolateral thoracotomy (n=31)	24 (88.89%)	7 (11.11%)	
Sinus rhythm	**Present (n=47)**	44 (93.62%)	3 (6.38%)	**0.021***
	Absent (n=21)	15 (71.43%)	6 (28.57%)	
Cardiac tamponade	**Present (n=38)**	36 (94.74%)	2 (5.26%)	
	Absent (n=30)	23 (76.67%)	7 (23.33%)	**0.037***
Anatomical site of injury	**Right ventricle (n=30)**	26 (86.67%)	4 (13.33%)	**0.079**
	Left ventricle (n=26)	24 (92.31%)	2 (7.69%)	
	Right atrium (n=2)	2 (100%)	0 (0%)	
	SVC (n=1)	1 (100%)	0 (0%)	
	Pulmonary artery (n=2)	2 (100%)	0 (0%)	
	Coronary arteries (n=2)	2 (100%)	0 (0%)	
	Multiple chambers (n=5)	2 (40%)	3 (60%)	
Preoperative Hb gm/dl	**Mean± std**	10.39±1.17	8.05±1.36	**<0.001***
Amount of blood transfused (unit)	**Mean± std**	4.32±1.08	4.33±1.15	**0.9796**

**Statistically significant*

Table 3. Comparison between survivors and non survivors

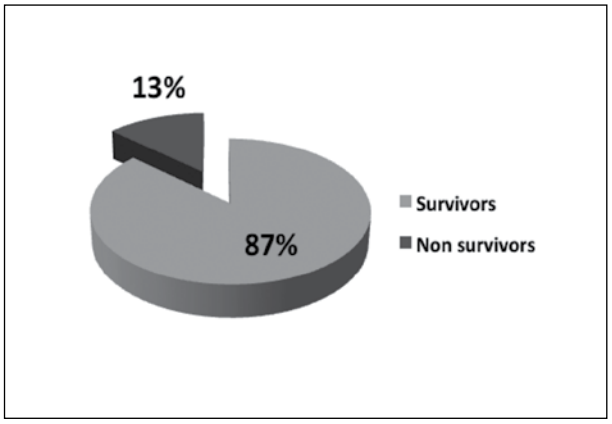

Fig 1. Mortality rate

Discussion

In this study, nine (13.2%) out of 68 patients operated for penetrating cardiac injuries died. This percentage is accepted by comparison to other studies. We did not include victims who reached hospital dead. So it could be considered as one of selective studies with ignoring mortuary data. This percentage is similar to Topal et al. [8] who documented 15% mortality rate in 61 patients sustained penetrating cardiac injuries. In Brazilian study by Rodrigues et al [3], mortality rate was 32.9% and Rhee et al [9] documented low survival rate 19.3%. Also, Molina et al. [10] reported high mortality rate (67%) in a cohort with mainly stab wounds throughout the last decennium. Recently, there was Scandinavian study reported thirty-one patients with penetrating cardiac injury of them only 14 patients survived [11].

Regarding mechanism of trauma, we found that gunshot injuries were significantly related to mortality. This could be explained by the high kinetic energy of missile injuries and its ability to make much tissue destruction with multiple chamber injuries [12]. This is in accordance to Seamon et al who documented that multiple gunshot wounds were unsalvageable[13].

Another study showed that none of the patients injured by high velocity projectiles had signs of life on admission. The only survivor among these happened to shoot himself close to the hospital and was transported to the emergency department in a few minutes [14].

Different reports studied the effect of time of transfer on outcome and found that the outcome is usually poor when the time from trauma to surgery increases [15, 16]. An Israeli study of 14 patients reported 0% mortality with the mean time from injury to surgery of 37 min only [17]. Kaljusto et al. [11], in his recent study, found that the concept of load and go is superior to stay and paly and they documented that transport time and choice of strategy on the site based on patients charts are the main predictors of survival.

In our study, we failed to make statistical significant relationship between time of transfer and outcome. This may be attributed to one patient that presented 3 weeks after onset of trauma with late cardiac tamponade and the patient survived the operation . Despite this result, it is out of discussion that rapid transfer and immediate management are the cornerstones that affect outcome of any patient with penetrating cardiac injuries.

In our study, we found that cardiac tamponade was a predictor of survival. Cardiac tamponade played a role in preventing exsanguinations and may help in temporary pressure control of bleeding by elevating intrapericardial pressure or by decreasing intracardiac pressure. This effect is limited and time dependent. This is similar to studies by Demetiades et al [18], Velmahos et al [19] and Moreno et al [20] who specifically found that pericardial tamponade is the most determinant of survival among 100 unselected consecutive patients with acute cardiac injuries patients using multivariate logistic regression analysis. However, Aseniso et al [1] did not find that cardiac tamponade was predictor of survival in his study on 105 patients, but they found, like our study, that sinus rhythm was a predictor of survival. We think that absence of arrhythmia could be related to hemodynamic stability of patients. Similar conclusion was given by Keogh and Wilson [21] and Attar et al [22].

It is important to mention that successful repairs of cardiac defects may be effectively accomplished without the heart being able to recover its rhythm. In these cases, pharmacological manipulation and direct defibrillation is frequently needed to regain a normal sinus rhythm. If a sinus rhythm cannot be restored despite all attempts, the prognosis will be poor. Sometimes a rhythm can be restored, but no effective pumping mechanism is observed and the insertion of pacemaker wires may help to restore this ineffective forward pumping motion, but this is uncommon. Progressive myocardial death can be expected, first by dilatation of the right ventricle and accompanying cessation of contractility and motion, followed by the same process in the left ventricle [23].

Patients were divided into 4 groups according to their presenting hemodynamics, this division was taken from Arreola-Risa et al [7]. Those with immeasurable blood pressure or arrested before thoracotomy had poor outcome with more mortality. This is in agreement to the study given by Gewely et al [24] who stated that patient who was shocked or arrested before thoracotomy has a higher mortality rate. Also, patients having cardiopulmonary resuscitation (CPR) has mortality rate of 68.2%. But, Arreola-Risa et al. [7] stated that although profound hypotension SBP < 40 mmHg, CPR and emergency room thoracotomies were associated with poor outcome, none were uniformly predictive of death. Also, Tyburski et al. [6] found that the physiologic status of the patient at presentation were significant prognostic factors in his series of penetrating cardiac injuries on 302 patients underwent emergency thoracotomy.

Regarding cardiac chamber affected, we found that right ventricle was the most chamber affected. This is related to the

position of right ventricle in ventral position and is similar to many studies who found that right ventricle is the most chamber affected followed by left ventricle, right atrium and left atrium [1,2,25] but there was no statistical significant relationship between chamber affected and mortality. Even patients with coronary artery affection had good survival rate with no one needed coronary artery bypass graft surgery as injuries to coronary arteries were distal and their ligation were sufficient without ischemic changes or myocardial infarction. Multichamber injuries were not a predictor of survival in our study. This is in contrast to a study by Kang et al [26] who found that patients with a single right ventricle injury are mostly salvageable whereas those with multichamber injuries have a very high mortality.

It was interesting, in our study, to find statistical significant relationship between reduced hemoglobin level before surgery and mortality and by multivariate analysis it was the only predictor of death. This could be explained by the association between exsanguinations and decreased hemoglobin level. All non survivors had Hb level of 6.5- 8 gm /dl. The significance of hemoglobin level was addressed by Topal et al [8] who found, in their study, that mortality increased with loss of consciousness, blood pressure <50 mmhg and low hemoglobin level.

In our study, we did not use emergency room thoracotomy as there is no availability for it. Unstable patients were transferred immediately to operating room for operating room thoracotomy. We achieved a good survival rate with this protocol as emergency room thoracotomy had low survival rate in some literatures [1, 14, 27]. We preferred sternotomy for stable patients and anterolateral thoracotomy for patients with hemodynamic instability. We did not need to change our incisions in all cases and accessibility to control injury was good. Our concepts are similar to Asensio et al [28] who documented that sternotomy is the incision of choice in patients admitted with penetrating precordial wounds that may harbor occult or non –hemodynamically compromising cardiac injuries and anterolateral thoracotomy is the incision of choice in patients in extremis. Site of incision was not predictor of survival in this study.

In our study, postoperative complications were minimal. All complications were managed conservatively including residual hemothorax and cerebral infarction. We did not have patients with cardiac complications postoperative as detected by echocardiography done before discharge.

Conclusions

We can conclude that penetrating cardiac injuries are salvageable injuries with good survival rate and minimal postoperative complications. Mechanism of injuries, cardiac tamponade , sinus rhythm , hemodynamic status of patients and hemoglobin level could predict survival. Low hemoglobin level was the only independent risk factor of death.

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Early Postoperative Arrhythmias after Mitral Valve Surgery in Patients with Minitransseptal versus Left Atrial Approach

Moataz Rezk, MD

***Objectives*: The vertical transseptal approach has become popular because it offers excellent exposure of the mitral valve and it is easy to close. Despite the excellent view it affords, the vertical transseptal approach can result in postoperative sinus node dysfunction and dysrrhythmias.**

***Methods*: This prospective randomized study is to compare the postoperative outcome-mainly arrhythmia- in patient who underwent isolated mitral valve replacement using either minitransseptal approach or classic left atriotomy approach. All mitral valve disease patients with sinus rhythm were selected for this study. Patients with low EF, Ischemic mitral lesion and previous permanent pacemaker were excluded.**

***Results*: From June 2011 and July 2014 total 120 patients with mitral valve disease underwent elective mitral valve replacement (MVR). Group A had 56 patients with a minitransseptal approach while group B had 64 patients with left atriotomy. There was no statistically significant difference between both group regarding preoperative and demographic data. No significant difference in Cross-clamp time (96.0±15.9 min in Group A versus 89.4±21.1 min in group B, *P value* = 0.13) and no difference in postoperative ventilation time (6.1±0.5 hours in Group A versus 5.0±0.2 hours in Group B, *P value* = 0.356). Three patients in Group A (5.36%) re-opened for bleeding versus one patient (1.57%) in Group B with no significant statistical difference, *P value* = 0.356. There was no significant difference in hospital stay (14.4±5.4 days in Group A versus 13.3±1.9 days in Group B, P *value* = 0.608. There was no statistical significance between the two groups regarding the patients' rhythm during weaning off bypass, during the ICU stay or after discharge. 15 Patients (27%) in group A while in group B 19 patients (29%) showed AF of previous sinus rhythm postoperatively which was non statistically significant.**

***Conclusion*: Minitransseptal approach does not increase the postoperative complications even postoperative arrhythmia when compared to classic left atriotomy approach. Nowadays many centers used the transseptal approach as a routine approach for mitral valve surgery.**

***Keywords* : MINITRANSEPTAL, MVR, ARRHTHMIAS.**

Lecturer of Cardiothoracic Surgery, Benha Faculty of Medicine.

Corresponding Author:
Moataz Rezk
drmoatazrezk@gmail.com

Codex : o3/08/1512

Adequate exposure of the mitral valve and the subvalvular apparatus is critical to the success of mitral valve procedures. Various surgical approaches have been developed to solve this problem. The traditional longitudinal left atrial incision although widely used, may not provide optimal visualization especially in patients with deep chest or small left atrium. [1, 2]

In contrast, the access to the mitral valve through transseptal approach is technically more demanding, but it allows a better exposure of its leaflets and subvalvular apparatus, specially, in small atria, in reoperations or when it is combined with tricuspid valve treatment. [3]

However, the risk of transecting the sinus node artery, the internodal pathways and the need to reconstruct the wall of the atria and the interatrial septum were considered important limitations to its routine use in mitral valve procedures. Atrial arrhythmia has been identified as a risk factor for poor outcome after MV replacement.[4, 5]

The aim of this study is to evaluate postoperative complications specially arrhythmias after the minitransseptal approach as compared to standard left atriotomy for routine mitral valve replacement.

Patients and Methods

The prospective randomized study was done to compare the outcome-mainly arrhythmia in postoperative period in patient who underwent mitral valve replacement at the Cardio-Thoracic Surgery Department, Benha University, in the period between June 2011 and July 2014 using either minitransseptal approach or classic left atriotomy approach. All mitral valve disease patients with sinus rhythm were selected for this study, after institutional and informed consent.

Exclusion criteria include:

1. Patients with any rhythm other than sinus rhythm.
2. Combined aortic valve surgery.
3. EF<35%.
4. Ischemic mitral lesion
5. Previous permanent pacemaker and/or automatic implantable cardioverter defibrillator implantation.

The patients were randomly divided into two groups

Group (A): patients were submitted to minitransseptal approach to the mitral valve.

Group (B): patients were submitted to standard left atrial approach to the mitral valve.

All preoperative, operative and early postoperative data were collected including: Full Clinical examination, Routine laboratory investigations, Electrocardiogram (ECG): 12- lead electrocardiogram was done to record the basic rhythm of the patient whether sinus rhythm or AF and Echocardiography.

Surgical procedure

The same cardiac anesthesiologist, perfusionist, and surgical technique were involved in the study. All the patients underwent median sternotomy and standard cardiopulmonary bypass with moderate hypothermia, antegrade crystalloid cardioplegic arrest, and local hypothermia with ice slash. The MV was approached through either minitransseptal approach on group A (just confined to interatrial septum not reaching the left atrial roof) or standard left atriotomy sited posterior to the interatrial groove on group B.

After surgery, patients were transferred to the cardiothoracic intensive care unit. The patients were monitored by continuous electrocardiogram (ECG) during a minimum period of 48 h postoperatively. In the ward routine ECG is done every 8 hours daily until discharge. In case of clinical suspicious of rhythm disturbance, a 12-lead ECG recording was conducted and continuous ECG monitoring was reused. The occurrence of AF was diagnosed on the basis of a minimum of 15-min AF duration documented by a continuous 12-lead ECG recording and readmission to ICU was done for management.

After discharge, patients were followed up in outpatients' cardiac surgery clinic according to our institute protocol which includes routine full clinical examination, complete lab study, 12 lead ECG and trans-thoracic echocardiography every one month for successive 3 months.

Statistical analysis

All data were stored in a Microsoft Access Database. Statistical analysis was performed using the SPSS 10.0 for Windows package. Summary descriptive statistics were expressed as mean (± SD) or percentages. Comparisons of baseline characteristics and differences between preoperative and postoperative variables between the two patient groups were carried out using Student's unpaired t-test. For all comparisons, statistical significance was assessed at the 0.05 level using two-tailed p-values, and 95% confidence intervals of the difference between the mean values (95% CI) were quoted where appropriate. All *P*-values ≤0.05 were quoted, and those >0.05 were designated not significant (NS).

Results

This study was conducted on 125 patients with mitral valve disease. 120 patients completed the study; there was five mortality among the patients.

Group A: Minitransseptal group included Fifty Six patients.

Group B: The left atriotomy group included Sixty Four patients.

There was no significance difference regarding preoperative demographic and clinical data between both groups. Table (1) summarizes these data.

Although group A showed longer cross-clamp time, CPB time and operative time but with no significant statistical difference between both groups. Table (2) summarizes these results.

There was no significant difference between both groups regarding early postoperative complications. Table (3) summarizes these results.

Table (4) a comparison between Echocardiographic findings preoperative and postoperative in both groups which shows small left atrial size in group A than in group B but with no significant difference.

Variables	Group A Minitransseptal (n= 56)	Group B Left Atriotomy (n= 64)	*P* value
Mean age (yrs, SD)	33.6±13.4	36.5±9.2	0.462
Male	12	44	
Class III NYHA (n, %)	6 (71.10%)	8 (12.5%)	0.445
Class IV NYHA (n, %)	6 (10.71%)	4(6.25%)	0.587
DM (n, %)	13 (23.21%)	11 (17.18%)	0.774
COPD (n, %)	31 (55.36%)	37 (57.81%)	0.364

SD=standard deviation; COPD=chronic pulmonary obstructive disease; DM=diabetes mellitus

Table 1. Demographic and Clinical Characteristics of the Patients.

Variables	Group A Minitransseptal (n= 56)	Group B Left Atriotomy (n= 64)	*P* value
Tricuspid valve repair (De Vega procedure)	30 (53.6)	35 (54.7)	0.421
Cross-clamp time (min) (mean±SD)	96.0±15.9	89.4±21.1	0.13
CPB time (min) (mean±SD)	138.3±38.2	120.3±45.8	0.12
Inotropic support (n, %)	32 (57.14%)	36 (56.25%)	0.046
Operative time(min)	265±32	251±39	0.4
Duration of inotropic use (day) (mean±SD)	1.6±3.2	1.7±0.5	0.129

SD=standard deviation; CPB=cardiopulmonary bypass

Table 2. Intraoperative Variables between the two Groups.

Variables	Group A Minitransseptal (n= 56)	Group B Left Atriotomy (n= 64)	*P* value
Re-exploration for Bleeding (n, %)	3 (5.36%)	1(1.57%)	0.356
Postoperative pleural effusion (n, %)	2 (8.93%)	0	0.121
Ventilation time in hours (mean±SD)	6.1±0.5	5.0±0.2	0.356
Length of ICU stay (Hours) (mean±SD)	83±7	77±9	0.378
Length of hospitalization (days) (mean±SD)	14.4±5.4	13.3±1.9	0.608

ICU=intensive care unit; SD=standard deviation

Table 3. A comparison of postoperative variables between the groups.

Variables	Group A Minitransseptal (n= 56)	Group 2B Left Atriotomy (n= 64)	P value
LA dimension (mm)			
			NS
Preoperative	50.2 ± 9.5	54.0 ± 8.5	NS
Postoperative(3mth later)	44.2 ± 6.9	53.2 ± 9.5	
LVES dimension (mm)			
Preoperative	38.3 ± 6.8	41.4 ± 6.4	NS
Postoperative(3mth later)	35.9 ± 9.0	38.0 ± 11.6	NS
LVED dimension (mm)			
Preoperative	58.0 ± 6.0	60.9 ± 6.3	NS
Postoperative(3mth later)	52.0 ± 8.7	56.4 ± 8.4	NS

Table 4. Echocardiographic findings in both groups.

Postoperative Arrhythmia

After weaning from the cardiopulmonary bypass, the patients' rhythm was recorded in both groups. In group "A" 20 patients (36%) developed AF and 36 patients (64%) remained in sinus rhythm, and two patients (3.6%) were in nodal rhythm and no patients were in heart block.

While in group "B" after weaning from cardiopulmonary bypass, the patients rhythm were as follows: 25 patients (39%) developed AF and while 39 patients (61%) remained in sinus rhythm, three patients (4.7%) developed who treated with biphasic D.C. shock and returned sinus rhythm and no patients experienced nodal rhythm or heart block.

There was no statistical significance (P value >0.05) between the two groups regarding the intraoperative rhythm after weaning from the cardiopulmonary bypass.

During the ICU stay, in group "A" 7 patients (12.5%) returned to sinus rhythm, while in group "B" 9 patients (14%) returned to sinus rhythm which was non statistical significant between the 2 groups as regarding postoperative conversion to sinus rhythm during the ICU stay.

Only one patient in group B developed ventricular tachycardia in the ICU mostly hypoxia induced (COPD patient) and treated with biphasic D.C. shock.

After discharge, only two patients, in group A developed AF while in group B three patients developed AF which was non statistical significant as shown in table [5].

Variables	Group A Minitransseptal (n= 56)	Group B Left Atriotomy (n= 64)	P value
Atrial Fibrillation			
-After weaning of bypass	20 36%))	25 (39%)	NS
-Postoperative	13 (23%)	16 (25%)	NS
-After 3 months	15 (27%)	19 (29%)	NS
Ventricular tachyarrhythmias			
***V*entricular Tachycardia (VT)& Ventricular Fibrillation (VFib).**			NS
-After weaning of bypass	2 (3.6%)	3 (4.7%)	NS
-Postoperative	0	1 (1.6%)	
-After 3 months	0	0	
Nodal rhythm			
- After weaning of bypass			
-Postoperative	2(3.6%)	1(1.6%)	NS
-After 3 months follow up	0	0	
	0	0	
Heart block			
-After weaning of bypass	0	0	NS
-Postoperative	0	0	
-After 3 months	0	0	

Table 5. Shows cardiac rhythm behavior in both groups:

Discussion

Vertical Transseptal approach to expose the mitral valve is one of the oldest approaches to mitral surgery .many modifications and extension on this approach were done to improve the visualization of the mitral apparatus like extended Septal incision and left atrial roof approach.**(1)**

The extended septal approach and left atrial roof approach can increase the incidence of complications like atrial arrhythmia especially nodal block **(6).**

In our study we used the Minitransseptal incision during mitral valve surgery to minimize such complications.

In our study we compare the Classic left atrial approach to the Minitransseptal approach regarding the postoperative complications and the short term follow up results especially occurred arrhythmias.

In our study although the cross clamp time , the cardiopulmonary bypass time, operative time and ICU stay were longer in patients of the transseptal group but with no significant statically difference. The exposure of the mitral valve was much better with less traction effort done by the assistant which would help the surgeon regarding the full assessment and decision making especially if mitral repair intended.

In our study the incidence of some complications like pleural effusion and re- exploration for bleeding were relatively longer in transseptal approach but no significant difference from the classic left approach. which again infavours the use of transseptal approach as you get the benefit of better exposure without increase in the perioperative complications which was proved by many previous studies. **(5, 7)**

Many studies did not comment on the intraoperative rhythm disturbance because it might be multifactorial and is not only related to the surgical approach to atrium. Other others propose that postoperative arrhythmia, especially new atrial arrhythmias, relatively higher in classic left atrial incision. ***(8, 9,10)***

In our study there was no significant difference between both groups regarding postoperative arrhythmias .this finding is supported by other studies. ***(7, 8,10)***

Only two patients in transseptal approach group had nodal rhythm which completely recovered spontaneously in early postoperative period which could be explained by edema around the SA node which resolves by time***. (8, 10).***

Off course the operative and postoperative heart block due to nodal injury is higher in extended incision which is not the case in our study.

Conclusion

Minitransseptal approach gives better exposure of the mitral valve apparatus during mitral valve surgery. It is more beneficial during redo surgery and in relatively small atrial size. It does not increase the postoperative complications even postoperative arrhythmia when compared to classic left atriotomy approach. Many centers used the transseptal approach as a routine approach for mitral valve surgery nowadays.

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Emergency Reoperation for Acute Prosthetic Mitral Valve Thrombosis: Early Results of Thirty Patients

Ahmed Abdelaziz Elsharkawy, MD

Background: **Acute Prosthetic Mitral Valve Thrombosis is a life-threatening emergency that requires immediate surgical intervention. Reoperation for mechanical valve malfunction became more frequent due to the increasing number of patients with mitral valve replacement for several pathologies and poor anticoagulation control by pregnant females with mitral prosthesis.**

Patients and Methods: **Our study included 30 patients with prosthetic mitral valve thrombosis, who underwent emergency re-replacement of mitral valve prosthesis (from march 2012 till march 2015) in cardiac surgery casualty unit of *Kasr Al-Ainy* University Hospitals.**

Results: **Our patients were 27 females (90%)and 3 males (10%). The mean age was 30 ± 10 years. The overall mortality was 3 patients (10%). 6 patients(20%) were pregnant. The main risk factors for hospital mortality were the need for preoperative mechanical ventilation due to severe acute heart failure and pulmonary edema, long cross clamp time, and the need for high inotropic support after weaning from bypass.**

Conclusion: **Early diagnosis and emergency surgical intervention in patients with acute prosthetic mitral Valve Thrombosis, before the development of severe myocardial dysfunction , is associated with better outcome and less post operative complications .**

KEY WORDS: **Mitral prosthesis thrombosis - Mitral valve reoperation - Stuck mitral.**

Acute Prosthetic Mitral Valve Thrombosis is a life-threatening emergency that requires immediate surgical intervention. reoperation for prosthetic mechanical valve malfunction or thrombosis became more frequent due to the increasing number of replacement of the mitral valve for many pathologies such as degenerative or rheumatic valve disease.[1]

There have been gradual decrease in perioperative risk for redo valve surgery over the past 20 years, mostly due to better myocardial protection, increased surgical experience and improved patient management. However, mortality rates remain higher than first time valve replacement surgery. [2]

Aim of The Study

The aim of this work is to review and analyze the data of patients with acute Prosthetic Mitral Valve Thrombosis and to highlight the impact of early diagnosis and emergency surgical intervention on outcome.

Patients and Methods

This is a retrospective analytical study conducted in cardiac surgery casualty unit of Kasr Al-Ainy University Hospitals, and included 30 patients who were undergoing re-operation for management of acute prosthetic mitral valve thrombosis between march 2012 and march 2015.

Lecturer of Cardiothoracic surgery,
Faculty of medicine, Cairo University

Corresponding Author:
Ahmed Abdelaziz Elsharkawy
ahmedsharkawy.cts@hotmail.com

Codex : o3/09/1512

Full history was taken from the patients and their relatives with special concern of acute onset dyspnea, history of embolism, and the compliance on oral anticoagulation therapy. Full laboratory investigations especially INR level, ECG, chest X-ray and urgent transthoracic echocardiography as well as fluoroscopic assessment of mobility of leaflets of mitral prosthesis were done for all patients.

Operative technique

All patients had groin incision for exposure of femoral artery for the possibility of emergency cannulation in case of cardiac injury during sternal reopening.

All patients had median resternotomy using the oscillating saw.

Cardiopulmonary bypass was conducted using aortic and bicaval cannulation.

Myocardial protection was achieved by warm antegrade blood cardioplegia.

The mitral valve was approached through a trans-septal incision through the right atrium and fassa ovalis. The incision is sometimes vertically extended into the roof of left atrium to allow very good exposure of the mitral valve prosthesis ,especially with small left atrium or with previously implanted aortic prosthesis.

Out of the 30 patients,Two female patients had mitral valve re-replacement with biological valve,and the rest received mechanical valves.

This approach has also the advantage of repairing the associated tricuspid insufficiency from the same incision.

Concomitant Tricuspid valve repair was done for 23 patients using segmental annuloplasty technique.

Quantitative data was expressed as mean and standard deviation (X±SD), and qualitative data expressed as number and percentage (No. & %). Categorical variables were compared using the Pearson's chi-square test or Fisher's exact test and in- dependent continuous variables was compared by the unpaired Student t test. A P value of less than 0.05* was considered statistically significant.

Results

This retrospective analytical study included 30 patients. They were 27 females (90%) and 3 males (10%). The age of our patients ranged between 20-40 years with a mean of 30±10 years.

Regarding preoperative congestive heart failure, 20 patients came to the hospital with dyspnea NYHA class III (66.6%), and 10 patients came with dyspnea NYHA class IV (33%). three patients had acute severe pulmonary edema on admission and they need preoperative mechanical ventilation (10%).

Six female patients were pregnant (20%), 3 in the 1st trimester, 3 in the 3rd trimester. Three patients had associated acute lower limb ischemia due to thrombus embolization, that required urgent embolectomy .

INR level on admission to the operative room was 1.64 ± 0.75, ranging between 1 – 3.6, with 75% of patients having INR less than 2.

Only 3 patients(10%) had history of two previous open heart surgeries (10%),and 3 patients(10%) had previous aortic and mitral valve replacement.

The time interval from the last mitral valve replacement ranged between 2 and 10 years.

The time elapsed from hospital admission till reaching the operating room was ranging from 4 to 12 hours .

Regarding echocardiographic assessment of mitral valve prosthesis, elevated mean and peak pressure gradient was found in all patients .

Echocardiography of the patients revealed that pulmonary artery pressure was higher than 60 mmHg in 75% of patients.

Intra-operatively, thrombus over atrial and /or ventricular aspects of mitral prosthesis was found in all patients with limited excursion of both leaflets.

During weaning from cardiopulmonary bypass, high inotropic support was required in 15 patients (50%) in the form of norepinephrine and milrinone.

Cardiopulmonary bypass time was ranging from 100 – 250 minutes with a mean 130 ± 30 minutes. Cross clamp time was ranging from 80 - 170 minutes with a mean 100 ± 20 minutes. ***Cross-clamp time and total bypass time were not significantly different from conventional left atrium approach.***

Duration of post operative mechanical ventilation in the ICU was ranging from 4 – 72 hours .

Regarding postoperative complications, two patients needed re-exploration due to excessive postoperative bleeding (6.7%),1 patient(3.3%) was complicated with acute renal failure that required dialysis and 2 patients had wound infection (6.7%).

No incision-related rhythm complication occurred in any patient

The mean of the total ICU stay was 101±74.3 hours, ranging from 40 – 240 hours. The mean of the total hospital

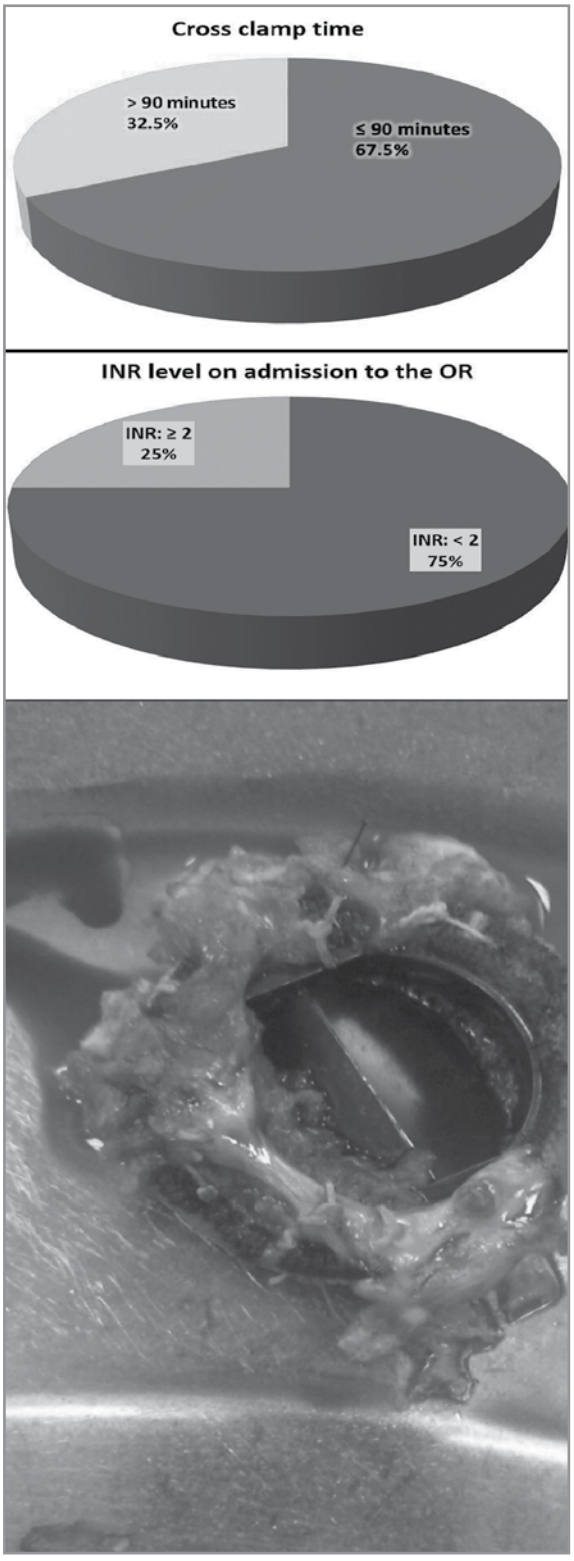

Fig. (1) Mitral prosthesis with attached thrombus.

stay for discharged patients was 10.6 ± 4.3 days, ranging from 6 - 27 days.

Three patients (10%) died post-operatively due to myocardial failure. Mortality was strongly correlated with long cross clamp time, and need for high inotropic support after weaning from bypass .

Follow up

Post operative echocardiography done for the patients revealed well functioning prosthesis with mean gradient range of 3-6 mmHg.

Variable	Value	Percentage
Age	30±10 (20-40 years)	
Gender		
Female	27	90%
Male	3	10%
NYHA class 3	20	66.6%
NYHA class 4	10	33.3%
Pregnancy	6	20%
Acute limb ischemia	3	10%
Previous cardiac surgery	3	10%
Time interval from first surgery	2-10 years	
Time from admission till surgery	4-12 hours	
Echocardiography data: Pulmonary pressure above 60 mmHg	23 patients	75%
Mean pressure gradient across mitral prosthesis	10-20 mmHg	
Peak pressure gradient across mitral prosthesis	20-30 mmHg	
Cardiopulmonary bypass data: Cross-clamp time	100±20 min	
Total bypass time	130±30 min	

Table (1) Pre operative and operative patients characters

Variable	Value	Percentage
Duration of mechanical ventilation	4-72 hours	
ICU stay	40-240 hours	
Need for reexploration	2 patients	6.6%
Post operative acute renal failure	1 patient	3.3%
Post operative wound infection	2 patients	6.6%
Mortality	3 patients	10%

Table (2) Post operative patients characters:

Discussion

Regarding sex distribution in our study, our patients were 3 males (10%) and 27 females (90%). This is similar to **Akay et al (2008)** who studied 62 redo patients underwent mitral valve re- replacement, between 1989 and 2003 in Baskent University, Turkey, where 75.8% of his patients were females and 24.1% were males. This is also convenient with results of **Ahn et al. (2008)** who studied 20 patients underwent surgical intervention due to mechanical valve thrombosis from January 1981 through March 2006 at Seoul National University Hospital, Korea, with 70% of patients were females and 30% were males. [2, 3]

Our results were different from the study reported by **AbouelKasem et al. (2007)** who studied 50 patients underwent mitral valve re- replacement for prosthetic mechanical valve dysfunction in cardio-thoracic surgery departement, Kasr El-Ainy hospital, Cairo, from February 2004 to March 2007, where 28% of patients were females and 72% were males. The reason for this big difference is that he excluded pregnant females from his study. [1]

The age of our patients ranged between 20 – 40 years with the vast majority of young females. This is in agreement with **Fouda et al. (2014)** who studied the outcome of surgical management of 60 patients with mechanical mitral valve dysfunction from July 2011 till June 2013 at Kasr El-Ainy hospitals, Cairo, with the mean age was 39 ± 10.14. [4]

This was different from the results of **Durrleman (2004)** who reported with his colleagues twenty year experience in prosthetic valve thrombosis management at Montreal heart institute, with mean age of 55 ± 15 years.[5]

Many patients presented with acute severe congestive heart failure and this is in agreement with many studies as **Fouda et al(2014) and Durrleman et al. (2004)** who reported that severe congestive heart failure was found in 44% of his patients. Also, **Ahn et al. (2008)** reported that the most frequent clinical presentation was heart failure, presented in 65% of patients. [3-5]

Regarding NYHA class, our results were similar to the study of **Ahn et al. (2008)** where all patients came with NYHA functional class III or IV at the time of diagnosis. Also, 84% of patients in **AbouelKasem et al. (2007)** study was in NYHA class III and IV. **Brandao et al. (2002)** studied 146 patients underwent reoperations for prosthetic valve dysfunction between 1995 and 1999 at the University of Sao Paulo Medical School, Brazil, reported that 91.1% of his patients were in NYHA class III and IV before surgery. [1, 3, 6]

As pregnancy is a risk factor for prosthetic valve thrombosis due to poor anticoagulation control,, many studies show a respectable proportion of pregnant females that may reach up to 35% of the patients as in **Ahn et al. (2008)** study. **Lafci et al. (2006)** studied 18 patients presented with mitral valve thrombosis between July 1997 and September 2005 at Ataturk Hospital, Turkey, reported that 5.6% of patients were pregnant. Also, **Toker et al. (2006)** who studied 63 patients underwent reoperation for obstructive prosthetic valve dysfunction between January 1994 and April 2005 at Kosuyolu Heart and Research Hospital, Istanbul, Turkey, 7.9% of patients were pregnant. [3, 7,8]

As inadequate anticoagulation is risk factor for prosthetic valve thrombosis, 75% of our patients had INR less than 2 on admission. many studies reported low INR level of patients. In study of **Ahn et al. (2008**), INR profile **with diagnosis of thrombosis was 1.66+_0.64** (1.02-2.68). [3]

The time interval from the last mitral valve replacement surgery was 2 to 10 years. this is concordant with most researches that studied prosthetic valve thrombosis, as **Toker et al. (2006)** who found that the mean time to reoperation was 58.9 ± 56.1 months (rang: 1 – 252 months); **Lafci et al. (2006)**, the mean time to reoperation was 48.3 ± 15.4 months; **Durrleman et al. (2004)**, the mean time to reoperation was 39 ± 42 months. [5,6,7]

In our study, The time elapsed to admission to the operating room was short in comparison to other studies of mechanical prosthetic valve thrombosis, as in **Toker et al. (2006)** 65.1% of patients were operated on under emergency conditions. Also, in **Ahn et al. (2008)** 40% of patients underwent an emergency or urgent operations. In **AbouelKasem et al. (2007)** 58% of patients were operated urgently, this is because patients with prosthetic valve thrombosis were 36% only. [1, 3]

Cardiopulmonary bypass time and cross clamp time in our results were similar to the results of **Toker et al. (2006)** who reported that the mean aortic cross clamp time was 85.5±36.4 minutes and total perfusion time was 135.3±68.73 minutes, and **Vohra et al. (2012)** reported that cardiopulmo-

nary bypass time was 120 ± 56 min and cross-clamp time was 92±32min. [4,8]

These results were longer than the results of **Durrleman et al. (2004)** who reported that, the cross clamping time was 75 ± 32 minutes (range, 16-133 minutes), and the cardiopulmonary bypass time was 118 ± 48 minutes (range, 31-217 minutes).

Total ICU stay ranged from 40 to 240 hours, and this was longer in comparison to **Akay et al (2008)** who reported that total ICU stay was 81.6 ± 38.4 hours. Total hospital stay was similar to the results of **Akay et al (2008)** who reported that total hospital stay was 9.1 ± 2.7 days. Our total hospital stay was shorter in comparison to **Ahn et al. (2008)** who reported total hospital stay was 16.9 ± 6.7 days and **Vohra et al. (2012)** who reported 17 ± 11 days [2, 3]

Our study showed that the overall mortality was 3 out of the 30patients (10%). This is similar to the results of **AbouelKasem et al. (2007)** 14%, **Fouda et al. (2014)** 15%, **Lafci et al. (2006)** 16.7%, and **Toker et al. (2006)** 20.6%. Our mortality rate was higher than other studies as **Ahn et al. (2008)** 5%, **Akay et al (2008)** 6.4%.[1- 8]

AbouelKasem et al. (2007) in his study reported that risk factors related to hospital mortality were the presence of pulmonary hypertension more than 60 mmHg, high creatinine level more than 1.8 mg% and long cardiopulmonary bypass time. **Akay et al (2008)** also reported that low left ventricular ejection fraction (<35%), NYHA functional class IV, pulmonary edema, female gender, and urgent operations were found to be risk factors for mortality. [1, 2]

A bigger sample size is needed for better outlining of predictors of mortality in patients with prosthetic valve thrombosis.

Conclusions

Patients with prosthetic mitral valve thrombosis presenting to Kasr Al-Ainy hospitals are characterized by being young, more commonly females, with sever heart failure on presentation. Inadequate anticoagulation and low INR level are risk factors of prosthetic mitral valve thrombosis. Pregnant women with mechanical prosthetic heart valves are more vulnerable to prosthetic valve thrombosis. Hemodynamic instability, long operative time and renal dysfunction were especially associated with increased mortality. Earlier surgical management before the development of myocardial dysfunction and severe heart failure had improved greatly the results of mitral valve re-replacement in such critical patients.

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Mitral Valve Thrombosis Results: 8-Year Experience in Nasser Institute

Mohamed A. Amr, MD

Objectives: **Retrospective evaluation of the frequency of mitral prosthetic valve thrombosis (PVT) after valve replacement surgery (VRS) at Nasser Institute. Determination of in-hospital mortality rates (MR) and its relation to patients' demographic and clinical data, and type of valve used.**

Patients & Methods: **The files of patients re-admitted or referred to Nasser Institute with mitral PVT were systemically studied and extracted data were statistically analyzed.**

Results: **Throughout 8-year duration, 1835 patients underwent mitral valve replacement (MVR) in Nasser Institute. Out of these cases 1322 patients had isolated MVR only, while 513 patients underwent combined MVR and tricuspid valve repair (TVR) for a frequency of 72% and 28%, respectively. Bioprosthetic tissue valve was used in 129 patients (7%) and mechanical valve in 1706 patients (93%). During this period 160 patients with mitral valve thrombosis were admitted, 97 patients of them (60.63%) had their 1st surgery in Nasser institute, and 63 patients (39.37%) had their 1st surgery in other centers. 33 patients (20.6%) died during their hospital stay and all were of those had mechanical valve thrombosis. Survivors were significantly younger and had significantly lower body mass index (BMI) than non-survivors. Survival of PVT patients showed positive significant correlation with at admission INR level, ejection fraction (EF%) and hemoglobin concentration, but showed negative significant correlation with at admission serum creatinine, time-lag till admission, presence of associated co-morbidities, serum bilirubin, age, angina and dyspnea grades, and presence of AF. ROC curve analysis defined long time-lag till admission, high serum creatinine, low EF%, old age, low hemoglobin concentration, high serum bilirubin, low INR level, angina grade, high BMI, presence of associated co-morbidities and dyspnoea grade are predictors for mortality in decreasing order of significance.**

Conclusion: **Postoperative PVT is not uncommon complication of mitral VRS. Bioproshetic valve significantly reduced the frequency of PVT. Disturbed at admission INR level, old age, and presence of associated medical co-morbidities especially liver and kidney dysfunction are bad predictors for survival.**

Keywords: **Mitral valve replacement surgery, Prosthetic valve thrombosis, Mortality predictors**

Lecturer of Cardiothoracic Surgery, Faculty of Medicine, Suez Canal University, Consultant of Cardiac Surgery, Nasser Institute

Corresponding Author:
Mohamed A. Amr
doctor2001eg@yahoo.com

Codex : o3/10/1511

Prosthetic valve replacement whether mechanical or bioprosthetic carries an inherent risk for serious, sometimes devastating complications [1]. Prosthetic valve thrombosis (PVT) is a severe complication, which usually occurs in inadequately anticoagulated patients [2]. Obstruction of prosthetic valves can result from thrombus, pannus overgrowth, vegitations or combination of thrombus and pannus formation [1].

Women are more vulnerable to PVT. Pregnant women with mechanical prosthetic heart valves have an increased risk of thrombosis and valve malfunctioning and their treatment is a challenge as surgery carries a high risk of mortality for the mother and the fetus. On the other side, effective anticoagulation is crucial because both oral

anticoagulants and heparin are associated with high risks for the mother and the fetus [3]. Oral contraceptive drugs are associated with increased risk of thrombo-embolism with a possible association between oral contraceptive drug use and PVT despite of the rarity of case reports [2].

Atrial fibrillation (AF) is common in patients with mitral valve disease and is common postoperative (PO) complication of cardiac surgery. It is associated with an increased risk of PO stroke, increased length of intensive care unit and hospital stays, healthcare costs and mortality [4]. AF occurs in 30% to 50% patients during PO period. The incidence of POAF was higher after mitral valve surgery than after coronary artery bypass grafting or aortic valve surgery [5]. The terms 'non-valvular AF' and 'valvular AF' have not been consistently defined. 'Valvular' AF has included any valvular disorder, including valve replacement and repair [6].

AF in the presence of a bioprosthetic heart valve or after valve repair appears to have a risk of thromboembolism [7]. Post-surgical endothelization after prosthetic valve surgery occurs over weeks to months. During this time, the exposed and healing endothelium may serve as a nidus for clot formation. Typically, an initial small thrombus may develop and act as a further substrate for additional layering of new thrombus [8]. In addition, the newly placed mechanical valve results in the development of turbulent flow and stasis which is an additional contributor to thrombus development. Also, increased prosthetic surface area has been correlated to a greater formation of both thrombi and pannus [6,9].

Study design and Targets: The study consisted of two parts:

- Part-1 aimed at retrospective evaluation of the frequency of mitral prosthetic valve thrombosis (PVT) after valve replacement surgery (VRS) throughout 8-year duration at Nasser Institute.
- Part 2 aimed to determine the in-hospital mortality rates (MR) and its relation to patients' demographic and clinical data, and type of valve used.

Patients and Methods

The current retrospective study was conducted at Cardiac surgery Department, Nasser Institute. The study protocol was approved by Local Ethical Committee. The files of patients readmitted to or referred to Nasser Institute with mitral PVT were systemically studied. Extracted data were statistically analyzed.

Statistical analysis

Obtained data were presented as mean±SD, ranges, numbers and ratios. Results were analyzed using One-way ANOVA with post-hoc Tukey HSD Test and Chi-square test (X^2 test). Possible relationships were investigated using Spearman linear regression. Evaluation of estimated parameters as mortality predictors using the receiver operating characteristic (ROC) curve analysis as judged by the area under the curve (AUC) compared versus the null hypothesis that AUC=0.05. Statistical analysis was conducted using the SPSS (Version 15, 2006) for Windows statistical package. P value <0.05 was considered statistically significant.

Results

Throughout 8-year duration out of 14671 admitted to Nasser Institute, 1835 patients underwent mitral VRS (MVR) for a frequency of 12.5%. Out of these cases, 1322 patients had MVR only, while 513 patients underwent combined valve surgery including MVR and tricuspid valve surgery for a frequency of 72% and 28%, respectively. One-hundred and twenty-nine patients had MVR using bioprosthetic valve, while 1706 patients had MVR using mechanical valve for a frequency of 7% and 93%, respectively. Bioprosthetic valve was inserted in 86 patients who had isolated MVR (4.7%), while 43 patients had combined valve surgery using bioprosthetic valve (2.3%). There was non-significant (p>0.05) difference between the frequency of application of biosynthetic valve for cases had MVR alone compared to those had combined valve surgery (Table 1).

Throughout 8-year duration out of 1835 patients underwent MVR surgery at Nasser Institute and discharged uneventfully, 97 patients were re-admitted with PVT for a frequency of 5.29%. According to the initially performed surgical procedure; 59 of 1322 patients had MVR (4.46%) and 38 of 513 patients had combined surgery (7.41%) were re-admitted for PVT, with non-significantly (p>0.05) higher frequency of PVT among patients had combined surgery. According to type of valve used during the initial surgery, only one of 129 patients had biosynthetic valve (0.78%) inserted during combined surgery was readmitted because of PVT. On the other hand, 96 of 1709 patients had mechanical valve (5.29%) inserted during the initial surgery were readmitted because of PVT; 59 patients (4.77%) had MVR only and 37 patients (7.87%) had combined surgery (Table 1).

Another 63 patients were referred to Nasser Institute for management of mechanical valve thrombosis after MVR surgery in other centers; 34 patients (54%) had MVR only and 29 patients (46%) had combined surgery with significantly higher frequency of PVT with mechanical valve compared to bioprosthetic valve (Table 1). The frequency of patients with PVT categorized according to type of valve or operative procedure showed non-significant (p>0.05) difference between referred and in-hospital readmitted cases.

Despite of careful management of cases admitted for management of PVT, unfortunately 33 patients died during their hospital stay for in-hospital mortality rate of 20.6%.

Data			Mechanical valve	Bioprosthetic valve	Total
In-hospital cases	Operated cases	MVR	1236 (67.4%)	86 (4.7%)	1322 (72%)
		Combined surgery	470 (25.6%)	43 (2.3%)	513 (28%)
		Total	1706 (93%)	129 (7%)	1835 (100%)
	Cases re-admitted for PVT	MVR	59 (4.77%)	0	59 (4.46%)
		Combined surgery	37 (7.87%)	1 (2.33%)	38 (7.41%)
		Total	96 (5.63%)	1 (0.78%)	97 (5.29%)
Cases referred for management of PVT		MVR	34 (54%)	0	34 (54%)
		Combined surgery	29 (46%)	0	29 (46%)
		Total	63 (100%)	0	63 (100%)

Data are presented as numbers; percentages are in parenthesis; MVR: Mitral valve replacement; TVR: Tricuspid valve repair; PVT: prosthetic valve thrombosis

Table 1. Patients' distribution according to operative procedure, type of valve inserted and occurrence of thrombotic valve events

Data			Survivors (n=127; 79.4%)	Non-survivors (n=33; 20.6%)	P value
Type of inserted valve	Mechanical		126 (99.2%)	33 (100%)	NS
	Bioprosthetic		1 (0.8%)	0	
Age (years)	Strata	≤20	7 (5.5%)	0	0.032
		21-30	25 (19.7%)	6 (18.2%)	
		31-40	45 (35.4%)	6 (18.2%)	
		41-50	31 (24.4%)	9 (27.2%)	
		51-60	10 (7.9%)	7 (21.2%)	
		>60	9 (7.1%)	5 (15.2%)	
	Mean (±SD)		39.1±11.5	45.8±12.2	0.004
Gender	Males		41 (32.3%)	9 (30.3%)	NS
	Females		86 (67.7%)	7 (69.7%)	
BMI (kg/m^2)	Strata	<18.5	3 (2.4%)	1 (3%)	NS
		18.5-23.99	28 (22%)	3 (9.1%)	
		24-29.99	64 (50.4%)	17 (51.5%)	
		>30	32 (25.2%)	12 (36.4%)	
	Mean (±SD)		26.9±4.1	29.2±5.3	0.007

Data are shown as numbers & mean±SD; percentages are in parenthesis; BMI: Body mass index

Table 2. Type of thrombosed valve and demographic data of patients admitted with PVT categorized according to survival at time of discharge

All non-survivors had PVT on top of inserted mechanical valve, but the difference between survivors and non-survivors according to type of thrombosed valve was non-significant. Survivors were significantly (p=0.004) younger than non-survivors with significantly (p=0.032) higher frequency of survivors among younger age strata. Moreover, non-survivors had significantly (p=0.007) higher BMI compared to survivors with non-significantly (p>0.05) higher frequency of non-survivors among higher BMI strata. Details of demographic data of patients as shown in table 2.

Analysis of at admission clinical data showed that time-lag prior to admission was significantly (p=0.001) shorter in survivors with significantly (p=0.004) higher frequency among short time-lag strata compared to non-survivors. Despite the non-significant (p>0.05) frequency of patients had associated medical co-morbidities between survivors and non-survivors, the mean number of co-morbidities was significantly (p=0.042) higher in non-survivors than survivors. The frequency of patients had at admission AF was significantly (p=0.043) higher among non-survivors compared to survivors. Moreover, non-survivors showed significantly higher angina and dyspnoea grading (p=0.009 and 0.012, respectively) with significantly (p=0.001) lower ejection fraction compared to survivors. Six patients had cerebrovascular accidents; 3 patients had transient ischemic attack within 6 months prior to admission, 2 patients had stroke and one patient had hemorrhage. There was non-significant (p>0.05) between survivors and non-survivors as regards the frequency of cerebrovascular accidents. Details of clinical data are shown in table 3.

Mean hemoglobin concentration was significantly (p=0.002) higher with significantly (p=0.033) higher frequency among higher hemoglobin concentration strata in survivors compared to non-survivors. On contrary, serum creatinine levels were significantly (p=0.001) lower with significantly (p=0.002) lower frequency among patients had serum creatinine >1.2 mg/dl in survivors compared to non-survivors. Moreover, serum bilirubin levels were significantly (p=0.001) lower with non-significantly (p>0.05) lower frequency among patients had serum bilirubin >1.2 mg/dl in survivors compared to non-survivors. As regards INR levels, the frequency of patient had

Data			Survivors (n=127)	Non-survivors (n=33)	P value
Time-lag prior to admission	Strata	<12	47 (37%)	8 (24.2%)	0.004
		12-24	45 (35.4%)	6 (18.2%)	
		>24-36	34 (26.8%)	16 (48.5%)	
		>36-48	1 (0.8%)	2 (6.1%)	
		>48	0	1 (3%)	
	Mean (±SD)		17.9±9.5	25.2±13.2	0.001
Associated medical co-morbidities	Presence	Yes	93 (73.2%)	17 (51.5%)	NS
		No	34 (26.8%)	16 (48.5%)	
	Mean (±SD) among affected patients		1.35±0.68	1.88±1.07	0.042
Presence of AF	Yes		100 (78.7%)	31 (93.9%)	0.043
	No		27 (21.3%)	2 (6.1%)	
CCS Angina grade			2.35±0.88	2.82±1	0.009
NYHA Dyspnoea grade			3.04±0.73	3.39±0.6	0.012
Ejection fraction (%)			59.4±8.6	52.2±12.8	0.001
Cerebrovascular accidents	Yes		3 (2.4%)	3 (9.1%)	NS
	No		124 (97.6%)	30 (90.1%)	

Data are shown as numbers & mean±SD; percentages are in parenthesis; AF: Atrial fibrillation; CCS- angina grade: Canadian Cardiovascular Society grading of angina pectoris; NYHA: New York Heart Association; NS: Non-significant

Table 3. Clinical data of studied patients presented with thrombotic valve complications categorized according to survival at time of discharge

			Survivors	Non-survivors	P value
Hb (gm %)	Strata	<7	0	1 (3%)	0.033
		7-9	2 (1.5%)	2 (6.1%)	
		>9-12	90 (70.9%)	26 (78.8%)	
		>12	35 (27.6%)	4 (12.1%)	
	Mean (±SD)		11.5±1.28	10.7±1.5	0.002
Serum creatinine (mg/ml)	Strata	≤1.2	119 (93.7%)	2 (75.8%)	0.002
		>1.2	8 (6.3%)	8 (24.2%)	
	Mean (±SD)		0.88±0.26	1.29±1.02	0.001
Serum bilirubin (mg/ml)	Strata	≤1.2	117 (92.1%)	2 (81.8%)	NS
		>1.2	10 (7.9%)	6 (18.2%)	
	Mean (±SD)		0.78±0.56	1.37±1.39	0.001
INR level	Strata	<2	58 (45.7%)	23 (69.7%)	0.014
		>2	69 (54.3%)	10 (30.3%)	
	Mean (±SD)		1.92±0.17	2±0.15	0.005

Data are shown as numbers & mean±SD; percentages are in parenthesis; Hb conc.: Hemoglobin concentration; INR: International Ratio

Table 4. Laboratory findings of studied patients presented with PVT categorized according to survival at time of discharge

INR level >2 was significantly (p=0.014) higher in survivors with significantly higher INR level compared to non-survivors. Details of laboratory findings are shown in table 4.

There was positive significant correlation between survival of patients with PVT and at admission INR level, ejection fraction and hemoglobin concentration in descending order of significance. On the other hand, survival of patients of PVT showed negative significant correlation with at admission serum creatinine, time-lag till admission, presence of associated co-morbidities, serum bilirubin, age, angina and dyspnea grades, and presence of AF in descending order of significance. Details of correlations and its significance are shown in table 5.

ROC curve analysis defined long time-lag prior to hospital admission, high serum creatinine, low ejection fraction, old age, low hemoglobin concentration, high serum bilirubin, low INR level, angina grade, high BMI, presence of associated co-morbidities and dyspnoea grade are predictors for mortality in decreasing order of significance. Details of AUC values and its significance are shown in table 6 and figure 1.

Parameter	r	p value
age	-0.211	0.007
Male gender	0.017	NS
BMI	-0.192	0.015
Time lag prior to hospital attendance	-0.238	0.002
Associated co-morbidities	-0.241	0.002
Type of valve	-0.040	NS
Presence of AF	-0.160	0.044
CCS Angina grade	-0.198	0.012
NYHA Dyspnoea grade	-0.196	0.013
Ejection fraction (%)	0.217	0.006
Cerebrovascular accidents	-0.143	NS
Hb conc. (gm %)	0.215	0.006
Serum creatinine (mg/ml)	-0.266	0.001
Serum bilirubin (mg/ml)	-0.230	0.003
INR level	0.206	0.009

PVT: Prosthetic valve thrombosis; BMI: Body mass index; AF: Atrial fibrillation; CCS- angina grade: Canadian Cardiovascular Society grading of angina pectoris; NYHA: New York Heart Association; Hb conc.: Hemoglobin concentration; INR: International ratio; r: Pearson's correlation coefficient, NS: Non-significant

Table 5. Correlation coefficient between survivals of patients admitted with PVT and their demographic and clinical data

Predictor	AUC	p
age	0.658	0.006
Male gender	0.495	NS
BMI	0.635	0.018
Time lag prior to hospital admission	0.673	0.002
Associated co-morbidities	0.635	0.018
Type of valve	0.504	NS
Presence of AF	0.575	NS
CCS Angina grade	0.642	0.013
NYHA Dyspnoea grade	0.621	0.035
Ejection fraction (%)	0.330	0.003
Cerebrovascular accidents	0.535	NS
Hb conc. (gm %)	0.346	0.007
Serum creatinine (mg/ml)	0.678	0.002
Serum bilirubin (mg/ml)	0.654	0.007
INR level	0.358	0.013

PVT: Prosthetic valve thrombosis; BMI: Body mass index; AF: Atrial fibrillation; CCS- angina grade: Canadian Cardiovascular Society grading of *angina* pectoris; NYHA: New York Heart Association; Hb conc.: Hemoglobin concentration; INR: International ratio; AUC: Area under curve; NS: Non-significant

Table 6. ROC curve analysis for at admission demographic and clinical data as predictors for mortality of patients with PVT

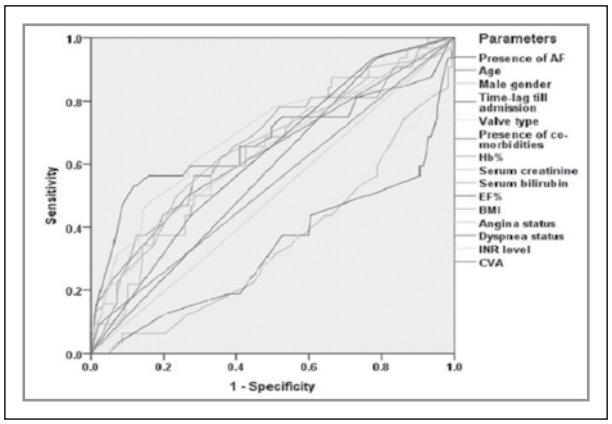

Fig 1. ROC Curve analysis for predictors of mortality of patients admitted with PVT

Discussion

The current study included 160 patients; 97 readmitted and 63 patients referred to Nasser Institute with mitral PVT. Only one patient had thrombosed bioprosthetic tissue valve and 159 patients had thrombosed mechanical valve. The reported frequency of mitral PVT (0.78% vs. 5.63%; bioprosthetic vs. mechanical) among cases that were operated at Nasser Institute points to safety of bioprosthetic valve. In support of safety of bioprosthetic valve, **Bianchi et al.** [10] in their systemic literature review reported no differences in survival between mechanical and biological valves despite of the finding that patients who received biosynthetic valve were more high-risk patients; older in one study, had undergone dialysis for longer period of time in another study, and had suffered from more previous myocardial infarction in a 3rd study, than those had mechanical valve.

Moreover, **Zhibing et al.** [11] found no significant difference in the perioperative morbidity and mortality, late survival of dialysis patients after cardiac valve replacement with bioprosthetic versus mechanical valves and concluded that bioprosthetic valve could be a favorable choice for renal failure patients.

Unfortunately, 33 patients died during their hospital stay and all were of those had mechanical PVT. The infrequent number of bioprosthetic PVT may be attributed to the rarity of its application as throughout these 8 years only 129 out of 1835 patients underwent valve replacement surgery (7%) had bioprosthetic tissue valve insertion. However, statistical analyses found a non-significant correlation between mortality and type of used valve. Also, ROC curve analysis found type of valve was non-significant predictor for patients' mortality. In line with the results of these statistical analyses, **Bianchi et al.** [10] reported no differences in survival between mechanical and biological valves and **Hellgren et al.** [12] documented that survival was comparable in older patients irrespective of prosthesis type.

The development of postoperative AF was found to be common event among studied patients with a frequency of 81.9% and 93.9% among non-survivors. Thus, development of AF in conjunction with PVT could not predict mortality as its frequency among survivors was non-significantly lower than non-survivors and ROC curve analysis found AF as non-significant predictor for mortality. In line with such association multiple recent studies are trying medical [13, 14] and surgical [15,16] prophylactic managements for reducing the frequency of AF or its sequale after valve replacement surgery, but unfortunately its outcome is not promising.

Non-survivors were found to be significantly more obese than survivors; a finding indicated a relationship between obesity and development of PVT and could predict poor outcome of these patients. In line with this finding,

D'Alessandro et al. [17] using univariate analysis showed that preoperative risk factors for mortality of patients undergoing valve replacement surgery include body mass index >30 kg/m^2 and body surface area >2 m^2.

Survivors had significantly higher EF compared to non-survivors and EF was found to be significant predictor of mortality of patients with PVT. This finding goes in hand with **Halkos et al.** [18] found mid-term mortality after valve replacement surgery, on univariable analysis, was associated with EF and concomitant CABG, but after multivariable adjustment, only EF was associated with mid-term mortality.

The frequency of patients had associated co-morbidities and mean number of associated co-morbidities were significantly higher in non-survivors compared to survivors. Moreover, estimated high creatinine and bilirubin serum levels as markers for renal and hepatic dysfunction were found to be significant predictors for mortality of patients with PVT. In hand with these data, **Toker et al.** [19] found, in multivariate analysis, the only risk factor for early hospital mortality in patients requiring reoperation for valve dysfunction due to pannus or thrombus was left ventricular EF. Also, **Halkos et al.** [18] found in-hospital mortality after valve replacement surgery included dialysis-dependent renal failure.

ROC curve analysis defined long time-lag prior to hospital admission, high serum creatinine, low ejection fraction, old age, low hemoglobin concentration, high serum bilirubin, low INR level, angina grade, high BMI, presence of associated co-morbidities and dyspnoea grade are predictors for mortality secondary to PVT in decreasing order of significance. In support of the significance of these predictors, **Halkos et al.** [18] found multivariable predictors of in-hospital mortality after valve replacement surgery included age, emergent status, prolonged bypass time, previous stroke, and peripheral vascular disease. Also, **Egbe et al.** [20] documented that biosynthetic PVT is not uncommon and can occur several years after surgery and independent predictors of thrombosis were >50% increase in mean echo-Doppler gradient from baseline within 5 years, paroxysmal AF, sub-therapeutic INR, increased cusp thickness and abnormal cusp mobility.

Conclusion

This retrospective study for outcome of patients admitted to Nasser Institute with mitral PVT allows concluding that development of PVT is not uncommon sequale for mitral valve replacement surgery. Bioprosthetic tissue valve significantly reduced the frequency of PVT than the mechanical valve. Higher frequency of female patients among studied population could be attributed to possibility of disturbance of anticoagulant therapy especially if they got pregnant. Disturbed at admission INR level, old age, and presence of associated medical co-morbidities especially liver and kidney dysfunction are bad predictors for survival.

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Assessment of Factors Associated With High Postoperative Events and Impact of Gender on its Frequency in Patients Undergoing Coronary Artery Bypass Grafting Surgery

Mohamed A. Amr, MD

Objective: **Coronary artery disease prevalence is more in males under the 5th decade of life than in females of the same age group and becomes equal in higher age groups. The current retrospective study aimed to determine the total short-term outcome of isolated coronary artery bypass graft (CABG) surgery and its relation to patients' data and to determine the risk factors for early postoperative (PO) events.**

Methods: **Data of patients underwent conventional (CABG) or off-pump coronary artery bypass grafting (OPCAB) through 10-years were extracted and analyzed. Study outcomes included frequency of PO morbidity and mortality in total and in relation to gender, relation between PO events and patients preoperative, operative and PO data and evaluation of patients, data as risk factors for mortality defined as mortality rate (MR).**

Results**: Through 10-years, 13627 patients (9408 males and 4219 females) underwent isolated CABG; 10346 underwent conventional CABG and 3281 underwent OPCAB surgery. Hospital MR was 6.45% and was significantly lower with OPCAB than with conventional CABG (5.6% vs. 6.7%; respectively). Morbidities were higher in females more than males (16.4% and 10.9%). Mortality was significantly higher in female patients than in males (7.4% and 6%, respectively). Evaluation of patients' perioperative parameters as mortality risk factors defined perioperative MI, preoperative previous PTCA, use of LIMA graft, EF<40%, urgent surgery, female gender, obesity and old age as significant risk factors in decreasing order of significance.**

Conclusions: **Hospital morbidity and mortality rates after coronary artery surgery are higher in females than males. Increased hospital mortality is associated with the severity of coronary disease and associated co-morbid conditions. Off-pump surgery is better option for coronary surgery especially in females.**

Keywords: **CABG, Mortality rate, Risk factors, Gender difference**

Lecturer of cardiothoracic surgery, Faculty of Medicine, Suez Canal University, Consultant of cardiac surgery, Nasser institute

Corresponding Author:
Mohamed A. Amr
doctor2001eg@yahoo.com

Codex : o3/11/1510

Coronary artery disease (CAD) is one of the most important issues in modern medicine due to its high mortality and prevalence. However, early detection and prevention can reduce morbidity and mortality [1].

Appropriate treatment methods lead to a reduced rate of mortality and morbidity, and an improved quality of life, in patients with multi-vessel CAD. Coronary artery bypass grafting (CABG) surgery may be the superior form of treatment for long-term outcomes in terms of the relief of chest pain, improvement of the functional class, reduced need for re-admission, and later death. However, short-term morbidity may be higher among the CABG group, but the mortality rate after 30 days is quite similar to medical therapy [2]. CABG was associated with significantly lower long-term adverse clinical outcomes compared to percutaneous coronary intervention (PCI) but is associated with insignificantly higher rate of stroke [3].

A selective strategy to direct higher risk patients towards an off-pump revascularization yielded favorable outcomes in an unselected population treated at a single Medical Center over a 5 year period [4]. OPCAB is associated with less postoperative morbidity and mortality and shorter hospital and intensive care unit length of stay[5].

Women historically have a greater risk of operative mortality than men after CABG. There is paucity of contemporary data in gender outcomes of surgical revascularization, and understanding modifiable factors that contribute to gender differences are critical for quality improvement and practice change [6]. The annual rate of CABG surgeries decreased by 53.7% in men and 57.8% in women over the 10-year study period, however, a high proportion of female patients (28.2%) underwent emergency surgery [7].

Emergency CABG is associated with increased in-hospital mortality rates and adverse events. Emergency CABG patients experienced high rates of intra-aortic balloon pump support, bleeding, dialysis, prolonged length of stay and in-hospital death [7].

The current retrospective study aimed to determine the total short-term outcome of isolated coronary artery bypass graft (CABG) surgery and its relation to patients' data and to determine the risk factors for early postoperative (PO) events.

Patients and Methods

The current study was conducted at Nasser Institute after approval of the study protocol by Hospital Ethical Committee. The study target was to explore files of patients underwent isolated first do coronary artery surgery throughout the duration between Jan 2005 and Dec 2014. Combined surgery and redo cases were excluded. Collected data included preoperative data; age, gender, history of myocardial infarction (MI), previous percutaneous translumenal coronary angioplasty (PTCA), family history of coronary artery disease (CAD), presence of associated co-morbidities including diabetes mellitus (DM), arterial hypertension, hyperlipidemia, obesity, peripheral vascular disease, chronic obstructive pulmonary disease (COPD), previous cerebrovascular strokes (CVS), renal impairment or failure. Preoperative evaluation of left systolic function manifested as preoperative left ventricular ejection fraction (EF), extent of CAD manifested as number of occluded vessels and presence of left main coronary artery disease. Assessed operative parameters included timing of surgery either urgent, emergency or elective, number of grafts per patient as a ratio between total number of grafts and number of patients, complete revascularization as a relation between number of performed grafts to number of diseased vessels, aortic cross clamping, and bypass times. Postoperative (PO) data included mechanical ventilation (MV) time, ICU stay, total PO hospital, frequency of ICU readmission, need for re-mechanical ventilation and other postoperative complications.

Study outcomes:

1. Frequency of PO morbidity and mortality.
2. Frequency of PO morbidities and mortalities in relation to gender.
3. Relation between PO events and patients preoperative, operative and PO data.
4. Evaluation of patients preoperative, operative and PO data as risk factors for mortality defined as mortality rate (MR).

Statistical analysis

Obtained data were presented as mean±SD, ranges, numbers and ratios. Results were analyzed using One-way ANOVA with post-hoc Tukey HSD Test and Chi-square test (X^2 test). Statistical analysis was conducted using the SPSS (Version 15, 2006) for Windows statistical package. P value <0.05 was considered statistically significant.

Results

Throughout 10-year period, 13627 patients; 9408 males (69%) and 4219 females (31%) underwent isolated CABG. Females were found to be significantly ($p<0.05$) younger and showed significantly ($p<0.05$) higher frequency of family history of CAD than males. Moreover, the frequency of DM and obesity were significantly ($p<0.05$) higher among females, while the frequency of systemic hypertension, hyperlipidemia, peripheral vascular diseases and COPD were significantly ($p<0.05$) higher among males. The frequency of associated co-morbidities/ patient was 4.29 in females vs. 1.72 in males. Details of preoperative data are shown in table 1.

Preoperative cardiac catheterization and ECHO showed significantly ($p<0.05$) higher frequency of patients had combined lesions among females than males. The frequency of patients had three diseased vessels was higher in females than in males, despite being non-significant ($p>0.05$) difference. However, mean number of diseased vessels was significantly ($p<0.05$) higher in females than in males. Mean EF of studied patients was about fifties with non-significantly ($p<0.05$) lower EF in females than in males. Details of preoperative investigations are shown in table 2.

Only 173 patients had emergency surgery, 4406 patients had urgent and 9048 had elective surgery. There was non-significant ($p>0.05$) difference between male and female patients concerning timing of surgery. The frequency of patients had conventional CABG (CCABG; 75.9%) was about three times the frequency of patients had off-pump CABG (OPCAB; 24.1%) with non-significant ($p>0.05$) difference between patients categorized according to gender. Mean number of performed anastomosis per case was significantly ($p<0.05$) higher in males compared to females underwent either CCABG or OPCAB.

The frequency of males had complete revascularization during CCABG was significantly (p<0.05) higher compared to females, while the difference was non-significantly (p>0.05) higher in males underwent OPCAB. Mean bypass and cross-clamping times were significantly (p<0.05) longer in females than males underwent CCABG. However, mean total operative time was non-significantly (p>0.05) different, in both CCABG and OPCAB, between males and females. Details of operative data are shown in table 3.

Parameter		Male	Female	P value
Frequency		9408 (69%)	4219 (31%)	
Age (years)		64±11.4	59±8.7	0.001
History of previous MI		5778 (61.4%)	2581 (61.2%)	NS
Previous PTCA		965 (10.3%)	541 (12.8%)	NS
Family history of CAD		1755 (18.7%)	891 (21.1%)	<0.05
Associated co-morbidities	DM	2780 (29.5%)	1377 (32.6%)	<0.05
	Systemic hypertension	2917 (31%)	1214 (28.8%)	0.0005
	Hyperlipidemia	6845 (72.8%)	2784 (66%)	<0.05
	Obesity	2319 (24.6%)	1972 (46.7%)	<0.001
	Renal impairment or failure	1251(13.3%)	573 (13.6%)	NS
	Peripheral vascular disease	793 (8.4%)	328 (7.8%)	<0.05
	COPD	1719 (18.3%)	356 (8.4%)	<0.05
	Previous CVS	192 (2%)	97 (2.3%)	NS

Data are presented as numbers & mean±SD; percentages are in parenthesis; MI: myocardial infarction; PTCA: percutaneous translumenal coronary angioplasty; CAD: coronary artery disease; DM: diabetes mellitus; COPD: chronic obstructive pulmonary disease; CVS: cerebrovascular strokes

Table 1. Patients' preoperative data categorized according to patients' gender

Parameter		Male (n=9408)	Female (n=4219)	P value
Left main disease	Isolated LM	523 (5.6%)	251 (5.9%)	NS
	Combined lesions	1471 (15.6%)	912 (21.6%)	<0.05
Number of diseased vessels	One	1086 (11.5%)	238 (5.6%)	
	Two	2887 (30.7%)	1262 (30%)	NS
	Three	5435 (57.8%)	2719 (64.4%)	
	Diseased vessel/patient	2.46±0.7	2.6±0.6	0.001
Ejection fraction (%)		53±18	51±14	NS
Ejection fraction <40%		1873 (19.9%)	885 (20.3%)	NS

Data are presented as numbers & mean±SD; percentages are in parenthesis; LM: Left main artery; NS: Non-significant; p<0.05: Significant difference

Table 2. Preoperative cardiac catheterization and ECHO data of studied patients categorized according to gender

Parameter		Total (n=13627)	Male (n=9408)	Female (n=4219)	P value
Timing of surgery	Elective	9048 (66.4%)	6317 (67.1%)	2731 (64.7%)	
	Urgent	4406 (33.2%)	2983 (31.7%)	1423 (33.7%)	NS
	Emergency	173 (0.4%)	108 (1.1%)	65 (1.5%)	
CCABG (n=10346)	Frequency	10346 (75.9%)	7284 (77.4%)	3062 (72.6%)	NS
	Anastomosis per case	2.65±1.9	3.2±1.9	2.1±1.9	<0.05
	Complete revascularization	79.9%	83.7%	76.1%	<0.05
	Bypass time	78±18.7	74±20	82±17.4	<0.05
	Cross clamp time	46.5±18.7	45±19.1	48±18.2	<0.05
	Total operative time	312.8±33	311.4±34.5	316±29.7	NS
OPCAB (n=3281)	Frequency	3281 (24.1%)	2124 (22.6%)	1157 (27.4%)	NS
	Anastomosis per case	2.1±1.35	2.4±1.6	1.8±1.1	<0.05
	Complete revascularization	84.78%	85.26%	84.3 %	NS
	Total operative time (min)	216.2±20.4	218.6±20.3	212±21	NS
Need for inotropic drugs		32.25%	30%	35%	NS

Data are presented as numbers & mean±SD; percentages are in parenthesis; CCABG: Conventional coronary artery bypass graft: OPCAB: Off-pump coronary artery bypass; NS: Non-significant; p<0.05: Significant difference

Table 3. Operative data of studied patients categorized according to gender

The frequencies of in-hospital PO events reported in studied patients categorized according to gender showed non-significant (p>0.05) difference between male and female patients apart from the frequency of patients developed PO infections and those required ICU re-admission and mechanical ventilation after weaning was significantly (p<0.05) higher in females than males. However, total duration of ICU stay and PO hospital stay showed non-significant (p>0.05) difference between males and females. Details of the frequencies of PO events are shown in table 4.

Throughout 10-year, 879 patients died for a total mortality rate (MR) of 6.45%. MR was significantly (p=0.0005) lower after OPCAB compared to CCABG (5.6% vs. 6.7%, respectively). MR after CCABG was significantly (p<0.05) higher in females than males (5.92% vs. 4.73%, respectively). On the other hand, MR after OPCAB was non-significantly (p>0.05) higher in females than males (1.47% vs. 1.3%, respectively).

Perioperative MI was a predominant perioperative event reported in non-survivors for a frequency 82.7% among non-survivors with a significantly higher frequency of perioperative MI among females versus males; 6.38% vs. 4.87%, respectively. Patients had previous PTCA showed higher PO mortality than patients did not have previous PTCA where 35% of non-survivors had previous PTCA with a significantly (p<0.05) higher frequency of previous PTCA among non-survival females versus males; 5.5% vs. 3.15%, respectively. PO mediastinitis and multi-organ failure are the most frequent PO events reported in died females with a frequency significantly (p<0.05) higher than in died males for both events. The frequency of PO stroke, respiratory failure and bleeding is significantly higher in non-survival males compared to females (Fig. 1). Details of PO mortalities and associated PO events are shown in table 5

PO mortality showed positive significant correlation with old age, preoperative low EF%, surgical interference on emergency or urgency basis, development of PO events, preoperative obesity, preoperative previous PTCA and peripoperative MI; in increasing order of significance. Details of significance of these correlations are shown in table 6. ROC curve analysis assured correlation between these perioperative risk factors and PO mortality as shown in table 7 and figure 2

Complications		Male (n=9408)	Female (n=4219)	P value
Surgical	Bleeding and/or tamponade	439 (4.67%)	226 (5.4%)	NS
	Re-operation	104 (1.1%)	34 (0.81%)	NS
	Sternal resuturing	108 (1.15%)	30 (0.71%)	NS
Cardiac	Low cardiac output (need inotropes)	1353 (14.4%)	681 (16.1%)	NS
	Myocardial infarction	183 (1.95%)	49 (1.16%)	NS
	Arrhythmias	619 (6.6%)	261 (6.2%)	NS
	Use of IABP	410 (4.4%)	121 (2.87%)	NS
Renal	Treated medically	1324 (14.1%)	434 (10.3%)	NS
	Temporary dialysis	413 (4.4%)	97 (2.3%)	NS
	Permanent dialysis	81 (0.86%)	31 (0.73%)	NS
Neurological	Delayed recovery	458 (4.87%)	164 (3.89%)	NS
	Transient paralysis	108 (1.15%)	34 (0.81%)	NS
	Permanent stroke	408 (4.34%)	174 (4.1%)	NS
	Delirium, behavioral changes	358 (3.8%)	169 (4%)	NS
Respiratory	Pneumonia	508 (5.4%)	194 (4.6%)	NS
	ARDS	201 (2.1%)	69 (1.64%)	NS
	Pleural effusion	837 (8.9%)	378 (9%)	NS
	Pneumothorax	383 (4.1%)	261 (6.2%)	NS
	Tracheostomy	58 (0.62%)	19 (0.45%)	NS
GIT	GIT bleeding	184 (2%)	69 (1.64%)	NS
	Liver insult	376 (4%)	133 (3.2%)	NS
Infection	Superficial wound infection	493 (5.2%)	412 (9.8%)	<0.05
	Deep sternal wound infection	72 (0.76%)	68 (1.6%)	<0.05
	Peripheral wound infection	357 (3.8%)	265 (6.3%)	<0.05
ICU data	Re-admission to ICU	477 (5.07%)	341 (8.1%)	<0.05
	Total ICU stay (days)	2.6±0.7	2.9±0.8	NS
	Re-mechanical ventilation	291 (3.09%)	213 (5.05%)	<0.05
	Ventilation time (hours)	7.8±3.6	8.6±4.3	NS
Hospital stay (days)		9±2.6	8.2±2.3	NS

Data are presented as numbers & mean±SD; percentages are in parenthesis; IABP: ; ARDS: Adult respiratory distress syndrome; GIT: Gastrointestinal tract; ICU: Intensive care unit; NS: Non-significant; p<0.05: Significant difference

Table 4. Frequency of in-hospital PO events reported in studied patients categorized according to gender

Parameter		Male (n=9408)	Female (n=4219)	p value
OPCAB mortality		122 (1.3%)	62 (1.47%)	NS
CCABG mortality		445 (4.73%)	250 (5.92%)	0.003
Total mortality		567 (6%)	312 (7.4%)	0.003
Associated medical co-morbidities or PO events detected in non-survivors	Previous PTCA	296 (3.15%)	231 (5.5%)	0.00003
	Perioperative MI	458 (4.87%)	269 (6.38%)	0.0003
	Low cardiac output	146 (1.55%)	89 (2.11%)	NS
	Mediastinitis	11 (0.26%)	58 (0.62%)	0.007
	Stroke	408 (4.34%)	149 (3.53%)	0.028
	Respiratory failure	219 (5.19%)	390 (4.14%)	0.006
	Multi-organ failure	303 (3.2%)	205 (4.86%)	0.00003
	Bleeding and/or tamponade	558 (5.93%)	184 (4.36%)	0.0002

Data are presented as numbers; percentages are in parenthesis; CABG: Coronary artery bypass graft: OPCAB: Off-pump coronary artery bypass; MI: Myocardial infarction; PO: Postoperative; NS: Non-significant; p<0.05: Significant difference

Table 5. Frequency of in-hospital PO morbidity and its probable causes in studied patients categorized according to gender

Risk factors	Rho	p value
Old age	0.115	0.038
Preoperative obesity	0.278	0.0007
Preoperative previous PTCA	0.777	0.0003
Low preoperative ejection fraction	0.140	0.012
Urgent/Emergency surgery	0.203	0.0009
Perioperative MI	0.921	0.0001
Development of PO events	0.241	0.0008

Rho: Sperman correlation coefficient; PTCA: percutaneous transluminal coronary angioplasty; MI: Myocardial infarction; PO: Postoperative; p<0.05= significant correlation

Table 6. Correlation coefficient between perioperative risk factors and in-hospital PO mortality

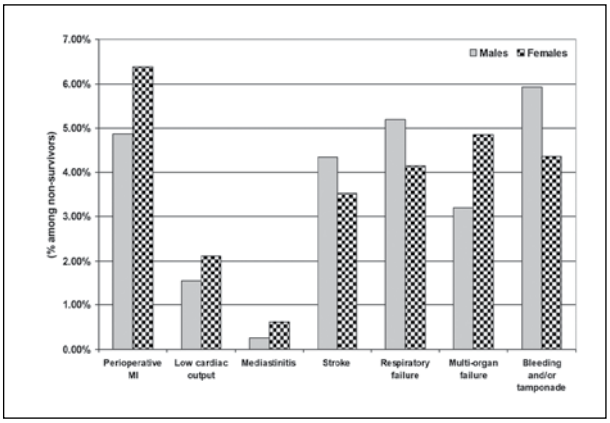

Fig 1. Frequency of mortality assoicated PO events

Risk factors	AUC	95% CI	P value
Old age	0.635	0.508-0.762	0.038
Preoperative obesity	0.237	0.135-0.339	0.0009
Preoperative previous PTCA	0.190	0.000-0.160	0.0007
Low preoperative ejection fraction	0.336	0.200-0.472	0.012
Urgent/Emergency surgery	0.304	0.178-0.429	0.003
Perioperative MI	0.071	0.178-0.429	0.0004
Development of PO events	0.276	0.161-0.391	0.001

AUC: Area under curve; CI: Confidence interval; PTCA: percutaneous transluminal coronary angioplasty; MI: Myocardial infarction; PO: Postoperative; p<0.05= significant correlation

Table 7. Correlation coefficient between perioperative risk factors and in-hospital PO mortality

Evaluation of patients' perioperative parameters as mortality risk factors defined perioperative MI, preoperative previous PTCA, use of LIMA graft, EF<40%, urgent surgery, female gender, obesity manifested as high BMI and old age as significant risk factors in decreasing order of significance as shown in table 8.

Risk factors	HR	95% CI	p value
Previous PTCA	2.481	2.069-3.157	0.010
Perioperative MI	3.145	2.091-2.458	0.007
Use of LIMA graft	2.039	1.897-2.416	0.017
Ejection fraction <40%	1.674	1.432-2.297	0.018
Urgent surgery	1.451	1.241-1.71	0.024
Female gender	1.589	1.357-2.036	0.029
BMI	1.381	1.189-1.987	0.034
Age	1.269	1.069-1.782	0.048

HR: Hazard risk; CI: confidence interval; PTCA: percutaneous transluminal coronary angioplasty; MI: Myocardial infarction; LIMA: Left internal mammary artery; BMI: Body mass index

Table 8. Hazard ratio for studied parameters as independent Risk Factors of in-hospital PO mortality

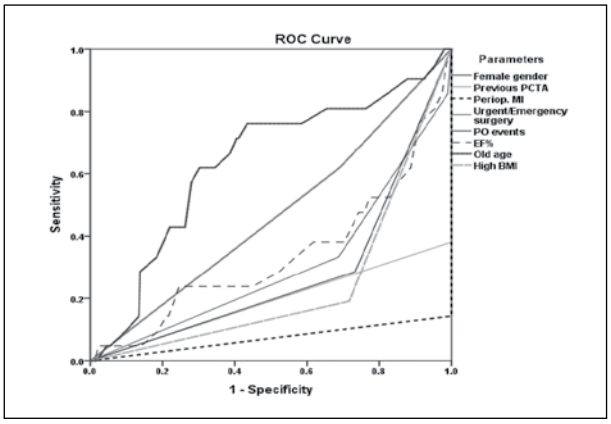

Fig 2. ROC curve analysis of studied parameters as risk factors for in-hospital mortality

Discussion

The current study detected high frequency of preoperative associated medical co-morbidities including high frequency of family history of CAD, DM and obesity especially in females and high frequency of systemic hypertension, hyperlipidemia, peripheral vascular diseases and COPD especially in males. In line with the high frequency of associated co-morbidities in patients assigned for CABG, **den Ruijter et al.** [8] reported that women were older and more often reported diabetes and hypertension, while smoking and impaired renal function were more prevalent in men undergoing CABG. **Kim et al.** [9] found patients admitted for isolated CABG were more likely to have a history of previous CABG, previous percutaneous coronary intervention, peripheral vascular disease, hypertension, or chronic renal failure. Also, **Pang et al.** [10] reported that long-term survival and freedom from cardiac death are significantly lower in patients with DM compared to non-diabetics and so aggressive treatment of DM, cardiovascular comorbidities and smoking cessation are essential to improve long-term survival in diabetic patients.

Throughout 10-year, 879 patients died for a mortality rate (MR) of 6.45%. MR after OPCAG was significantly (p=0.0005) lower compared to that after CCABG. These data indicted that shift to OPCAB improved outcome of patients underwent isolated CABG especially that population with high associated preoperative medical problems. These data are in line with **Dhurandhar et al.** [11] who reported that in the high-risk population, CABG surgery has a low rate of mortality and morbidity suggesting that surgery is a safe option for coronary revascularization, but OPCAB reduces PO morbidity and is a safe procedure for 30-day mortality, stroke and long-term survival in high-risk patients. Recently, **Kowalewski et al.** [12] documented that OPCAB is associated with a significant reduction in the odds of cerebral stroke compared with CCABG and benefits of OPCAB in terms of death, MI,

and cerebral stroke are significantly related to patient risk profile, suggesting that OPCAB should be strongly considered in high-risk patients. Also, **Deppe et al.**[13] out of their systematic review emphasizes that both off- and on-pump CABG provide excellent and comparable results in patients requiring surgical revascularization and the choice for either strategy should take into account the individual patient profile (comorbidities, life expectancy, etc.) and importantly, the surgeon's experience in performing on- or off-pump CABG in their routine practice.

MR after CCABG was significantly higher in females than males, while was non-significantly higher in females than males after OPCAB. Moreover, female gender was found to be an independent predictor for mortality, irrespective of surgical procedure, with significantly higher hazard risk among other evaluated risk factors. These data go in hand with **den Ruijter et al.** [8] who reported that women have a worse long-term outcome after CABG than men in univariate analysis. Recently, **Swaminathan et al.** [6] who found overall, unadjusted in-hospital mortality after isolated CABG was greater in women (3.2% vs 1.8%), female gender remained an independent predictor of mortality after multivariate adjustment ($p < 0.001$ for odds ratio) across all age groups and concluded that women have worse in-hospital outcomes than men. **Filardo et al.** [14] reported that short-term mortality was significantly higher in women than men and the higher risk associated with female sex lead to 35 'excess' deaths in women and to 392 'excess' deaths among women undergoing isolated CABG in the USA each year.

As another support for the vulnerability of females to high mortality after CABG, **Lempereur et al.** [15] observed gender-based differences in hospital MR after PCI and concluded that after multivariable adjustment female sex remained an independent predictor of mortality after coronary artery manipulations.

The reported high MR in females could be attributed to higher frequency of preoperative associated co-morbidities; 4.29/died female patient vs. 1.72/died male patient. In support of this finding, **Berndt et al.** [16] retrospectively evaluated the impact of gender on outcome of octogenarians after CABG and found EuroSCORE II differs significantly between women and men in this cohort.

Evaluation of patients' perioperative parameters as mortality risk factors defined perioperative MI, previous PTCA, use of LIMA graft, EF<40%, urgent/emergency surgery, female gender, obesity manifested as high BMI and old age as significant risk factors in decreasing order of significance. Similarly, **Wang et al.** [17] reported that with all-cause death as the endpoint, preoperative LVEF and perioperative implantation of intra-aortic balloon pump (IABP) had adverse effect on survival of patients with IHD and left ventricular dysfunction (LVD) undergoing surgical revascularization, where survival of patients with severe LVD was significantly lower than those with mild to moderate LVD and also survival significantly decreased among patients undergoing perioperative implantation of IABP. Moreover, **Kamal et al.** [18] compared mortality after CABG in patients had previous PCI versus patients did not have previous PCI and found patients had previous PCI exhibited a significantly larger proportion of patients who experienced in-hospital major adverse events and on multivariate analysis, previous PCI was found to be a significant predictor of major adverse events.

Conclusions

In-hospital morbidity and mortality rates after CABG are higher in females than males. Increased hospital mortality is associated with the severity of coronary disease and associated co-morbid conditions. Off-pump surgery is better option for coronary surgery especially in females and high-risk patients.

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The Size of The Ventricular Component of Complete Atrioventricular Septal Defect as A Risk Factor in The Repair

Khaled Samir Mohamed, MD, FETCS

Objective: **comparative study between the Australian technique and other techniques in CAVSD repair.**

Patients and methods: **between January 2010 and January 2016 the author has performed 118 CAVSD repair using one of 3 techniques: Australian, single or double patch techniques with age median 15.2 months, weight 10.3 kg, 42 patients (35.6%) had Down syndrome, pulmonary artery pressure more than 40 was found in 81 patients (68.6%). VSD component ≤ 5mm in 39 patients (33.1 %, Group A), 5 - ≤ 10 mm in 79 (66.9%, Group B). All patients had warm CPB and blood enriched cold ante grade cardioplegia. Follow up by echo at 1 week, 1 months and every 6 months afterwards.**

Results: **There were 7 hospital mortalities (5.9%) 1 in group A (2.6%) and 7 in B (10.4%). No reoperations during the follow up period. Group B had statistically significant risk for more inotropes (P=0.036) longer bypass(P=0.02) longer hospital stay (P=0.041) and residual MR (0.046) and group C for the need for more inotropes (P=0.027), longer bypass (0.041), longer ventilation time (P=0.026) longer hospital stay (P=0.033) and residual moderate mitral regurgitation (p=0.019).**

Conclusion:

A VSD component 5-10 mm was a statistically significant risk factor for longer ICU stay duration and having more than mild left A-V valve regurgitation.

A VSD component > 10 mm was a statistically significant risk factor for ventilation and ICU stay duration, the need for inotropes and having more than mild left A-V valve regurgitation.

Key words: **CAVSD, VSD size, repair, technique.**

Cardiovascular

Complete atrioventricular septal defect (CAVSD) is a complex cardiac malformation characterized by a variable deficiency of the atrioventricular area (cruxcordis) in the developing heart. The malformation involves the atrial, ventricular and atrioventricular septa and both atrioventricular valves. CAVSD accounts for about 3% of all cardiac malformations. Atrioventricular canal occurs in two out of every 10,000 live births. Both sexes are equally affected, with a slightly higher frequency in female (female/male ratio 1.3/1) and a striking association with Down syndrome was found about 70% are children with Down syndrome. Down syndrome patients, about 40% have congenital heart defects and 50% of the defects are AVSD. [1]

Half of children with untreated CAVSD die in the first year of life. The main cause of death in infancy is either heart failure or pneumonia. In surviving patients with unrepaired complete atrioventricular canal, irreversible pulmonary vascular disease becomes increasingly common, and affects virtually all patients older than 2 years of age. Long-term prognosis in patients with irreversible pulmonary hypertension is poor. [2]

This anatomic arrangement gives a scooped out appearance to the ventricular inlet and a long and narrow morphology to the left ventricular outlet. The key finding for the

Department of cardiac surgery, Ain Shams University, Abbassiya, Cairo, Egypt.

Corresponding Author:
Khaled Samir Mohamed
drksamir@gmail.com

Codex : o3/12/1512

anatomic classification in type A, B or C of this malformation is the morphology of the common atrioventricular valve.

The first repair of complete atrioventricular canal (CAVC) by Dr. Walton Lillehei in 1955 performed using controlled cross-circulation, involved suture closure of the atrial septal defect (ASD) and ventricular septal defect (VSD) with direct suturing of the atrioventricular valve leaflets to the crest of the interventricular septum. Many surgeons during the 1970s and early 1980s advocated palliation with pulmonary artery banding to delay surgical repair beyond infancy. [3]

On the other hand, as operative techniques and postoperative care improved as well as cardiopulmonary bypass in infants became safer, most centres abandoned this practice and opted for elective repair before 6 months of age in asymptomatic infants with complete AV canal defects.

Two standard methods for repair of CAVSD defect are in use today. In the traditional single-patch technique· the same patch is used for closure of the ASD and VSD; the A-V valve leaflets are re-suspended onto this single patch, with a need for leaflet division in order to allow patch placement for Rastelli type C, which by definition has a common superior leaflet. In the double-patch technique, 2 separate patches are used, one for closure of the VSD and the other for closure of the ASD; the A-V valve leaflets are typically not divided. [2]

A primary characteristic of the modified single-patch technique, which was introduced in the mid-1990s, is the obliteration of interventricular communication by direct closure of the bridging leaflet and septal crest.

Patients and methods

Between January 2010 and January 2016 the author has performed 118 CAVSD repair using one of 3 techniques: Australian, single or double patch techniques.

The age median 15.2 months, weight 10.3 kg, 42 patients (35.6%) had Down syndrome, pulmonary artery pressure more than 40 was found in 81 patients (68.6%). VSD component ≤ 5mm in 34 patients (28.8 %, Group A), 5 - ≤ 10 mm in 71 (60.2%, Group B), VSD > 10mm in 13 (11%).

Patient characteristics are listed in table 1.

Variable	Median (S.D.)
Age median (months)	15.2 (± 2.8)
Sex: female	67 (56.8%)
male	51 (43.2%)
Chromosomes: normal	76 (64.4)
trisomy	42 (35.6%)
Weight median (kg)	10.3 (±1.9)
Previous PAB	47 (39.8%)
VSD size: < 5mm	34 (28.8%)
5-10 mm	71 (60.2%)
> 10	13 (11%)
PAP : < 40 mmHg	37
> 40 mmHg	81

Table 1. Patient characteristics:

All patients had warm CPB and blood enriched cold ante grade cardioplegia. Follow up by echocardiography at 1 week, 1 month and every 6 months afterwards.

Statistical Analysis

The data are summarized using frequencies and medians, with the standard deviation, as appropriate. The collected data was revised, coded, tabulated using Statistical package for Social Science (SPSS 15.0.1 for windows; SPSS Inc, Chicago, IL, 2001). Suitable analysis was done according to the type of data obtained for each parameter.

i. Descriptive statistics:

Median and standard deviation were used for parametric numerical data, while frequency and percentage for non-numerical data.

ii. Analytical statistics:

Multivariate statistical regression and Student T Test was used to assess the statistical significance of the difference between the study groups. Chi-Square test was used to examine the relationship between two qualitative variables.

Results

The patients were classified according to the size of the VSD component into 3 groups: Group A (34 patients, 28.8 %) with VSD size up to 5mm in diameter, Group B (71 patients, 60.2%) with VSD size more than 5 and up to 10 mm, Group C (13 patients, 11%) with VSD size more than 10 mm.

Patients' characteristics according to their groups are listed in table 2.

The choice of the operative technique was decided intraoperatively as a function of the VSD size and the atrioventricular valve anatomy. All patients in Group A had modified singe patch (Australian) technique. In Group B: 17 patients had Australian technique (24%), 49 patients had double patch tech-

nique (69%) and 5 patients had single patch technique (7%) and remarkably all the 5 were type a CAVSD. In group C: 3 (27.3%) patients had single patch technique and 8 (72.7%) had double patch technique.

Variable	Group A (34)	Group B (71)	Group C (13)
Age median (months)	17.1 (±3.1)	14.9 (±1.9)	10.2 (±2.3)
Sex: female male	19 (55.9%) 15 (44.1%)	39 (54.9%) 32 (45.1%)	9 (69.2%) (30.8)4
Chromosomes: normal trisomy	24 (70.6%) 7 (29.4%)	43 (60.6%) 28 (39.4%)	6 (46.2%) 7 (53.8%)
Weight median (kg)	12.8 (±4.1)	9.9 (±2)	8.1 (±1.8)
Previous PAB	3 (8.8%)	39 (54.9%)	5 (38.5%)
VSD size	< 5 mm	5-10 mm	>10mm
PAP : < 40 mmHg > 40 mmHg	21 (61.8%) 13 (38.2%)	13 (18.3%) 58 (81.7%)	3 (23.1%) 8 (86.9%)

Table 2. Characteristics of patients in the 3 groups.

There were 7 hospital mortalities (5.9%) 1 in group A (2.6%), 7 in group B (10.4%) and 2 (15.4%) in group C.

The cause of death was low cardiac output in 4 patients all in group B and complications of chest infection in 3 patients; 1 in group A and 2 in group B.

There were no operations during the follow up period.

The results of the studied variables are listed in table 3.

	OVER ALL	Group A	Group B	Group C
Clamp time(min)	29.1	25.6	32.8	33.9
CPB time (min)	42.4	39.2	51.1	50.2
Ventilation (day)	2.1	1.3	2.9	3.6
Dobutamine ≤5	71 (60.2%)	29 (85.3%)	38(53.2%)	3 (23.1%)
More inotropes	47 (39.8%)	5 (14.7%)	33(46.8%)	10 (86.9%)
ICU stay (day)	7.5	5.9	8.3	8.7
≤Mild MR	99(83.9%)	32(94.1%)	58(81.7%)	10 (78.5%)
≥ moderate MR	19(16.1%)	2 (5.9%)	13(18.3%)	3(21.5%)

Table 3. Studied variables in the 3 groups (median).

Residual shunts were present in 21 patients (17.8%), 3 in group A (8.8%), 15 in group B (21.1%) and 3 in group C (23.1%) none of these residuals was of medical or surgical significance.

Multivariate regression analysis showed that being in group A was not a significant risk factor to be associated with an increase in any of the studied variables.

Being in group B had statistically significant risk for the need for more inotropes (P=0.036), longer cardiopulmonary bypass duration (P=0.02) longer hospital stay (P=0.041) and residual moderate mitral regurgitation (0.046).

Being in Group C had statistically significant risk for the need for more inotropes (P=0.027), longer cardiopulmonary bypass duration (0.041), longer ventilation time (P=0.026) longer hospital stay (P=0.033) and residual moderate mitral regurgitation (p=0.019).

Discussion

In the last 20 years, improved understanding of the natural history and morphology of CAVSD as well as the advances in surgical techniques, have markedly improved postoperative mortality and morbidity for this condition.

In CAVSD defects and as a result of gradual decrease in the pulmonary vascular resistance by the 4-6 weeks of life, large volume 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 A-V 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. [4]

The surgical repair of CAVSD is routinely performed during infancy, although no consensus has been reached regarding the ideal timing to avoid the risk of congestive heart failure symptoms and the increase in pulmonary vascular resistance putting in mind the greater technical operative risks in younger and lower body weight infants. [5,6]

Increased pulmonary vascular resistance develops in those who survive with fibrosis and intimal hyperplasia of the pulmonary vasculature leading to increasing pulmonary hypertension. [7] This eventually leads to a reduction in the total cross-sectional area of the pulmonary vascular bed and the pulmonary vascular disease becomes irreversible over time. [8]

Therefore, it stands to reason that CAVSD should be treated before the onset of irreversible pulmonary hypertension especially in the presence of Down syndrome. This usually occurs at the sixth month of life. [9]

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. [7]

Refinements in the surgical technique due to better understanding of the surgical anatomy, together with advancements in myocardial protection, anesthetic and intensive care, improved results of early primary repair of CAVSD in comparison to two-stage repair which consists of pulmonary artery banding as a first stage followed by complete repair thereafter. [8,11]

Our study had a group of patient with a median of age 15.2 months which is considered an average of age in the Egyptian centers as the age depends on the timing of presentation, the presence of complications especially an increase in the pulmonary artery pressures and the association with other congenital anomalies and the results are comparable to the recently published Egyptian experience. [3]

Our choice of the technique used for repair depended upon the size of the VSD component as our earlier experience showed bad results in case of using the collapse technique for CAVSD with a large interventricular component. Our results showed that our tendency is higher towards the double patch technique especially in CAVSD type C.

Our results seem to be logic when it showed more statistically significant risk factors associated with patients in group B and C as the bigger interventricular component the more left to right shunt volume and more incidence of complications, in the same time it is associated with more technical difficulty and consuming more operative time.

There were no risk factors related to the type of chosen technique for repair. Two stage repair in our group of patient was not a statistically significant risk factor. The presence of trisomy 21 was not a risk factor by itself in our series but was more associated with CAVSD with a bigger VSD component. We had only 3 patients who were in a need for augmentation of the mitral component and it was done with a part of the VSD pericardial patch, 2 of them were in group C and 1 in group B, all the 3 patients had minimal to mild mitral regurgitation that didn't increase through the whole period of follow up.

Surprisingly, neither the patient age or weight was a risk factor for CAVSD repair in our series this can be explained by our policy to avoid repair in patients below 6months or 6 kg to avoid the ICU care risk.

Conclusion

CAVSD is a wide range of pathology that is readily operable in infancy with acceptable results and good prognosis.

In balanced CAVSD the size of the VSD is the most important factor in choosing the technique of repair and the prognosis.

Our study aimed at the evaluation of the risk factors to CAVSD repair and its relation to the size of the interventricular component.

A VSD component 5-10 mm was a statistically significant risk factor for ICU stay duration and having more than mild left A-V valve regurgitation.

A VSD component > 10 mm was a statistically significant risk factor for ventilation and ICU stay duration, the need for inotropes and having more than mild left A-V valve regurgitation.

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Assessment Of High Volume Threshold For Early Chest Tube Removal After Pulmonary Lobectomy: A Prospective Randomized Study

Thoracic

Ahmed Labib Dokhan,

Montaser Elsawy Abd Elaziz,

Mohamed Gamal Hagag

Objectives: **Too much debate about how to manage chest tubes after pulmonary resection, especially the volume threshold that we can remove the chest tube without complications. This study aimed at evaluation of the impact of high volume threshold < 350 ml /day for tube removal after lung resection on postoperative outcome.**

Methods: **This was a prospective randomized study of 108 patients subjected to pulmonary resection by thoracotomy. Patients were divided into two groups; group A, included 55 patients where we placed a single chest tube with early conversion to water seal. The tube was removed when the drainage was 350 mL/ day or less, and the other group (B) included 53 patients where we inserted two tubes. The drains were removed with drainage <150 ml/day. These two groups were compared regarding the amount of tube drainage for each postoperative day (POD) and its impact on postoperative complications, prolonged air leak, chest tube duration, and length of hospital stay.**

Results: **we have statistical significant difference between both groups in percentage of patients discharged on each POD. There was statistically significant difference between both groups regarding the mean duration of chest tube, prolonged air leak and mean duration of hospital stay. No statistical significant difference between both groups regarding postoperative complications leading to readmissions.**

Conclusion: **Insertion of a single chest tube, and a 350 ml /day volume threshold for removal is safe and reduces chest tube duration following pulmonary lobectomy without increasing postoperative morbidities.**

Key words**: Air leak, thoracotomy, pulmonary resection**

Patient discharge is frequently delayed because the last chest tube is not removed since the drainage is ''too high'' to allow safe removal. A chest tube may cause pain and impair mobility. Furthermore, it has been suggested that chest tube removal improves forced expiratory volume in first second [1]. Early chest tube removal may favour recovery of vital capacity and Physical performance after lobectomy [2]. This makes chest tube removal crucial to recovery after Pulmonary resection. Also, early chest tube removal has potential economic benefits, since patients who have their chest tubes removed early have shorter in-hospital stay [3].

A consensus on when to remove the chest tube after pulmonary resections on the basis of the amount of pleural drainage has not yet been reached [4]. And recently proposed standardized definitions and nomenclature on chest tube related topics, require studies of more standardized patients with clinically relevant outcomes [5].

We aimed in this study to assess the outcomes of a prospective algorithm that was applied to the patients underwent pulmonary resection and had their last chest tube removed when the nonchylous effluent was 350 mL/day or less.

Department of Cardiothoracic Surgery, Faculty of Medicine, Menoufia University, Egypt

Corresponding Author:
Montaser Elsawy Abd Elaziz
mnt_swy@yahoo.com

Codex : o4/01/1510

Patients and Methods

Study Design

A prospective pre-muted blocked randomized study of 108 patients was performed from June 2011 to March 2015 in the Cardiothoracic Surgery Department, Menoufia University Hospital. All patients had different thoracic diseases indicating pulmonary lobectomy (10 neoplastic and 98 non-neoplastic).

Only patients underwent elective thoracotomy and non-pneumonectomy pulmonary resection were eligible for this study. Patients were excluded if they were <18 years of age, patients reopened for bleeding, or underwent decortication, pneumonectomy, and patients needed postoperative mechanical ventilation.

Before starting the study, the ethics committee of the Menoufia Faculty of Medicine approved it, and consent was taken from all patients informing them that they would have one of the two protocols of chest tube management after pulmonary resection.

Patients were divided randomly into two groups;(figure.1), group A, New Protocol included 55 patients in whom new protocol was followed which included insertion of a single chest tube. The chest tube was removed when air leak had resolved and non-hemorrhagic, non-chylous fluid drainage was 350 ml/day or less.

The other group (B) included 53 patients in whom the usual old protocol was used where two chest tubes were placed: one anterior apical and the other is posterior basal. The drains were removed after cessation of air leak and when the fluid drainage was 150 ml/day or less.

Patients were allocated in both groups sequentially according to the computerized random number generator. Only the surgeon and his team were aware of the assignment of patients. Patients, data collectors, and the statistician were blinded to group assignment.

All patients had the standard posterolateral thoracotomy with division of the latissimus dorsi muscle and preservation of the serratus anterior muscle by the same surgical team. Intraoperative techniques for air leak reduction included manual suturing and pleural tenting. All patients were extubated in the operating theatre after completion of the surgery.

In group A, we left a single chest tube (30 French) with the tip positioned mid-posteriorly and connected to the underwater seal.

Criteria for chest tubes removal are when air leak resolved (air leakage was evaluated as no bubbles were seen in the water seal when the patient coughs) and the fluid drainage was 350 ml/day or less provided that the drained fluid was macroscopically non-chylous and non-haemorrhagic. One post-removal CXR was performed before discharge.

In group B, two chest tubes were placed: one anterior apical and the second is posterior basal. Criteria for tube removal were after cessation of air leak and when the fluid drainage was 150 ml/day or less. If there were patients suffered prolonged air leak (PAL) which lasts for seven days or more, we discharged them on a Heimlich valve where they were frequently revised in the outpatient clinic and the chest tubes were removed after cessation of the air leak.

The level of drainage was further verified by the resident (blinded to patients assignment) during rounds by placing a mark on the level of drainage each morning. The drainage amount and its appearance were recorded each day. The last drain as removed when the effluent was nonchylous in character, <350mL/day, and there was no air leak.

In general, patients were sent home the day the last chest tube was removed. If the drainage appeared white or milky it was sent for triglyceride level analysis. A triglyceride level of 110 mg/dL or more was considered diagnostic of a chylothorax and patient had only total parenteral nutrition, and the chest tubes were kept in place.

The primary outcomes of this study were the numbers of patients discharged on each POD and, volume of drainage, and their impact on the number of patients readmitted due to any postoperative complication.

The secondary outcome variables were: duration of hospital stay, duration of chest tubes, and any complications during 1-month postoperative follow-up that leaded to readmission and intervention.

Statistical Analysis

Based on the previous studies [6,7,8] sample size was calculated not to be less than 50 patients in each group to provide 95% power and 0.05 statistical significance level. Two types of statistics were done: descriptive: e.g. percentage (%), mean and standard deviation (SD), and analytic statistics: e.g. Chi-square test (X2): was used to study association between two qualitative variables. Mann-Whitney test (nonparametric test): is a test of significance used for comparison between two groups not normally distributed having quantitative variables. Analyses were conducted with the SPSS version 20 software (SPSS, IBM., Chicago, IL, USA).

Results

Patients randomly allocated to this study were 129 patients. We excluded 10 patients from group A and 11 patients from group B, and the remaining 108 patients were statistically analyzed, 55 patients in group A and 53 patients in group B (Fig 1).

There were no significant differences between the two groups with regard to age, sex, body mass index, preoperative forced expiratory volume in the first second and type of resection (Table .1).

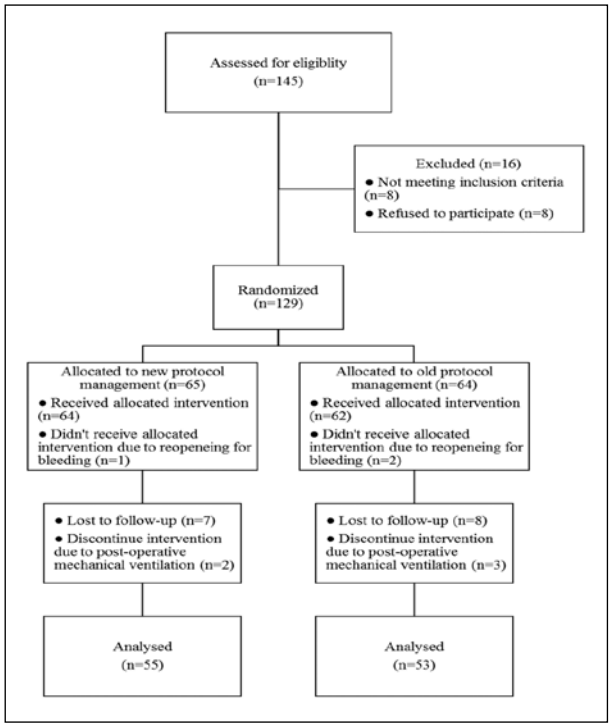

Fig 1. Flow diagram of patients included in the study

About the patients in each POD, and amount of drainage (table 2) we have statistical significant difference between the two groups in number of patients discharged on each POD from POD zero to four as on POD2-3 patients discharged in group A were 38 of 55 (69.09 %) and in group B, 17 of 53 (32.07%) patients discharged (Table.2).

The mean amount of drainage decreased significantly from POD zero to four, and there was significant difference between both groups on POD 0-1, but it was not significant during POD 2-3, and POD> 4.(table .2), (Figure .2).

The mean duration of chest tube in group A was 2.05 days and differs significantly from group B where it was 4.53 days. There was no cases recorded to have PAL>seven days in group A, while seven cases in group B had PAL. The mean duration of hospital stay was statistically significant different between both groups where it was lower in group A (Table .3).

We had recorded no statistical significant difference between both groups regarding postoperative complications that needed patients to be readmitted. (table.4). Postoperative Complications and their management before discharge and during 1-month follow-up in two groups are discussed in table 5, we had 100% of patients follow-up during the first 30 postoperative days.

Variable	Group A n=55	Group B n=53	Test	P-value
Age(Mean±SD)	53.13±10.6	55.87±9.2	t test=1.4	0.16
Range	30-75	39-75		
Sex				
Male	32 (58.2)	43 (64.2)	X2=0.41	0.53
Female	24 (41.8)	19 (35.8)		
BMI(Mean±SD)	22.6±2.7	22.75±2.6	t-test=0.3	0.76
Range	18-28	18-27		
FEV1% (Mean±SD)	1.75±0.5	1.72±0.5	W-test =0.54	0.59
FEV1(Mean±SD)	60.25±17.5	59.2±18.08	W-test =0.44	0.66
Type of resection			X2=3.34	0.34
RUL n(%)	17(30.9)	22(41.5)		
RLL n(%)	21 (38.2)	10(18.9)		
LUL n(%)	6 (10.9)	10(18.9)		
LLL n(%)	6(10.9)	7(13.2)		
wedge resection	5(9.09)	4(7.5)		

BMI:Body mass index, FEV1:forced respiratory volume in first second, RUL:right upper lobectomy, RLL:right lower lobectomy, LUL: left upper lobotomy, LLL: left lower lobectomy, X2:chi square, t test: paired t test, w test:wilcoxon signed rank

Table 1. Demographic and operative data between group A and group B

POD	Group A(n=55) (%)N Mean±SD	Group B(n=53) N(%) Mean±SD	Pvalue
POD 0-1			
Admitted	55(100)	53(100)	< 0.001
Drainage	333.16±81.03	270.75±90.44	0.006
Discharged	14(25.5)	0	
Readmitted	2(3.6)		
POD2-3			
Admitted	41(74.5)	53(100)	< 0.001
Drainage	178.41±77.52	184.53±105.78	0.75
Discharged	38(69.09)	17(32.07)	< 0.001
Readmitted	8(14.5)	3(5.6)	
POD ≥4			
Admitted	3(5.5)	36(67.9)	< 0.001
Drainage	143.33±40.41	141.11±63.73	0.83
Discharged	2(3.6)	20(37.7)	< 0.001
Readmitted	2(3.6)	4(7.5)	

POD: postoperative day, High statistically significant difference (P < 0.001). Statistically significant difference (P < 0.05).

Table 2. Comparison between group A and group B regarding number of patients in each POD and amount of drainage

Variable	Group A (n=55) Mean±SD	Group B (n=53) Mean±SD	Test	Pvalue
Chest tube duration	2.05±0.8	4.5±2.75	U=5.8	<0.001**
Prolonged air leak >7 days			FE=7.77	0.006
yes	0 (0.0)	7 (13.4)		
no	55 (100)	46 (86.8)		
Duration of hospital stay	5.73±1.2	7.68±1.6	U=6.64	<0.001**

U = Mann Whitney U, FE = Fisher's Exact test, **High statistically significant difference (P < 0.001). *Statistically significant difference (P < 0.05).

Table 3. Comparison between group A and group B regarding chest tube duration, prolonged air leak and duration of hospital stay.

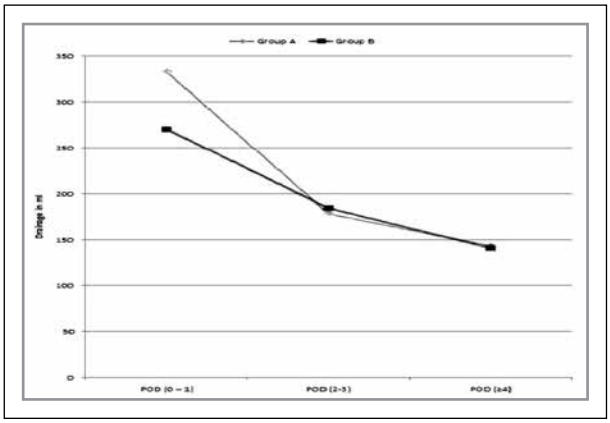

Fig 2. Line graph for average chest tube output in 2 groups in relation to postoperative day (POD).

	Group A (n=55)	Group B (n=53)	Test	P-valve
Pleural effusion	6(10.9)	5(9.4)	X2=0.6	0.8
Pleurocentesis	5(9.09)	3(5.7)	FE=0.75	0.55
New ICT	1(1.8)	2(3.6)		
Pneumothorax	2(3.6)	2(3.6)	FE=0.001	1
New ICT	2(3.6)	2(3.6)		
Empyema needed ICT	2(3.6)	2(3.6)	FE=0.001	1
Wound infection	2(3.6)	3(5.7)	FE=0.25	0.68
Pneumonia	4(7.2)	6(11.3)	X2=0.16	0.67
Chylothorax	1(1.8)	1(1.8)	FE=0.001	1

ICT: intercostal chest tube, FE :Fisher's Exact test, X2: chi square , p-value>0.05:non-significant

Table 4: Postoperative complications in both groups and interventions

Variable	Group A (n=55)		Group B (n=53)	
	Before discharge	During 1 month follow-up	Before discharge	During 1 month follow-up
Pleural effusion	1(1.8)	5(9.09)	2(3.7)	3(5.6)
Pleurocentesis	0(0)	4(7.2)	1(1.9)	2(3.7)
New ICT	0(0)	1(1.8)	1(1.9)	1(1.9)
Pneumothorax	0(0)	2(3.6)	1(1.9)	1(1.9)
New ICT	0(0)	2(3.6)	1(1.9)	1(1.9)
Empyema needed ICT	0(0)	2(3.6)	0(0)	2(3.7)
Wound infection	0(0)	2(3.6)	1(1.9)	2(3.7)
Pneumonia	1(1.8)	3(5.4)	2(3.7)	4(7.5)
Chylothorax	1(1.8)	0(0)	1(1.8)	0(0)

All values in number and percentage of total 55 in group A, and 53 in group B, ICT:intercostal chest tube

Table 5. Differential Number and percentage of postoperative complications before discharge and during 1- month follow-up

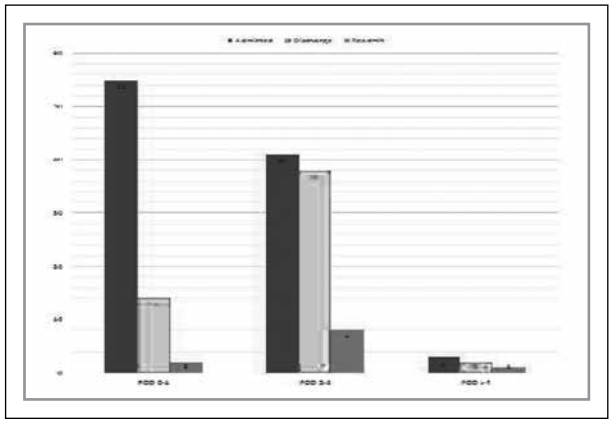

Fig 3. Course of patients in group A in relation to postoperative days.

Discussion

As the patients are more liable to postoperative complications such as Empyema and wound infection, due to prolonged chest tube duration and the tube itself causes pain, impairs early mobilization and is a port of entry for pathogens, we thought to overcome these problems by increasing the volume threshold of tube removal to shorten the duration of chest tubes.

Our objective was to evaluate a new chest tube management protocol following pulmonary lobectomy. We changed our protocol for simple decision making and better patient care.

A majority of thoracic surgeons prefer to leave chest tubes in until the air leak has resolved and the output is less than 250 mL/day, [8] and some even use 200 mL/day [7].

High chest tube output is the main reason that delayed discharge and not the presence of air leaks. Thus patient length of stay is often prolonged owing to ''the drainage being too high.'' Despite the fact that the patient is otherwise ready for discharge, the volume of drainage prevents it even though there is little published data to support leaving the patient's tube in.

Recently, some studies [11,12] have showed that early removal of the chest tube is possible and feasible when drainage volume was <200, 300 or 500 ml/day without other contraindications. The chest tube was even removed in two hours after operation [13].

In our study, when the threshold of 350 mL/day was used instead of 150 mL/day, considering no air leak, we reported 14(25.5%) of patients in group A discharged on POD-1 at a mean drainage volume of (333.16±81.03 ml). Of those 14 only 2(14.3%) patients readmitted for pleural effusion, managed by pleurocentesis only. They represented only 2(3.6%) of patients in group A.

Also we reported 38(69.09%) of patients in group A were able to go home early on POD 2,3 vs 17(32.07%) of patients in group B. Of patients discharged on POD 2-3 in group A, we had 8(14.5%) of them were checked in outpatient clinic with complications (Figure.3).

About the eight patients readmitted, Four patients complicated with pleural effusion (three were managed by pleurocentesis and sent home on the same day, one by intercostal chest tube (ICT) for 2 days). One patient had pneumothorax and ICT was inserted. One had Empyema that was drained by ICT. Two patients had wound infection.

On POD-4, nearly total of patients of group A were discharged 54 (98.18%) of 55 patients vs 37(69.8%) of 53 patients in group B and were sent home without a chest tube and thus enjoyed an early hospital discharge (Figure.3).

Cerfolio and Brayant [12] reported 49% of patients were sent home on POD2-3, vs 69.09% in group A of our study and 15% on POD4 vs 2% in group A of our study. We found the percentage of interventions in our new protocol group was near to that of Bertholet et al [6] who reported in their study on new protocol group that interventions were ICT 3(4.6%) of the 65 patients in this group, versus 5(9.09%) in our similar group A, thoracocentesis were 6(9.2%) versus 5(9.09%) in our studied group A.

In summary, most of complications could be managed in outpatient clinic with few patients readmitted with intervention as we had only five(9.09%) of group A who needed intervention (ICT) vs 4(7.5%) in group B with no statistical significance between both groups, So we can conclude that removal of drains in patients with a high output does not seem to increase the intervention rate (table.5).

This provides more evidence that the removal of chest tubes with drainage greater than 150 mL/day but less than 350 mL/day is safe. However, We found that the removal of tubes, even when the output was as high as 350 mL/day was safe.

A significant decrease in duration of chest tube drainage was found in group A. Chest tube could be removed earlier because air leaks occurred less frequently. Also, changing the threshold of daily fluid drainage for the removal of chest tubes has contributed to the decline in chest tube duration.

Cerfolio and Bryant found in their retrospective cohort study that chest tubes can be removed with non-chylous drainage up to 450 ml/day after pulmonary resection [12]. In our study we increased the threshold for removal from 150 to 350 ml/ day of clear chest tube output.

Brunelli et al, in their recent studies have successfully demonstrated that duration of chest tube drainage can be reduced even further by using continuous recording of air leak with a digital drainage unit [13].

Length of hospital stay after elective pulmonary surgery is

determined by a number of factors. Patients can be discharged when the chest tube is removed, postoperative pain control is adequate and when there are no postoperative complications.

Bertholet et al [6] reported in their study a mean duration of hospital stay in new protocol group more than one week, which was longer than that in our study where the mean duration of hospital stay in group B was 7.68 days and declined significantly to 5.73 days in group A.

Duration of chest tube drainage declined significantly from a mean of 4.53 days in group B to 2.05 days in group A, and Obviously, a postoperative complication is an evident reason to remain hospitalized, but that does not account for every patient as some patients lack proper health care at home especially elderly patients.

Brunelli et al, have shown that fast-track pulmonary surgery for selected groups of patients can reduce length of hospital stay and costs with minimal morbidity and good patient satisfaction[14].

Most studies placed the chest tubes on water seal after a brief period of suction postoperatively, except for large air leak and a large pneumothorax was found on the CXR [15,16].

Alphonso et al, found no differences in terms of air leak duration when placing chest tubes directly on water seal. They adopted a uniform policy of no suction being applied to the underwater seal in order to limit the duration of chest tube drainage and to avoid unnecessary suction to chest tubes [16].

In our study, we observed a significant decrease in air leak duration in group A compared to group B that was treated according to the new protocol. In group B the incidence of PAL was 7(13.4%) of patients which is relatively similar to that reported by Stolz et al, where PAL ranged from (3 to 25%.) [17] and was lower than 25% that reported by Bertholet et al [6].

This could be attributed to the fact that upper lobectomy is considered to be more risky for postoperative prolonged air leak and in group B we had more patients underwent upper lobectomies (60.4% vs 41.8%) than in group A which can explain the higher incidence of prolonged air leak in group B.

Marshall et al, in their prospective randomized studies recommended that continuous negative suction should not be continued when a small air leak is present (visible when coughing) and water seal drainage should be used instead in the immediate postoperative period [18]. In our study we rapidly connected the tubes to underwater seal to decrease air leak.

Limitations to this study include First, our reported readmission rates for recurrent effusions may be incorrectly low due to lack of complete understanding of the hospital course of patients who were readmitted outside our hospital. Second, we may have missed pleurocentesis that were performed as an outpatient maneuver.

Conclusions

Insertion of a single chest tube, and a 350 ml /day drainage threshold for tube removal is safe and reduces chest tube duration following pulmonary lobectomy. Also reduced the hospital stay duration without increasing postoperative morbidities.

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Button Battery Ingestion: Clinical Analysis and Hazards

Osama Saber El Dib, MD,

Introduction: **Button batteries are widely used and may be accidentally swallowed. They could cause serious damage if impacted in the oesaphgus. The purpose of this study was to present clinical characteristics, management and outcome of 55 children treated in our hospital.**

Patient and methods: **Data of children admitted to Zagazig University Hospital after ingestion of button batteries from January 2011 to January 2014 were collected. Batteries were emergently removed by rigid oesophagoscopy. Patients were carefully followed up in hospital and in outpatient clinic.**

Results: **Fifty five patients (30 males and 25 females) were enrolled in this study. The ages ranged from 1 to 6 years with a mean of 3.5±1.5 years. The mean duration of ingestion was 5.5±2.5 hours (range from 4hours to 7 days). Dysphagia was the commonest symptoms (80%). Plain x ray was diagnostic in all patients. The sites of impaction were the upper thoracic oesphagus in 45 (81.8%), mid thoracic in 8 (14.5%) and lower thoracic in 2 (3.7%). Regarding complications, we had 2 (3.6%) cases of perforation managed conservatively and healed, and 2 (3.6%) patients with tracheoesophageal fistula. One was operated transthoracically and closed while the other died from sepsis. The second mortality was a 5 years male patient who died because of massive GI bleeding.**

Conclusion: **Impacted button batteries are very hazardous. Early diagnosis and emergent removal are the key for favorable outcome. Complications should be anticipated and careful follow up is mandatory.**

Key words: **Button battery, oesophageal perforation, tracheooesophageal fistula**

Ingestion of foreign body is a common problem in pediatric age group. However button batteries represent a distinct type because of serious injuries that could occur[1]. The incidence of button battery ingestion has increased in the last 2 decades due to widespread availability and use in household devices[2]. Here we present our experience in management of button battery ingestion .

Patients and Methods

We reviewed the medical records of children admitted to Zagazig University Hospital from January 2011 to January 2014. Diagnosis was made based upon history, clinical presentation, imaging studies and endoscopic findings. Routine plain x ray showing neck, chest and abdomen was done for all cases. We used rigid esophagoscopy for retrieval of batteries and according to the degree of mucosal damage, subsequent contrast esophagogram was decided. After endoscopy, careful monitoring in hospital and then regular follow up in outpatient clinic were carried out for anticipation of complications.

Lecturer of cardiothoracic surgery, Zagazig university hospital, Department of cardiothoracic surgery

Corresponding Author:
Osama Saber
u_saber@yahoo.com

Codex : o4/02/1511

Results

The characteristics of patients are shown in table (1). We had 2 patients with perforation. They were managed conservatively and healed well. A 5- years- girl did not follow up after endoscopy and presented 2 weeks later with chocking and dysphagia. Contrast esophagogram showed tracheoesophageal fistula. She had also right vocal cord paralysis. Surgical closure of fistula was done through right thoracotomy and the patient recovered well. Successful repair was confirmed by postoperative gasrtografin swallow. We had 2 cases of mortality (3.6%). Both were referred late to our hospital after 24 hours of ingestion. One was a 5- years- old boy who died because of massive upper GI bleeding . The other was one year old female infant. She did not follow up after removal of a large disc battery and was readmitted complaining of choking while breastfeeding. She had severe pneumonia. Tracheoesophageal fistula was diagnosed. Empirical broad spectrum antibiotic therapy was initiated without waiting results of septic screen. Unfortunately, her condition deteriorated and she died because of sepsis and respiratory failure.

Total No.	55
Age	Range: 1-6 years Mean: 3.5±1.5 years
Sex: M/F	/ 25 30
Mean duration of ingestion	5.5 hours
Sites of impaction	Upper oesaphagus: 45 (81.8%) Mid:8 (14.5%) Lower: 2 (3.7%)
Symptoms	
Dysphagia	44 (80%)
Abdominal pain	6 (11%)
Cough	5 (9%)
Chest x ray	55 (100%)
Gastrografin swallow	15 (27.3%).
Batteries	
Type	Disc, 3 volt lithium
Mean diameter	20.5±1.5 mm
Success rate of retrieval	100%
Morbidity	Perforation: 2 Tracheoesophageal fistula: 2
Mortality	2 (3.6%)
Duration of hospital stay	Range: 2-30days mean: 4.5±1.5 days

Table 1. Patients characteristics

Discussion

Button batteries are increasingly used in many household items like TV remote control, watches, toys, and calculators. If accidentally ingested, they can cause serious hazard to children. Hazards caused by batteries are related to local corrosive effect rather than systemic poisoning(1). Experimental studies had shown 3 mechanisms for injury: 1. Generation of an electrolytic current that hydrolyzes tissue fluids producing hydroxide at the negative pole of the battery; 2. Leakage of alkaline electrolyte; and 3. Physical pressure on tissues. The first mechanism is the major mode of injury in 20-mm lithium cells. They are 3 -volt batteries that generate more electrolytic current and hydroxide (2,3). Injurious effect of battery, mainly at the area of negative pole continues for days to weeks after removal and this may present by delayed perforation or fistula (1). Experimental studies on animals showed rapid onset of severe injuries. Transmural esophageal necrosis could occur within 1 hour in dogs and 2-4 hrs in cats(4). A sample from the National Electronic Injury Surveillance System including 65788 patients, showed battery ingestion in 76.6%. The remaining sites of insertion were nasal cavity, mouth and ear canal. Symptoms of esophageal foreign body include nausea, vomiting, dysphagia, odynophagea, drooling, chocking . These are non specific symptoms making diagnosis difficult in unwitnessed battery ingestion (5). About 35% of children with ingested foreign bodies are asymptomatic(6). In our series, dysphagia was the commonest symptom (80%). The incidence of missed diagnosis was reported as 27% in major outcome and 54% in fatal cases(1). The sensitivity of plain radiography in identifying button batteries and determining need for urgent intervention approaches 94.4%(7). It was diagnostic in all of our patients. Disc batteries are differentiated from coins by their double rim or halo effect on anteroposterior view or step off on lateral view of radiographs(8). Common sites of impaction in the esophagus are at the thoracic inlet, near the aortic arch and GE junction. In our series 81.8% of batteries were impacted in the upper thoracic oesophagus. Every minute counts and removal of battery within 2 hours is a favorable chance to avoid complication. Among our communities, we still have a problem of delayed diagnosis, difficulty in distinguishing batteries form coin by GP physicians and misconception that waiting for spontaneous passage might solve the problem. Guidelines for management of disc battery ingestion were recently updated by investigators from National Capital Poison Center based on analysis of data reported to the National Poison Data System from 1985 to 2009, the National Battery Ingestion Hotline from 1990 to 2008 and literature review (5). Disc batteries should be emergently removed from the esophagus A battery lodged in the esophagus should be removed within 2 hours. No intervention is required if it passes to stomach in asymptomatic patient unless a magnet is co ingested or if it remains in the stomach for more than 48 hours(1). We strictly follow these guideline and emergently manage swallowed disc even without prior fasting. Some authors recommend removal of intragastric button batteries

in young children if multiple(9). Endoscopy is essential for removal and assessment of magnitude of injury. Complications are anticipated accordingly. We rely on rigid esophagoscopy for easier retrieval of batteries. We never push batteries to the stomach as this may aggravate the risk of perforation. Risk of major complications or death may reach up to 12.6% in children younger than 6 years who ingest 20-25 mm lithium batteries(1). Our patients belong to this risky group. All were under 6 years with mean age of 3.5±1.5 years. They ingested large disc batteries with mean diameter of 20.5±1.5 mm. Adverse events accounts for 9% of our results (3 major complications and 2 fatalities). We had one patient died from severe pneumonia and sepsis complicating delayed neglected tracheoesophageal fistula. Long time interval between ingestion and endoscopic removal together with lack of follow up accounted for this mortality. The other patient died because severe uncontrollable upper GI bleeding. A large multicentre study carried out by Litovitz et al on battery ingestion hazards showed that exsanguination as a result of oesophageal fistula into the aorta or other major vessels is a major cause of death (1). Among major complications reported in their study, tracheoesophageal fistula and oesophageal perforation represent 47.9% and 23.3% respectively. Tracheoesophageal fistula complicating button battery ingestion carries high morbidity and mortality(10,11). Senthikumaran et al reported spontaneous closure of TEF with conservative treatment(12) . However this may require tracheostomy and prolonged nasogastric or jujunostomy feedings(13). Surgical repair is needed particularly when the fistula is large(14). We successfully repaired one patient with TEF. Disc batteries are now becoming more widely available in Egypt and increased rate of ingestion is expected. Since we cannot reverse tissue injuries, prevention would be the most effective management modality. Education programs should be given to public and care givers about hazards of battery and necessity to be kept away from children(15). Preventive strategies should be applied by manufactures to design packaging that is child resistant. (16) Large batteries should be replaced by smaller ones less than 15 mm so as they could not lodge in the esophagus. In addition, severe esophageal injuries were reported with batteries larger than 20 mm.

Conclusion

Disc battery ingestion is a serious pediatric problem. Victims prone to complications are commonly children younger than 6 years who ingest large diameter lithium batteries. Early diagnosis and emergent removal are crucial. However, complications should be anticipated.

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Congenital Lobar Emphysema: Experience with 37 Case

Ehab Kasem, MD,

Osama Saber El Dib, MD

Backgrounds: **Congenital lobar emphysema is a rare cause of respiratory distress. Patients present almost in the first month of life. Late presentation is uncommon. Surgical resection of the affected lobe is the curative management**

Objectives: **The aim of this study was to present our clinical experience in clinical management of this rare disease and highlight our surgical results.**

Methods: **We retrospectively analyzed data of patients operated for congenital lobar emphysema from 2005 to 2013 in Zagazig university hospital.**

Results: **Thirty seven patients (29 males and 8 females) were operated upon. The mean age was 1.15±0.7 months month. The commonest presentation was respiratory distress. The left upper lobe was involved in 19 case, middle lobe in 10 and right upper lobe in 8. Lobectomy was the surgical procedure done for all patients. Four patients developed pneumonia postoperatively. They improved except one patient who died 5 days postoperatively. All survivors had uneventful hospital and outpatient course.**

***Conclusion*: Congenital lobar emphysema is uncommon cause of infant respiratory distress. Although it is life threatening , early recognition and surgical intervention are the key for favorable outcome.**

Key words : **Congenital lobar emphysema, neonatal respiratory distress.**

Congenital lobar emphysema (CLE) is rare cause of neonatal respiratory distress. It is one of lung bud anomalies that is characterized by over distension and air trapping of a segment or a lobe of the lung. It is uni-lobar problem and rare to be bi-lobar anomaly [1]. The annular prevalence varies from 1 in 20.000 to 1 in 30.000 live births and the incidence from 1 in 70.000 to 1 in 90.000 [2] Left upper lobe is the most frequently affected lobe (40%) , followed by right middle lobe (35%) and right upper lobe (20%) . Lower lobes are the least to be affected [3]. Early recognition and surgical intervention can be life saving.

Lecturer of cardiothoracic surgery, Zagazig university hospital

Corresponding Author:
Osama Saber
u_saber@yahoo.com

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Patients and Methods

The purpose of this study was to review our surgical results and present our experience in management of CLE.

We retrospectively analyzed our data of 37 cases of CLE referred from pediatric department for diagnosis and management from 2005 to 2013.

All cases admitted in pediatric department with respiratory distress for medical treatment. Initial work up consisted of clinical examination and chest X-ray. Computed tomography was done for all cases to confirm the diagnosis and detect underlying cause. Bronchoscopy was done preoperatively in 3 cases to rule out foreign

body aspiration. Echocardiography was performed in all patients to exclude congenital cardiac anomalies. Anesthetic considerations were taken to avoid hypoxia and rupture of hyper-inflated lobe during induction. Gentle manual ventilation or pressure controlled ventilation were adopted to achieve that. The surgical team was standby at the time of induction and ready for quick thoracotomy. Postoperatively, all patients were admitted to ICU for monitoring and careful attention was given for fluid balance and control of secretion. Bronchoscopy was done for 2 patients with lung collapse for suction. Our policy was to do chest x ray when needed and to remove chest tubes early. All patients were followed in hospital and in outpatient clinic by thoracic surgeons together with pediatricians.

Results

Thirty seven cases (29 males and 8 females) were operated for CLE from 2005 to 2013. Their ages ranged from 1 week to 6 months with a mean 1.15±0.7 months. Left upper lobe (LUL) was affected in 19 cases, right middle lobe (RML) in 10 and right upper lobe (RUL) in 8. Respiratory distress was the commonest clinical presentation. Chest radiographs was a helpful initial diagnostic modality and showed hyperlucency of the affected lobe herniating across the midline, atelectasis of underlying normal lung and mediastinal shift (fig.1). CT chest confirmed the diagnosis in all cases (fig.2). No cardiac anomalies were reported in our series. All patients were managed surgically by resecting the emphysematous lobe. Left upper lobectomy was done in 19 patients, middle lobectomy in 10 and right upper lobectomy in 8. Data of patients are shown in table (1). Four patients (8.7%) developed pneumonia postoperatively. One of them, a 3 weeks male neonate died after 5 days of mechanical ventilation because of sepsis and respiratory failure.

Age	*1 week – 6 months* Mean: 1.15±0.7 months
S e x: F\M	8\29
AFFECTED LOBE	
LUL	19
RML	10
RUL	8
Morbidity	
Pneumonia	4
MORTALITY	1
Mean time of post operative mechanical ventilation	2.3 days

Table (1): Perioperative data

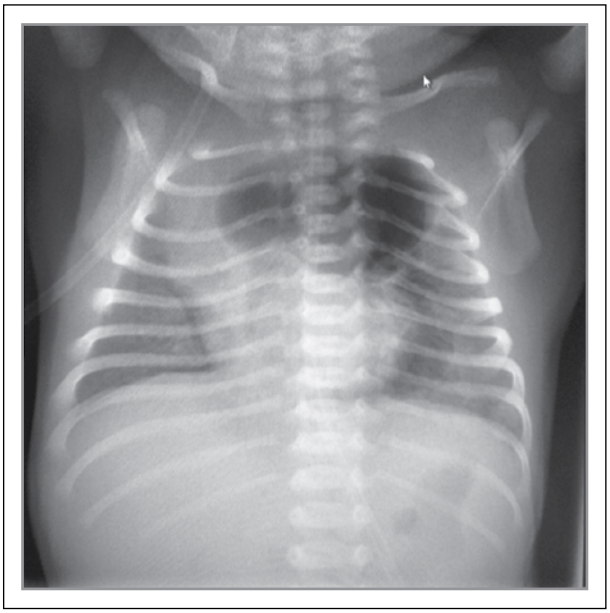

Fig 1. Plain chest x ray showing congenital left upper lobe emphysema in a 5-days male newborn.

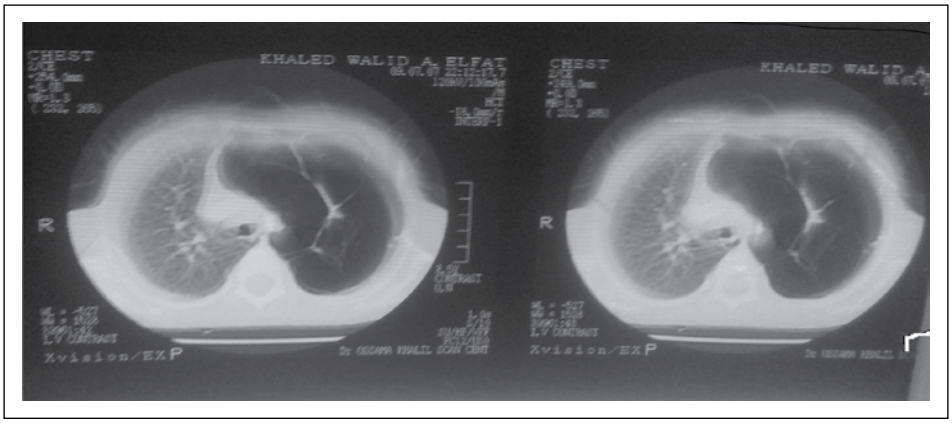

Fig 2. CT scan of congenital emphysema of left upper lobe

Discussion

Congenital lobar emphysema (CLE) is a rare cause of neonatal respiratory distress with life threatening outcome secondary to cardio-respiratory impairment. It is more frequently seen in males with ratio to females 3:1. In our study, the majority of cases were males (29 males to 8 females) and mean age of presentation was 1.15 month. This has been reported in many series [2-5].

Left upper lobe is the most commonly affected lobe as stated in literatures, followed by right middle and right upper lobes. Multiple lobar involvement is very rare [2]. Our results are in concordance with that.

The pathology of CLE is unknown in 45 % to 50% of cases. In the remaining patients a distinct abnormality in the bronchus of the affected lobe could be identified. This could be intrinsic web, mucous folds, bronchial stenosis or bronchomalacia. Bronchial obstruction from outside by vascular abnormalities is a rare cause [6]. Another theory attributes CLE to increased number of alveoli in each acinus (polyalveolar lobe) [7]. The affected lobe is characterized by hyper-inflation due to valve like obstruction of the leading bronchus with subsequent compression of underlying normal lung and shift of mediastinum to the other side. This will impair ventilatory and hemodynamic state [8].

Diagnosis of CLE is challenging . Clinical manifestations include breathlessness, cough, wheezing, grunting and recurrent chest infection [9]. Older children usually have mild symptoms and may present with repeated chest infection. In our series, signs of respiratory distress were the commonest presenting signs. Chest x ray and CT scan are essential for diagnosis [10]. Prenatal diagnosis by ultrasound is seldom reported in literature [11]. Differential diagnosis includes other causes of critical respiratory distress e.g. pneumothorax, pulmonary hypoplasia, pneumatocele and endobronchial mass, and congenital cystic adenomatoid malformation [12]. CLE may mimic tension pneumothorax. Careful observation of bronchovascular markings is the key for distinguishing both conditions. Misdiagnosis and inappropriate insertion of chest tube would cause deleterious effect [13]. Coordinated efforts of our colleagues in pediatric department and combined discussion of cases participated in proper diagnosis. We believe that chest x ray and CT scan are sufficient to establish a diagnosis. We performed bronchoscopy for 3 cases preoperatively to rule out foreign body inhalation.

CLE is associated with cardiac anomalies, commonly PDA, VSD in 10% to 15%. Preoperative echocardiographic evaluation is mandatory [14]. We hadn't reported any associated cardiac anomalies among our patients.

Conservative treatment is justified in patients with no or mild symptoms[15,16]. However, we believe that careful selection and strict follow up are needed since deterioration may occur necessitating surgical intervention. All of our cases were managed surgically by lobectomy. Left upper lobectomy was the most frequent procedure followed by right middle and ,right upper lobectomies. Our surgical results are encouraging with 97.7% survival rate. Four patients developed pneumonia postoperatively that resolved with medical treatment in 3 patients and progressed in one culminating into respiratory failure and death.

A critical anesthetic consideration is to avoid over distension and high positive pressure since this could compromise ventilatory and hemodynamic states [17].

Novel techniques were adopted to overcome the challenge of this critical time. High frequency jet ventilation was tried by Goto et al[18]. Spontaneous breathing till thoracotomy was reported by Raghavendra et al[19] using thoracic epidural analgesia. The policy of our anesthetists was to use gentle manual ventilation till the chest was opened. Surgical team were ready for emergent thoracotomy to relieve pressure effect of emphysematous lobe in case any adverse event happened during induction of anesthesia

Conclusion

CLE is a rare cause of neonatal respiratory distress . Accurate diagnosis depends upon correlation of clinical and radiological investigations. CT is main tool of diagnosis and echocardiography is mandatory to rule out associated cardiac anomalies . Surgical management is the definitive therapy in most of cases with favorable results.

List of abbreviations

Congenital lobar emphysema (CLE)

Left upper lobe (LUL)

Right middle lobe (RML)

Right upper lobe (RUL)

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