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Journal of The Egyptian Society of Cardio-Thoracic Surgery

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Guidelines For Authors

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

Editorial Office

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

General Instructions

Every submission must include:

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

Required disclosures;

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

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

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

Revised_Manuscripts:

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

General Information

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

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

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

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

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

Word Limits by Category of Manuscript

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

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

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

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

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

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

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

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

Manuscript Preparation

Title Page (first page)

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

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

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

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

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

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

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

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

Abstract Page (Second page)

- Original articles

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

*- **New Technology***

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

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

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

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

Text *(thirdpagecontinueuptoacknowledgments)*

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

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

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

Acknowledgments

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

References

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

Journal Article

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

Chapter in Book

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

Internet Address

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

Tables;

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

Figure Legends

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

Illustrations

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

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

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

Instructions:

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

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

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

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

Gray scale images should be at least 300 dpi .

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

Cover letter:

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

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

Date of acceptance : letter is provided from the editor.

Checklist:

A] Cover letter

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

B] Complete manuscript

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

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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.

Coronary Artery Bypass Surgery in Patients With Poor Left Ventricular Function

Ashraf S.A. Abou El Ela, MBBch,

Ahmed Kadry Abdallah, MD,

Mohamed Adel Fetouh Elgamal, MD,

Sameh Mostafa A. Amer, MD

Background: **Coronary artery bypass surgery (CABG) in patients with low left ventricular ejection fraction(LVEF) remains a surgical challenge. The outcomes of surgery for those patients is controversial.**

Objectives: **The purpose of this study is to evaluate the outcomes of CABG in patients with LVEF <35% and compare the results to a control group with LVEF >50%, including clinical status, surgical outcome, and change in the left ventricular ejection fraction(LVEF).**

Patient and methods: **The study included 100 patients with diagnosed multi-vessel coronary artery disease, who are amenable for CABG, divided into two groups; First group: 50 patients with LVEF <35%, and second group; 50 patients with LVEF >50%. After thorough preoperative evaluation, All patients were subjected to routine CABG on pump single clamp technique.**

Results: **Mean follow up was 6 months. Preoperative demographic data and comorbidities were similar in both groups; NYHA class improved from 2.72±0.95 preoperatively to 1.26±0.44 (p<0.001) in the first group, while second group improved from 2.74±0.96 to 1.28±0.45 (p<0.004). Mean LVEF significantly improved in both groups; first group from 25.16±6.44% preoperatively to 57.48±4.70% (p<0.001). In the second group increased from 33.86±9.84% to 59.52±4.78% (p<0.004). Univariate analysis for the first group patients showed that preoperative MI was the only independent risk factor for occurrence of complications.**

Conclusion: **CABG in patients with severely impaired LV function is beneficial if ischemia is reversible. Systolic heart function improves significantly after surgical revascularization in patients with hibernating myocardium.**

KEY WORDS: **CABG, Poor left ventricular function, LVEF.**

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Despite the recent advances in medical therapy, patients with coronary artery disease (CAD) and low LVEF still have poor prognosis with medical treatment alone. CABG in those patients with depressed LVEF has been reported to be superior to medical therapy by several authors.[1-3] The Coronary Artery Surgery Study (CASS) study showed that only 38% of medically treated patients (EF <35%) were alive and free of severe limitations 5 years after the onset of treatment.[4] Surgical approaches to CAD patients with low LVEF include CABG, ventricular assisted devices, and cardiac transplantation.[5] Patients with low LVEF have more preoperative co morbidities and are more prone to postoperative complications, longer hospital stay, need for inotropes, IAB and prolonged mechanical ventilation.[4] Continuous development of anesthetic medications, perfusion, and surgical techniques have improved outcomes in patients with poor LVEF.[3,6] There are few data that identify patients who are at highest risk and those who would benefit most from surgery.[4]

Patient and Methods

The study protocol was approved by the ethical committee at faculty of medicine

Mansoura University and the internal review board(IRB) at Mayo clinic. All patients provided informed consent. This study was conducted in Mansoura university hospital, Nasser institute for research and treatment, and Mayo clinic, Rochester, MN, USA. We conducted this study on 100 patients from June 2012 to March 2014. They were divided into two groups: First group; 50 patients with a LVEF <35% Second group; 50 patients with a LVEF >50%.

Inclusion Criteria: Patients undergoing isolated CABG on CPB with EF<35%, or EF>50%, all age groups. Exclusion Criteria: Redo CABG, associated valvular surgery, preoperative hepatic dysfunction, preoperative renal dysfunction, surgery to LV aneurysm.

We were able to pair match the 50 pairs of patients according to the following matching criteria: age, gender, diabetes, COPD, previous cerebro-vascular accident, previous myocardial infarction, hypertension, NYHA class and peripheral vascular disease.

All patients were subjected to the following evaluation:

Preoperative

Complete history, clinical examination including NYHA Functional Classification, Chest X- ray, electrocardiography, echocardiography, full laboratory investigations, coronary angiography and viability study (in the first group); either dobutamine stress echocardiography, radioactive isotope scanning or cardiac MRI.

Technique of Surgery:

Elective isolated CABG utilizing CPB. A median sternotomy and LIMA harvesting is started simultaneously with endoscopic great saphenous vein harvesting and/or radial artery or other conduit being harvested. The target blood vessels were identified and marked. The aorta is clamped and cold blood antegrade cardioplegic solution infused. In cases where the coronary lesions are tight and a systolic arrest cannot be achieved a retrograde cardioplegia cannula was placed in the coronary sinus. Distal anastomoses were done then proximal anastomoses single clamp technique, CPB is discontinued followed by heparin reversal. Chest was closed in layers, leaving drains and the patient was transferred to the intensive care unit; intubated unless prearranged for fast tracking and extubation on table. Auto transfusion was done whenever the patient hemoglobin was more than 12.5 gm/dl. Trans-esophageal Echocardiography or Swan-Ganz catheter was used routinely in cases with poor left ventricular ejection fraction for monitoring of cardiac index and contractility.

Postoperatively; Before discharge: All ICU events were recorded as duration of mechanical ventilation, inotropic support, use of IABP. Postoperative complications and echocardiography were recorded before discharge.

Six months follow up: NYHA class and echocardiography were assessed.

Statistical analysis

The data was collected on a pre-coded sheet. Data was Statistically analyzed using Statistical Package for the Social Sciences (SPSS Incorporated, Chicago, Illinois) Ver. 13, for Windows XP. Non discrete variables were presented as numbers and percent. Discrete variables were presented as mean ± standard deviation and will be presented by bar and pie charts. Statistical analysis will be performed using Chi-square test to detect any Statistical significance. Statistical significance was assumed at P value < 0.05.

Results

Preoperative assessment: Comparing the two groups: There was no significant difference in: age, gender, diabetes, hypertension, BMI, NYHA class, cerebrovascular accident, COPD, peripheral vascular disease(PVD). **Table(1)**

Intraoperative and postoperative assessment:

There was no significant difference in mean CPB in group one 98.88 ± 30.46 min. versus 90.02 ± 30.77 min. in group two (P=0.151), no significant increase in aortic cross clamp time in group one 63.14 ± 15.93 min. compared to 61.82 ± 23.03 min. in group two (P=0.74), no statistical significant difference in mean ICU stay time between group one (25.23 ± 14.45 hours) compared to (23.09 ± 18.89 hours) in group two(P= 0.546).

There was a significant difference in the use of inotropic medications in group one 18 (36%) compared to 9 (18%) in group two (P =0.043). There was a noticeable difference in the duration of mechanical ventilation (Duration - range) where group one had 8.3 (2.6 – 70.8) hours compared to 6.3 (3 – 90.8) hours in group two (P=0.008).

The first group had higher incidence of complications 42% (n=21), compared to 18% (n=9) in second group (p<0.009). Intra-aortic balloon pump (IABP) was utilized in 12 (24%) patients in group one and 4 (8%) patients in group two, with significant statistical difference (p<0.029). Two patients (4%) suffered bleeding requiring reoperation in group one compared to only one patient (2%) in group two. Total incidence of bleeding requiring retake to the O.R. in both groups was 3% (n=3). Total incidence of stroke in both study groups was 2% (n=2). Postoperative renal impairment requiring hemodialysis occurred in 1 patient (2%) in low LVEF group. However, none of group two patients required dialysis (P=0.315). **Table (2):**

	<35% group (n = 50)		>50% group (n = 50)		t	P
Age	65.28 ± 10.86		64.20 ± 10.69		0.501	0.617
BMI	30.44 ± 6.20		31.58 ± 5.39		0.983	0.328
Gender						
Male	41	82%	40	80%	0.065#	0.799
Female	9	18%	10	20%		
Diabetes	25	50%	25	50%	0.0#	1.0
Hypertension	41	82%	41	82%	0.0#	1.0
Cerebrovascular accident	2	4%	5	10%	1.382#	0.240
COPD	7	14%	3	6%	1.778#	0.182
PVD	7	14%	5	10%	0.379#	0.538
Sr. creatinine	1.02 ± 0.37		1.11 ± 0.43		1.031	0.305

#Chi-square test was used, data were expressed as mean ± Standard deviation and numbers(%)

Table 1. Preoperative data of study groups

	<35% group (n = 50)		>50% group (n = 50)		χ2	P
	No	%	No	%		
Postop. complication	21	42%	9	18%	6.857	0.009*
CHF requiring inotropes	18	36%	9	18%	0.0	0.043*
reop. for bleeding	2	4%	1	2%	0.344	0.558
IAB	12	24%	4	8%	4.762	0.029*
Stroke	2	4%	0	0%	2.041	0.153
Deep wound infection	1	2%	1	2%	0.0	1.0
Renal failure req.dialysis	1	2%	0	0%	1.010	0.315
Length Stay	23.5 (5 – 110)		8 (3 – 44)		431.0#	< 0.001*

*#Mann-Whitney test was used * Significant P < 0.05*

Table 2. Postoperative complications in each of the study group.

-Some patients had more than one complication.

Univariate analysis was performed to detect the predictive risk factors for prolonged hospital stay in both study groups. Cardiopulmonary bypass time > 120 minutes and prolonged mechanical ventilation (>24 hours) were found to be independent risk factors of prolonged hospital stay.

In order to detect the positive predictive value of preoperative co morbidities to the likelihood of developing any postoperative complications in the depressed LVEF group, univariate analysis was performed. There was significant increase in the risk of developing complications in patients who had preoperative myocardial infarction (p=0.02).

There was significant improvement in the mean NYHA class comparing the preoperative NYHA class to NHYA class 6 months after surgery in both groups. first group: from 2.72 ± 0.95 to 1.26 ± 0.44 (P<0.001), the second group: from 2.74 ± 0.96 to 1.28 ± 0.45 (P<0.004). **(Figure-1)**

Table(3) shows the significant increase in the LVEF from preoperatively to, before hospital discharge and 6 months postoperatively. Mean preoperative EF in group one was 25.16 ± 6.44 %, compared to 57.48 ± 4.70 % in the second group. **For the first group: LV** EF increased to was 27.34 ± 6.66% (before discharge), and EF was 33.86 ± 9.84%(6 months after surgery). (P< 0.001). **For the second group:** LVEF increased to 59.52 ± 4.78 %(before discharge), and was 59.80 ± 6.72% (6 months after surgery) (P< 0.001). **Figure (2)**

	<35% group (n = 50)	**>50% group (n = 50)**
Preoperative LVEF	25.16 ± 6.44	57.48 ± 4.70
Postoperative LVEF	27.34 ± 6.66	59.52 ± 4.78
6 months follow up LVEF	33.86 ± 9.84	59.80 ± 6.72
Preoperative vs. Postoperative LVEF	<0.001*	<0.001*
Preoperative vs. 6m follow up LVEF	<0.001*	0.004*

** Significant P < 0.05*

Table (3): Comparing preoperative, postoperative and 6 months follow up LVEF results in both groups.

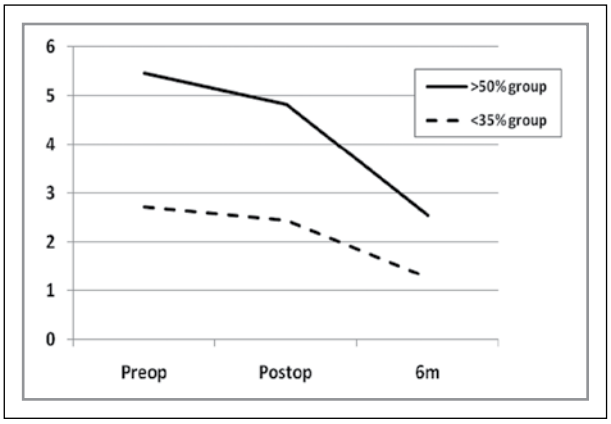

Fig 1. Comparing preoperative and postoperative changes in NYHA class in both groups.

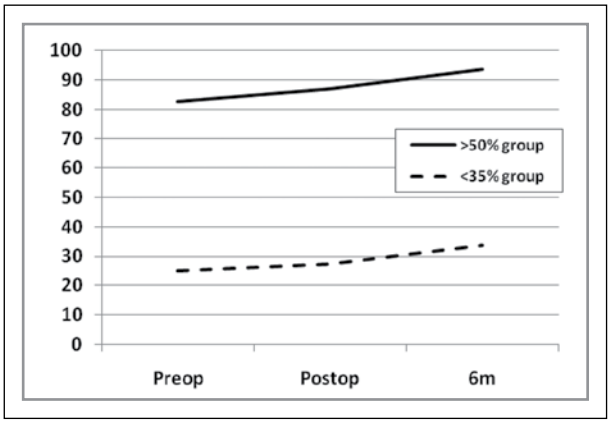

Fig 2. Comparing preoperative, postoperative and 6 months follow up EF results in both groups

Discussion

The prevalence of depressed LVEF in patients undergoing CABG is growing due to recent advances in medical therapies resulting in older, more frail surgical candidates.[5]

Depressed LVEF is known as a risk factor for mortality following CABG.[6] Reviewing the literature, there was still controversy about risk assessment, outcomes and complications of surgery in this subgroup of patients.[7] To address these issues, we designed the present study: we elected EF≤35% as a cut off value which is currently consistent with the most recent European guidelines.[8] In this study, the two groups were pair matched with multiple variable, in view of that, there was no significant difference in age, gender, body mass index, NYHA functional class, incidence of diabetes, hypertension, COPD, and history of previous cerebro- vascular accident (CVA).

The operative technique in the present study was isolated routine CABG utilizing CPB. Some authors reported less complications, less length of stay if surgery is done off pump.[9,10] Others recommended that surgery could be done on or off CPB but still low LVEF patients had more morbidity and mortality.[11] Others failed to document significant advantage to using the off-pump technique.[12,13] In our study there was no significant increase in mean CBP time between the 2 groups (P=0.151). Also, there was no significant increase in aortic cross clamp time comparing both groups (P=0.74). Similarly, other studies found no significant differences in cardiopulmonary bypass time and cross clamp time.[14,15] However, other authors reported significantly longer cardiopulmonary bypass in patients with LVEF <35% (p < 0.001).[16] In our study there was a significant increase in the incidence of overall use of intra-aortic balloon pump IABP in the first group compared to second group (P=0.029).

Expanded the potential clinical applications of IABP, to include high risk patients who undergo CABG[19] Miceli et al. (2009) concluded that patients who got IABP earlier(when indicated) had less incidence of postoperative MI (P<0.006), less incidence of Postcardiotomy low cardiac output syndrome(P<0.006) and shorter length of stay.[18] Shapira et al. (2006) reported similar results to our study.[15]

The total incidence of postoperative complications was significantly higher in first (P<0.009). Similarly, others reported that patients with LVEF < 35% had significantly higher postoperative complications.[15, 16] Also there was a significant increase in the incidence of postoperative low cardiac output(LCO) requiring use of inotropic medications in first group (p<0.043). Nemec et al. (2001) reported LCO in 75% of patients with low LVEF.[19]

However, in the study by Lslamoglu et al. (2002), LCO developed in only 5.55% of his patients with low LVEF[20], while Jemielity et al. (2001) reported 32.5% in patients with LVEF< 40%. [21] This variation may be attributed to difference in patient population and co morbidities. Ding et al. (2015) concluded that LCO lead to higher mortality, higher rates of morbidity, and longer ICU and postoperative hospital stay.[22] In our patient population the incidence of bleeding requiring reoperation was 3% (n=3). These findings come within the variant incidence of reoperation after on-pump coronary grafting reported in literature.[23- 25]

The overall incidence of postoperative renal impairment requiring hemodialysis was 1%. This was lower than the incidence reported by other authors in similar patient population; others reported overall incidence of renal failure was 13.2% of patients with depressed LVEF.[24] There was no significant difference in the mean length of intensive care unit (ICU) stay in our study (p= 0.546). However, there was a significant difference (p<0.001) in overall hospital stay between first group and second group. This is similar to, Shapira et al. (2006) who reported that the mean length of hospital stay was significantly higher in low LVEF(p < 0.0001).[15] Also, Wu et al. (2006) reported that, patients with LVEF < 35% had longer hospital.[16]

In the first group, the mean EF increased significantly after surgery (P<0.001). Moreover, comparing EF recorded preoperatively to 6 months after surgery, there was a significant increase in EF in both groups. In the first group, the mean EF increased from 25.16 ± 6.44 to 33.86 ± 9.84% (P<0.001), while in the second group, EF raised from 57.48 ± 4.70 to 59.80 ± 6.72% (P<0.004). Other authors in literature reported similar increase in the postoperative EF in patients with poor LVEF,[26-30] confirming that revascularization helps the LVEF if ischemia is reversible. There was no mortality in our study in either groups till the end of the follow up period (6 months Postoperatively). Reviewing the literature, mortality rate of (2.7% to 33%) was reported in multiple series. [15, 28, 30-33]

The improved survival rate observed in our study is most likely related to multiple factors, including meticulous patient selection and peri-operative management. Patient selection is, undoubtedly, a critical factor. Viability studies were performed in all patients with depressed LVEF in our study. Some authors advocate routine viability study in patients with depressed LVEF[34], while others use it selectively.[35] Other key factors accounting for the improved survival observed in our series include: insisting on complete revascularization, low threshold for use of IABP, use of heparin-bonded cardiopulmonary bypass circuits with reduced systemic anticoagulation, and all patients received Aspirin 325mg on arrival to the ICU.

Univariate analysis for both groups in our study showed that: cardiopulmonary bypass time > 110 min. and prolonged mechanical ventilation (>24 hours) were the only significant independent predictors of increased length of hospital stay in both groups hospital mortality. [15, 36] We suggest that chronological age is less important than biological age, frailty should be taken in consideration. Other authors suggested that age, NYHA class, hepatic or renal dysfunction and low cardiac output syndrome postoperatively were independent risk factors for postoperative morbidities. [20,25,32,37]

Study limitations

The study has the following limitations: Small sample size may reduce the power of conclusion, but having said that, our patients were matched with multiple variables which leads to more relevant data. The duration of follow up of the patients of our study was short compared to other studies. Insufficient data about specific LV wall motion abnormalities and correlating them to Dobutamine stress Echo data pre and postoperatively. Lack of randomization. Although group matching was done with several variables, still with our data set, other variables like frailty could not be detected.

Conclusion

CABG in patients with severely impaired LV function is beneficial if ischemia is reversible. Systolic heart function improves significantly after surgical revascularization in patients with coronary artery disease and hibernating myocardium. Results of surgical revascularization in patients with depressed LVEF (<35%) are comparable to patients with LVEF>50%. Preoperative patient evaluation and risk stratification is of outmost importance to improve outcomes. If characteristics associated with poor survival are identified, improved patient selection may be possible.

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Complete versus partial preservation of mitral valve apparatus during mitral valve replacement for chronic mitral regurgitation: Evaluation of Left Ventricular Function At Rest and During Peak Exercise

Bassem Ali Hafez

Objectives: **The aim of this work is to evaluate left ventricular function after mitral valve replacement with preservation of the chordopapillary apparatus whether partial or complete and to determine if there is any real difference between complete preservation (CP) and partial preservation (PP) of the mitral valve apparatus.**

Background: **Severe mitral regurgitation overloads the left ventricle. Over time, volume overload results in ventricular dilatation and eventual contractile dysfunction. Preservation of chordopapillary apparatus during mitral valve replacement (MVR) has been associated with more favourable left ventricular remodeling and less risk of death or postoperative low cardiac output syndrome (LCOS). Several laboratory and clinical investigations have demonstrated superiority of total chordal preservation over posterior chordal preservation regarding improvement of ejection performance, reducing chamber size and systolic wall stress.**

Methods: **This study included fifty patients underwent isolated mitral valve replacement (MVR) for chronic mitral insufficiency, they were divided into two groups: Group I included twenty five patients underwent MVR with complete preservation of both anterior and posterior chordopapillary apparatus (C-MVR). Group II included twenty five patients underwent MVR with preservation of the posterior leaflet only (P-MVR). The two groups were compared regarding preoperative, operative, and postoperative data. Left ventricular (LV) function was evaluated utilizing echocardiography preoperatively and 3-6 months postoperatively at rest and during peak exercise using dobutamine stress echocardiography (DSE).**

Results: **No significant differences were observed between both groups with respect to most preoperative variables. A typical proportion of age, sex and NYHA functional class was present in both groups. Patients in group I (C-MVR) had a significantly longer bypass time, cross clamp time, postoperative ventilator support as well as longer intensive care unit stay. There was no statistically significant difference between preoperative and postoperative left ventricular ejection fraction (LVEF) at rest in both groups, but LVEF was significantly higher postoperatively at stress during DSE in both study groups. Both groups demonstrated a significant reduction in left ventricular end diastolic dimension (LVEDD) and left ventricular end systolic dimension (LVESD) postoperatively both at rest and at stress during DSE. There was no significant difference between C-MVR or P-MVR groups regarding postoperative LVEF at rest and during stress (DSE), and both strategies were not different from each other.**

Conclusion: **Preservation of the chordopapillary apparatus whether partial or complete during mitral valve replacement for chronic mitral regurgitation is associated with beneficial postoperative clinical and echocardiographic outcomes and a more favorable left ventricular remodeling. Also there was significant improvement of left ventricular function during stress for both groups.**

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Complete preservation of mitral valve apparatus C-MVR (technically more-difficult surgery) is not superior to only posterior leaflet preservation P-MVR (technically less-difficult surgery) in terms of hard outcomes and LVEF.

Despite the fact that existing evidence advocates the preservation of the mitral apparatus during mitral valve replacement (MVR), it is not performed routinely. Surgeons are refractory to using preservation techniques because a possible left-ventricular outflow obstruction may occur as preserved tissue interferes with prosthesis function, mainly in patients with septal hypertrophy undergoing anterior leaflet preservation[1].

Recent studies suggest that surgeons should perform, as much as possible, preservation of mitral apparatus and use techniques to avoid and/or eliminate the problem of left-ventricular outflow obstruction because patients who underwent MVR with preservation of the mitral valve apparatus (partial or complete) experienced less risk of death (30-day and 5-year follow-ups) and postoperative low cardiac output syndrome (LCOS)[2].

Left ventricular response to corrective surgery depends largely on the functional state of the ventricle before surgery and the surgical procedure that is performed. When the valve, including the subvalvular apparatus, is replaced with prosthesis, the ventricle becomes more spherical, long-axis shortening declines and the EF falls. By contrast, valve repair or replacement with preservation of the subvalvular apparatus is not associated with a significant fall in the EF[3].

Resection of chordopapillary apparatus during mitral valve replacement (MVR) has been associated with a negative impact on postoperative left-ventricular remodelling and survival. On the contrary, more favourable remodelling has been observed with the use of subvalvular preservation techniques. There are few data available to clarify the relative effects of partial versus complete preservation of both anterior and posterior chordopapillary apparatus in MVR[4].

The aim of this work is to evaluate left ventricular function after mitral valve replacement with preservation of the chordopapillary apparatus whether partial or complete and to compare between mitral valve replacement with total preservation of mitral valve tissue and partial (posterior leaflet) preservation at rest and during peak exercise using dobutamine stress echocardiography (DSE).

PATIENTS AND METHODS

Fifty patients underwent isolated mitral valve replacement (MVR) for chronic mitral insufficiency done in Sharque ElMadena hospital from Jan. 2012 to Jun 2014. Patients were divided into two groups. Group I included twenty five patients underwent MVR with complete preservation of both anterior and posterior chordopapillary apparatus (C-MVR). Group II included twenty five patients underwent MVR with partial preservation of the chordopapillary apparatus (P-MVR), in these patients the anterior leaflet was completely excised and a partial or complete preservation of the posterior leaflet was performed as they had a more frequently redundant or excessive cuspal tissue, subvalvular fusion, extensive scarring and shortening or calcification of the anterior chordopapillary apparatus.

Patients with pure mitral stenosis, redo heart surgery, associated ischemic heart disease requiring coronary artery bypass surgery, aortic valve disease necessitating aortic valve replacement and patients with infective endocarditis were excluded from the study.

A standard operative technique utilizing extracorporeal circulation and moderate systemic hypothermia (28°C-32°C) with myocardial protection by antegrade cold intermittent blood cardioplegia was used in all patients. In this study, left atriotomy was the approach performed in all patients and all valves used were mechanical low profile bileaflet type size 27.

Many techniques had been utilized in order to accommodate the valve and to prevent the possibility of prosthetic interference by the retained native leaflets such as commisurotomy, splitting of the matted chordae or papillary muscles, partial decalcification of the posterior leaflet when feasible ormidline splitting of the posterior leaflet. In many patients of the C-MVR group, the anterior leaflet was divided into two or more segments and reattached to the annulus, according to the procedure described by Miki et al [5].

The two groups were compared regarding preoperative, operative, and postoperative data. Echocardiographic examination was the corner stone in patient's evaluation either preoperatively or postoperatively (Hewlett-Packard Sonos 1000; with a 2.7- or 3.5-MHz transducer). Three to six months after surgery complete resting echocardiographic doppler study to be repeated together with dobutamine stress echocardiography (DSE).

RESULTS

Preoperative characterstics:

Patient characteristics are shown in table 1. No significant differences were observed between both groups with respect to most preoperative variables. There was no significant difference between both groups(C-MVR and P-MVR) with respect to age and sex, although there was a greater percentage of female in both groups. Regarding the New York Heart Association (NYHA) functional classification, all patients operated upon in both groups were in class III/ IV with most of the patients (60%) were in NYHA class IV and there was no significant difference between both examined groups.

Variable	GROUP I (C-MVR) N= 25	GROUP II (P-MVR) N= 25	P- value
Age (years)	29.64± 9.4	29± 7.9	0.8
Female sex	16 (64%)	16 (64%)	1
NYHA III IV	10 (40%) 15 (60%)	10 (40%) 15 (60%)	1
AF	16 (64%)	15 (60%)	0.69
COPD	3 (12%)	2 (8%)	0.69
Renal impairment	1 (4%)	1 (4%)	1

NYHA= New York Heart Association; AF= Atrial Fibrillation; COPD= chronic obstructive pulmonary disease.

Table 1: Preoperative Characteristics of Study Groups

Operative Data

Bypass time and aortic cross clamp time were significantly longer in C-MVR group, otherwise there was no significant difference between both groups (table 2).

Variable	GROUP I (C-MVR) N=25	GROUP II (P-MVR) N=25	P- value
Clamp time(minutes)	47.4± 3.4	38.6± 3.8	<0.001
Bypass time(minutes)	68.1± 2.9	59.68± 6.2	<0.001
Need for inotropes	7 (28%)	8 (32%)	0.7
Need for vasodilator	4 (16%)	5 (20%)	0.6

Table 2: Operative data

Postoperative Data

Patients in group I with complete preservation of mitral valve chordopapillary apparatus showed a significantly longer ventilation time that ranged from 9- 12 hours with a mean of (10.8± 1) versus a range of 7- 12 hours and a mean of (9.5± 1.7) in group II with partial (posterior leaflet) preservation of the chordopapillary apparatus (p= 0.002). There was no statistically significant difference between both groups regarding the need for inotropic support and the use of vasodilators.

The length of stay in the intensive care unit (ICU- stay) was significantly more in group I (23- 32 hours with a mean of 27.5± 2.8) than in group II (18- 28 hours with a mean of 23± 3) (p<0.001), however the total hospital stay did not show any statistically significant difference between both groups (table 3).

Variable	GROUP I (C-MVR) N=25	GROUP II (P-MVR) N=25	P- value
Ventilation time (hours)	10.8± 1	905±1.7	0.002
Inotropic support	7(28%)	8(32%)	0.7
Vasodilator	4(16%)	5(20%)	0.6
ICU stay (hours)	27.5± 2.8	23± 3	<0.001
Hospital stay (days)	11.5± (1.3)	11.8± (1.58)	0.57

ICU= Intensive Care Unit.

Table 3. Postoperative characteristics

Echocardiographic characterstics of Group I (C-MVR):(table 4)

Comparative study between preoperative and postoperative echocardiography both at rest and during peak exercise using dobutamine stress echo (DSE) had been performed for group I (C-MVR) with stress on left ventricular ejection fraction as an indicator for left ventricular function (Fig.1). There was no statistically significant difference between preoperative and postoperative left ventricular ejection fraction (LVEF %) at rest (P1= 1), while there was a significant increase in LVEF postoperatively at stress during DSE (P2 and P3 <0.001). Overall, there was a significant difference between left ventricular ejection fraction preoperatively and postoperatively both at rest and during peak exercise as total P<0.001.

P1 = shows comparison between preoperative and postoperative values at rest.

P2 = shows comparison between preoperative and postoperative values at stress.

P3 = shows comparison between postoperative values at rest and stress.

Total P = shows comparison between P1, P2 and P3.

There was a significant postoperative reduction in both left ventricular end diastolic dimension (LVEDD) and left ventricular end systolic dimension (LVESD) both at rest and during DSE.

Echocardiographic characteristics of Group II (P-MVR): (table 5)

Comparative study between preoperative and postoperative echocardiography both at rest and during peak exercise using dobutamine stress echo (DSE) had been performed for group II (P-MVR) with stress on left ventricular ejection fraction as an indicator for left ventricular function (Fig.1). Also, there was no statistically significant difference between preoperative and postoperative left ventricular ejection fraction (LVEF %) at rest (P1= 0.38), while there was a significant increase in LVEF postoperatively at stress during DSE (P2=0.007 and P3 <0.001). There was significant difference between P1, P2 and P3 as total P < 0.001. Again, there was a significant postoperative reduction in both left ventricular end diastolic dimension (LVEDD) and left ventricular end systolic dimension (LVESD) both at rest and during DSE.

Postoperative Echocardiographic Data in Group I and Group II:

Table 6 shows comparison between echocardiographic data postoperatively at rest (P1) and at stress (P2) in both examined groups. There was no significant difference in all variables as p > 0.05

Variable	Preoperative	Postoperative (resting)	Postoperative (stress)	P value			
				P1	P2	P3	Total P
EF%	71.5± 6.6	71.4± 8.1	78.4± 6.8	1	<0.001	<0.001	<0.001
FS	35± 5.4	35.2± 5.59	41.2± 5.7	1	<0.001	<0.001	<0.001
LVEDD	5.9± 0.95	5.18± 0.76	4.88± 0.68	0.001	<0.001	0.001	<0.001
LVESD	3.8± 0.73	3.3± 0.59	2.8± 0.52	0.001	<0.001	0.001	<0.001
LAD	5.36± 0.9	4.34± 0.66	4.47± 0.6	<0.001	<0.001	0.038	<0.001
CI	3.45± 0.6	3.51± 0.67	7.88± 2	1	<0.001	<0.001	0.001
CO	5.4± 0.8	5.6± 1.2	12.4± 2.64	0.5	<0.001	<0.001	<0.001

EF%= ejection fraction; FS= fractional shortening; LVEDD= left ventricular end diastolic dimension; LVESD= left ventricular end systolic dimension; LAD= left atrial dimension; CI= cardiac index; CO= cardiac output.

P1 = comparison between preoperative and postoperative values at rest.

P2 = comparison between preoperative and postoperative values at stress.

P3 = comparison between postoperative values at rest and stress.

Total P = comparison between P1, P2 and P3.

Table 4. Comparison between preoperative and postoperative Echo in group I

Variable	Preoperative	Postoperative (resting)	Postoperative (stress)	P value			
				P1	P2	P3	Total P
EF%	69.9± 7.6	67.4± 12.2	75.5± 10	0.38	0.007	<0.001	0.002
FS	34± 6.3	32.6± 7.7	39.5± 7.4	0.8	0.001	<0.001	<0.001
LVEDD	6.14± 1.1	5.58± 1.09	5.26± 0.92	0.007	<0.001	0.01	<0.001
LVESD	4± 0.9	3.7± 1	3.2± 0.9	0.005	<0.001	<0.001	<0.001
LAD	5.3± 0.9	4.47± 0.87	4.51± 0.78	<0.001	<0.001	1	<0.001
CI	3.4± 0.7	3.5± 0.9	7.5± 2.2	1	<0.001	<0.001	<0.001
CO	5.54± 1.1	5.59± 1.4	12± 3.4	1	<0.001	<0.001	<0.001

EF%= ejection fraction; FS= fractional shortening; LVEDD= left ventricular end diastolic dimension; LVESD= left ventricular end systolic dimension; LAD= left atrial dimension; CI= cardiac index; CO= cardiac output.

P1 = comparison between preoperative and postoperative values at rest.

P2 = comparison between preoperative and postoperative values at stress.

P3 = comparison between postoperative values at rest and stress.

Total P = comparison between P1, P2 and P3.

Table 5. Comparison between preoperative and postoperative Echo in group II

variable	Postop. Echo at rest		P1	Postop. Echo at stress		P2	Total P
	GROUP I	GROUP II		GROUP I	GROUP II		
EF%	71.4± 8.1	67± 12.2	0.13	78.4± 6.8	75.5± 10	0.2	0.13
FS	35.2± 5.59	32.6± 7.7	0.17	41.2± 5.7	39.5± 7.4	0.3	0.17
LVEDD	5.18± 0.76	5.58± 1.09	0.13	4.88± 0.68	5.26± 0.92	0.1	0.9
LVESD	3.3± 0.59	3.7± 1	0.9	2.8± 0.52	3.2± 0.9	0.1	0.9
LAD	4.34± 0.66	4.4± 0.87	0.5	4.47± 0.6	4.5± 0.78	0.8	0.56
CI	3.51± 0.67	3.5± 0.9	0.8	7.88± 2	7.5± 2.2	0.5	0.74
CO	5.6± 1.2	5.59± 1.4	0.9	12.4± 2.64	12± 3.4	0.6	0.83

EF%= ejection fraction; FS= fractional shortening; LVEDD= left ventricular end diastolic dimension; LVESD= left ventricular end systolic dimension; LAD= left atrial dimension; CI= cardiac index; CO= cardiac output.

Table 6: Comparison of postoperative echo between group I (C-MVR) and group II (P-MVR) at rest and at stress

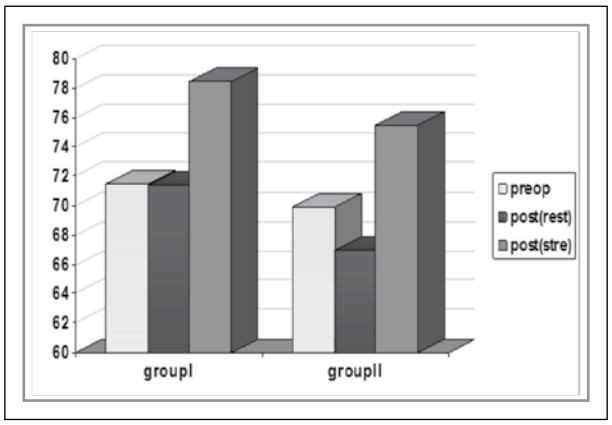

Fig 1. Differences between means of preoperative and post operative EF among both groups

DISCUSSION

MV surgery aims to correct haemodynamics without damaging LV function. An increased awareness that ventricular function deteriorates with chordal transection during MVR has led to an emphasis on repair or replacement methods that preserve annulo-ventricular continuity. The direct consequence of this preservation was the improvement of both early and long-term results of MV operations [4].

Recently, Sá MPBO et al [2] published a new meta-analysis suggesting that surgeons should perform, as much as possible, preservation of mitral apparatus but despite this fact, they did not establish whether there is any difference between complete and partial preservation during MVR. This issue was an area to be addressed in this study.

Patients in group I (C-MVR) seemed to have technically more-difficult surgery as clamp time and total bypass time were significantly longer, also postoperative ventilator support and intensive care unit (ICU) stay were significantly more in C-MVR group. The same results were recorded by Michel Pompeu et al [6]. In the study of Ahmet Coskun et al [7], no differences were found between the 2 groups in their need for inotropic agents or intra-aortic balloon pump support, or in cross-clamp time, duration of intensive care unit or hospital stays.

In our study, left ventricular ejection fraction did not show any statistically significant difference between preoperative and postoperative values at rest in both groups. The same was reported in the study of Michel Pompeu et al [6], where neither C-MVR nor P-MVR demonstrated a statistically significant improvement in LVEF before and after surgery, and both strategies were not different from each other.

On the other hand, Nielsen et al [8] found that section of the chordae to the anterior leaflet had a considerably more deleterious effect on LV systolic function than section of the chordae to the posterior leaflet. This observation has been explained by the concept of regional afterload reduction. The anterior leaflet is larger and development of tension in the chordae to this leaflet should be greater at a given LV pressure. Moreover, the anterior MV leaflet second-order (or 'strut') chordae are involved in valvular–ventricular interaction and transection of these chordae would adversely perturb regional LV systolic function.

Ahmet Coskun et al [7] demonstrated that in the C- MVR group, no decrease was observed in left ventricular ejection fraction during the postoperative period, whereas a significant reduction was observed in the P- MVR group (P=0.003). And in the study of Gonçalo F. et al [9], patients submitted to MVR

for rheumatic mitral valve disease were found to have a poor prognosis, independently of having the subvalvular apparatus preserved.

Postoperative dobutamine stress echocardiography (DSE) demonestred a significant improvement in left ventricular function at stress in both study groups. Similar resuls was recorded by Oda [10] who used DSE to evaluate left ventricular function after surgery for pure mitral regurgitation in 175 patients and suggested that preservation of papillary muscle-mitral annular continuity during mitral valve surgery for pure MR is beneficial to LV systolic function.

Many studies have demonstrated that LV dimensions and function are improved with mitral subvalvular preservation[4-11]. onsequently, LV ejection and pulmonary hypertension may also improve with time because of more favourable LV remodelling. Our study recorded a significant improvement in left ventricular end diastolic dimensions (LVEDD) and left ventricular end systolic dimensions (LVESD) postoperatively at rest and during DSE in both groups.

When comparing group I (C-MVR) and group II (P-MVR) postoperatively, we found no significant differences between both groups regarding left ventricular function and dimensions both at rest and during DSE.

Unlikely, Yun et al.[12] suggest that complete chordal preservation during MVR confers a significant advantage to the patient by reducing left ventricle chamber size and systolic afterload and minimizing any early postoperative drop in ejection fraction performance. Conversely, resection of the anterior chordae during MVR results in augmented systolic left ventricle afterload, thereby reducing pump performance, i.e. a larger decline in long-axis fractional shortening and ejection fraction and an increase in end-systolic volume.

Ahmet Coskun et al [7] concluded that bileaflet preservation prevented the decrease in left ventricular ejection fraction that usually followed preservation of the posterior leaflet alone. However, posterior leaflet preservation alone yielded excellent results in terms of decreased left ventricular diameter.

CONCLUSION

In light of this study we conclude that, preservation of the chordopapillary apparatus whether partial or complete during mitral valve replacement for chronic mitral regurgitation is associated with beneficial postoperative clinical and echocardiographic outcomes and a more favorable left ventricular remodeling. Also there was significant improvement of left ventricular function during stress for both groups.

Comparison between complete preservation of mitral valve apparatus C-MVR and posterior leaflet preservation P-MVR demonstrated that C-MVR (technically more-difficult surgery) is not superior to only P-MVR (technically less-difficult surgery) in terms of hard outcomes and LVEF.

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Predictors of Outcome and Management of Cardiogenic Shock Following Coronary Artery Bypass Surgery

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Cardiogenic shock may arise from a number of different etiologies. It carries a mortality of 50-90% varying according to the mechanism of hemodynamic insult and the aggressiveness of treatment. The incidence of cardiogenic shock has been raised after the widespread use of coronary artery bypass grafting procedures.

Aim of the work : **At finding the line of treatment for cardiogenic shock that follows complicated CABG procedures in an attempt to improve the morbidity and life expectancy of the growing slice of the society.**

Patients and Methods: **This is a prospective clinical one, which was conducted during the period of January 2012 till January 2014. It included 48 patients who underwent on-pump CABG complicated by cardiogenic shock development in the early postoperative period.**

A variety of preoperative and operative data were collected and analyzed for their coincidence with early postoperative cardiogenic shock and the outcome of surgical procedures.

Results: **The study included 48 patients with a mean age of 59.4±7.6 years (Range from 39 to 71 years). The male to female ratio was 3:1.Six patients died within 30 days following the initial surgery, 4 of them died during the course of medical treatment (16% of group I, n=24) due to intractable arrhythmia and renal failure. In one of them Obtuse marginal artery was occluded while LAD was occluded in another patient.**

On the other hand 2 patients in Group II (IABP group) died, one of them 20 days postoperatively due to severe chest infection and the other one died after 7 days due to multiorgan failure.The most frequent complications in descending order were: difficult weaning from mechanical ventilation, arrhythmias specially ventricular and neuro-psychological disorders.

Complications related to Intra-aortic Balloon Pump included: Groin hematoma in 3 patients, limb ischemia in one patient and hemolytic complications in 3 patients.

Conclusion **From this study, we recommend conducting further studies on the same field with selection of patients with better health status and following them for longer periods up to 5 years.**

We also recommend that IABP should be inserted within maximum 12 hours after failure of pharmacologic treatment.

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Cardiogenic shock may arise from a number of different etiologies. It carries a mortality of 50-90% varying according to the mechanism of hemodynamic insult and the aggressiveness of treatment. (1)

The incidence of cardiogenic shock has been raised after the widespread use of coronary artery bypass grafting procedures. Acute infarction may result from loss of critical muscle mass or occlusion of the newly formed graft, acute valvular insufficiency, cardiac tamponade, severe electrolyte disturbances, pulmonary embolism,

sever hypertension, tension pneumothorax, hemothorax, hypoventilation syndrome or intractable arrhythmias that are expected complications of those surgical procedures can precipitate the occurrence of cardiogenic shock. [2]

The appropriate treatment of cardiogenic shock after CABG is considered by many specialists as a mysterious enigma. Medical lines are the most frequent to be used and they include inotropes and even thrombolytic therapy. If pharmacologic manipulations of preload, afterload and contractility failed, minimally invasive interventions as Intraaortic Balloon Pump (IABP) are considered. [3,22]

Immediate and aggressive treatment combined with early revascularization is thought to be associated with great myocardial salvage and better survival of cardiogenic shock patients. The greater use of interventional procedures is thought to be responsible for the improved outcome of cardiogenic shock patients. [3,21]

This work aims at finding the line of treatment for cardiogenic shock that follows complicated CABG procedures in an attempt to improve the morbidity and life expectancy of the growing slice of the society.

Patients and Methods

This is a prospective clinical one, which was conducted during the period of January 2012 till January 2014. It included 48 patients who underwent on-pump CABG complicated by cardiogenic shock development in the early postoperative period.

A variety of preoperative and operative data were collected and analyzed for their coincidence with early postoperative cardiogenic shock and the outcome of surgical procedures.

Cardiogenic shock is diagnosed when the following criteria are fulfilled:

1. Systolic blood pressure less than 90 mmHg.
2. Cardiac index (CI) < 2.2L/min/m2
3. Pulmonary capillary wedge pressure (PCWP) > 18 mmHg
4. Elevation of systemic vascular resistance.

The 48 patients enrolled in this study were divided into 3 groups according to the mode of treatment. The modes of treatment were employed in a ladder-like pattern according to the response of the patients.

Group I: included 24 patients, who responded to the pharmacological treatment alone.

Group II: 15 patients, who improved with Intraaortic balloon pump after failure to respond to pharmacological treatment alone.

Group III: 9 patients in whom surgical measures were undertaken. The surgical lines included surgical exploration for patients with cardiac tamponade or uncontrollable bleeding or coronary artery bypass reoperation in case of early graft failure.

Inclusion criteria for re-exploration:

1. Uncontrollable bleeding despite normal coagulation profile.
2. Postoperative tamponade manifested by:
   a. High CVP
   b. High PCWP
   c. Absent oscillation in mediastinal tubes.
   d. Echocardiographic evidence.
3. Failure to respond to other measures with increased drains in the tubes.

Inclusion criteria for Re-do CABG:

1. Excluding other possible causes of cardiogenic shock.
2. PCWP>18 mmHg with increased systemic vascular resistance, decreased mixed venous oxygen saturation.
3. New changes in ST-segment or new Q-waves in ECG.
4. CK-MB levels > 80 U/L
5. Refractory ventricular arrhythmias and pump failure manifestations.
6. Angiographic evidence of graft occlusion. (whenever possible)

Follow up of the patients:

Allover their in-hospital stay, all the patients enrolled in the study were followed up for morbidity and mortality after treatment of cardiogenic shock.

Results

The study included 48 patients with a mean age of 59.4±7.6 years (Range from 39 to 71 years). The male to female ratio was 3:1. The relevant preoperative medical conditions are summarized in table 1.

Mean left ventricular EF at the beginning of the study was 0.44±0.8.44. Operative data ate listed in Table 2.

Eight patients died within 30 days following the initial surgery, 4 of them died during the course of medical treatment(group 1) , due to intractable arrhythmia and renal failure. In one of them Obtuse marginal artery was occluded while LAD was occluded in another patient.

On the other hand 3 patients in Group II (IABP group) died, one of them 19 days postoperatively due to severe chest infection and the other two died after 9 days due to multiorgan failure.

In Group III, only one patient died because of persistent cardiogenic shock after Re-do CABG using a radial artery graft.

Our study demonstrated that LAD was the most likely to be occluded (N=27, 56%), followed by the right coronary artery (n=19,40%). Occlusion of the LAD combined with left Circumflex artery (LCX) was found in 8 patients, 16.6%). The great saphenous vein was the most commonly used conduit in this study.

The most frequent complications in descending order were: difficult weaning from mechanical ventilation, arrhythmias specially ventricular and neuro-psychological disorders.

Complications related to Intra-aortic Balloon Pump included: Groin hematoma in 4 patients, limb ischemia in two patient and hemolytic complications in 3 patients.

Medical condition	Number	%
Systemic Hypertension	34	70.8
Diabetes Mellitus	21	44
Hypercholestremia	41	85
Hypertension & Hypercholestremia	30	62.5
Hypertension & Diabetes Mellitus	13	27
Diabetes & Hypercholestremia	21	43.8

Table (1) Preoperative medical conditions

Patient's Data	Number of Patients	Mean	SD
Cardiac Index (L/min/m2)	48	1.7	0.8
Systolic BP (mmHg)	48	90.3	14.8
Diastolic BP (mmHg)	48	56.2	13.9
Pulmonary Capillary Wedge Pressure (mmHg)	48	22.8	6.9
Aortic X-clamp (min)	48	24.52	5.9
Graft Number	48	2.48	1.04
Cardiopulmonary Bypass Time (min)	48	95.63	39.45
Blood Units used	48	4.39	1.69
Duration of IABP (days)	12	7.28	4.3
Hospital Stay (days)	40	15.39	6.9

Table (2) Operative data & Hospital Stay

Risk Factors for Early Mortality

Variable	Survived	Died	p-value
Number of patients	40 (85.40%)	8 (16.6%)	<0.01
Gender:	55±3.6	57±8.2	NS
Male	66%	50%	
Female	34%	50%	
Preoperative Risk Factors:			
Hypertension (>90)	40	83	<0.05
Diabetes Mellitus	41	85.4	<0.05
Hypercholestreamia	44	91.6	<0.01
Smoking	41	8.45	<0.05
Preoperative NYHA Class:			
I+II	54.3	62.9	NS
III+IV	45.7	35.8	NS
Preoperative creatinine level	1.07±0.3	1.02±0.25	NS
Preoperative MI	64.6	75.9	<0.05
LVEF%	46.2	36.8	NS
Aortic X-clamp time	23.2±.9	40.8±9.1	<0.05
CPB time	74.8±37.2	138.12±43.	<0.05

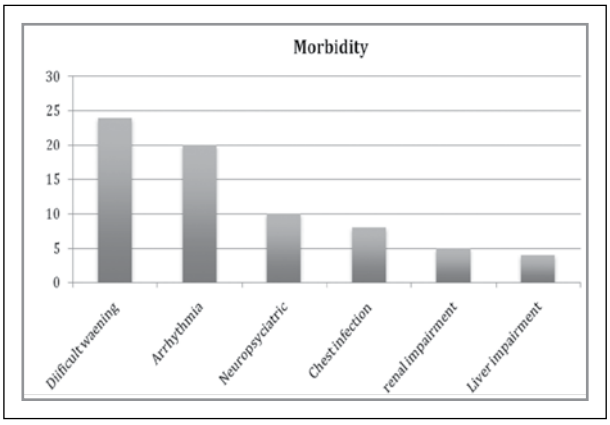

Fig 1. Histogram showing the complications after the initial procedure

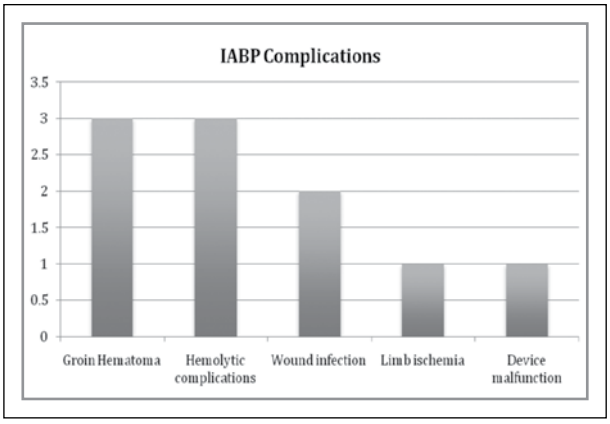

Fig 2. Complications of Intra-aortic Balloon Pump Counter pulsation

DISCUSSION

Cardiogenic shock complicates 7 to 10% of cases of acute MI and is associated with 70 to 80% mortality rate. [5,20]

Followingcoronary artery bypass grafting (CABG), cardiogenic shock occurs in 10-15% of patients. [6]

This study was a prospective clinical trial evaluating the management of cardiogenic shock after CABG. The primary outcome measure in this study was the mortality rate at 30 days. The mortality within 30 days was 15.8% for group I and 16.7% for group II. These rates were found to be relatively low for patients of their hemodynamic profile and even lower than those reported by other authors. [7,22]

This may be due to selection of younger patients as all patients in this study were younger than 75 years of age (mean age for group I was 60.7 years and for group II 61.8 years.). The significant interaction of age and the benefit of early revascularization were found to be most marked in those under 75 years of age as pointed out by Hochman et al, 1990. [12]

In two large earlier studies the mortality at one month for coronary artery reoperation varied between 4.0 and 4.8%. However, the three-redo CABG procedures in this study was done emergently. One of the cases was reoperated upon 12 hours after initial surgery. The cases has their other two redo CABG 26 and 48 hours following the first CABG. [7,8]

For the above-mentioned reasons the survival rate for redo CABG patients in this study (66.7%) was closer to those dredged from emergent revascularization of occluded coronaries for cardiogenic shock (SHOCK Trial), which ranged from 40 to 57.4%. [21]

All diabetic patients in this study had serum cholesterol level > 220mmg/dl. So the latter could not be eliminated as a possible cofounder.

Preoperative NYHA class differences were insignificant between survivors and those who did not survive. This was found to be similar to the results of previous studies. [2,9]

Prolonged aortic cross clamp and cardiopulmonary bypass times were important reasons for mortality in our study. However, Arafa and coworkers considered them sole factors of mortality but the indications for surgery in their study included not only ischemic disease but also valve disease. [10]

IABP improves the outcome when used before initial CABG when ventricular ejection fraction is < 25%, [11] and in those undergoing repeat CABG surgery. [12]

Improvement in left ventricular pump function, cardiac output and significant reduction in the dose of sympathomimetic within first 12 hours of IABP were considered to be a good predictor which occurred in all but 2 patients died in spite of IABP insertion. Similar observations were mentioned by Eremenko et al., 2005. [3]

The mortality rate related to IABP is within wide range from minor local infection to death. In this study major IABP complications as limb ischemia, device malfunction and hemolytic complications affected 42% of patients. Obviously increasing numbers of patients who have undergone CABG, the incidence of repeat CABG is rising.

In this study, 3 patients underwent on-pump redo CABG after early in-hospital graft occlusion. Early (within 7 days) graft occlusion is not uncommon occurring in 7% of vein grafts and 2% of LIMA conduits.

Revision of the grafts was done in all patients when one or more of the following criteria were fulfilled: new localized ST-segment changes, CK-MB > 80U/L, new Q waves in ECG, sustained ventricular arrhythmias, and ventricular fibrillation according to Rasmussen et al., 1997. [18]

Graft failure or incomplete revascularization was found in all patients fulfilling thesecriteria in this study. Unlike other studies, only one patient underwent c coronary angiography in this study.

Holmvang et al., 2002 illustrated that ST-segment deviation and T-wave inversion usually associated with acute ischemia were not related to graft occlusion and that Troponin T value > 3ug/L were the only independent predictor of in-hospital graft occlusion. [4,13]

Moreover, Jaffe et al., 2000 stated that interpretation of the ECG data are hampered because pericardial involvement and changes in heart position may cause ECG changes without graft occlusion. [14]

Transit time flow measurement showing only systolic flow pattern within the c coronary grafts suggesting graft failure or stenosis was proposed by Lausten et al are alternative to ECG changes. [15,16]

In this study, reliable continuous ischemia monitoring in multiple leads was performed in the ICU as suggested by Trupper-Carey et al., 200to solve some of the limitations associated with ECG data. [17,20]

The three vessel disease was insignificantly higher in the group with redo procedures (66.7%) when compared to the groups with medical therapy and IABP (18.2%) which is the same as recorded by White et al., 2005.However, the small number of our redo CABG patients limits generalization of results. [18,22]

Concerning gender impact as an independent risk factor for early morbidity after CABG, there was not a statistically significant difference after initial operation in ventricular ejection fraction between males & females unlike findings of Abramov et al., 2000, [1] yet the 30 days mortality rate was higher in females but did not reach level of significance (p=0.08)

In contrast, studies using 60 months actuarial survival as an endpoint reported a significantly higher survival for females. [19,20]

Conclusion

We recommend conducting further studies on the same field with selection of patients with better health status and following them for longer periods up to 5 years.

We also recommend that IABP should be inserted within maximum 12 hours after failure of pharmacologic treatment.

Finally we also recommend conducting further studies in which ender is taken as independent risk factor after ruling out other risk factors discussed in this research work.

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The Use of Cardiac Biomarkers as Indicators For Proper Myocardial Protection in Patients Undergoing Mitral Valve Replacement Surgery.

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Background: **The optimal temperature of cardioplegia solution in patients undergoing mitral valve surgery is still debatable. The aim of our study was to use biomarkers as indicators for proper myocardial protection to compare between warm and cold cardioplegia in patients undergoing mitral valve replacement.**

Patient and Methods: **A prospective comparative study on 100 patients undergoing mitral valve replacement surgery. Patients were divided into two groups; (warm group, used antegrade warm blood cardioplegia n = 50) and (cold group, used antegrade cold blood cardioplegia n = 50). Biomarkers of cardiac injury, operative and clinical data were collected.**

Results: **The need for DC shock, initial dose and duration of inotropes, total bypass time, the serum troponin, LDH levels were lower in the warm group by high statistically significant values (p value<0.01). The serum level of CK and CK-MB were less in the warm group by statistically significant values (p value<0.05).**

The aortic cross clamp time, the serum creatinine level, time for extubation and incidence of wound infection were less in the warm group by statistically insignificant values (p value>0.05).

Conclusion: **Intermittent antegrade warm blood cardioplegia affords better myocardial protection during global ischemia during cardiopulmonary bypass period and avoids to a great extent the postoperative low cardiac output and arrhythmias than intermittent antegrade cold blood cardioplegia.**

The remarkable advances in cardiac surgery over the last 40 years have led to the concept of "routine" open heart surgery. Although advances in cardiac surgical technique, cardiac anesthesia, and critical care have all contributed to reducing the morbidity and the mortality of cardiac operations, the evolution of intraoperative myocardial protection has been equally critical.[1]

The debate on the optimal temperature of cardioplegia still unsolved. Despite that hypothermia offers decrease in the oxygen demands, on the other hand oxygen availability in blood cardioplegia is influenced by temperature because of the leftward shift in the oxyhemoglobin saturation curve in response to hypothermia.[2]

Regarding myocardial function, hypothermia has been shown to inhibit myocardial enzymes, disrupt cellular membranes, impair calcium sequestration, decrease adenosine triphosphate production, and decrease oxygen delivery. This can lead to a poor recovery of cardiac performance after surgery.[3]

Creatine Kinase (CK) isoenzyme activity is distributed in many tissues, including skeletal muscle, but there is more of the CK-MB fraction in the heart. Most muscles have more CK per gram than heart tissue. Thus, skeletal muscle breakdown can lead to absolute increases in creatine kinase MB fraction (CK-MB) in the plasma.[4]

CK-MB has high specificity for cardiac tissue and was the preferred marker of cardiac injury for many years. CK-MB typically begins to rise four to six hours after the onset of infarction. An elevated CK-MB is relatively specific for myocardial injury,

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particularly in patients with ischemic symptoms when skeletal muscle damage is not present. Elevations return to baseline within 36 to 48 hours.[5]

Cardiac troponin concentrations usually begin to rise two to three hours after the onset of AMI or myocardial damage. By two to three hours after presentation, up to 80 percent of patients with AMI will have troponin elevations. Elevations in cardiac troponin after an AMI persist for up to 10 days, thus permitting late diagnosis.[6]

Therefore the purpose of our study was to use cardiac biomarkers as indicators to evaluate the safety and effectiveness of intermittent antegrade warm myocardial protection as compared to the standard intermittent antegrade cold blood cardioplegia in patients undergoing mitral valve replacement.

Patients and Methods

One hundred patients with mitral valve disease with or without tricuspid disease were included in this study. All patients were elective and assigned to one of two groups, the first group, which included 50 patients, received intermittent antegrade warm blood cardioplegia at normothermia, this group is known as the "warm group" throughout this study. The second group, known as the "cold group" received intermittent antegrade cold blood cardioplegia at moderate hypothermia (28ºC). All patients were evaluated preoperatively, intraoperatively, and postoperatively. Particular attention was paid to all surgical problems and postoperative complications related to the technique of myocardial protection. The exclusion criteria in our study were Patients with ischemic mitral valve, who need CABG as well. Patients with associated aortic valve disease requiring surgery, Patients in need for Emergency or redo operations, Patients with any associated surgical cardiac intervention than the mitral surgery.

Cardiopulmonary Bypass Technique:

Cardiopulmonary bypass was instituted using heparin coated hollow fiber membrane oxygenator. Systemic heparin sulphate was given in a dose of 4 mg/Kg to achieve an activated clotting time greater than 400 seconds. The activated clotting time "ACT" was done initially before giving heparin to determine the baseline value, then after giving the dose of heparin before starting the cardiopulmonary bypass and then regularly every 30 min. during the bypass to ensure proper anticoagulation. Priming was accomplished using 1000-1500ml. of a mixture of crystalloid (ringer´s or lactated ringer´s solution) and a colloid, the total volume of priming was 25 ml/Kg.

The mean perfusion pressure was between 60 and 90 mmHg, lower pressure was managed by giving vasoconstrictor agents as adrenaline or phenylephrine, and higher pressure was managed by proper sedation by anesthetic drugs as propofol, sometimes vasodilators as nitrates were used. In the cold group of patients, cooling to 28ºC was performed with rewarming again to 37ºC at the end of the procedure. Systemic flow was 2 L/m^2 /min at 28ºC and 2.2 L/m^2 /min at 37ºC. In the warm group of patients, the nasopharyngeal temperature was allowed to drift to 34ºC during the bypass, and the systemic blood flow was maintained at 2.2 L/m^2 /min all the time.

Surgical Technique:

All patients were submitted to mitral valve surgery via median sternotomy. Routine aorto-bicaval cannulation was done in all patients. Exposure of the mitral valve was done through left atriotomy in all cases.

Technique of Myocardial protection:

Patients were divided into two groups:

Group A: 50 patients had myocardial protection using intermittent antegrade warm blood cardioplegia.

Group B: 50 patients had myocardial protection using intermittent antegrade cold blood cardioplegia.

Group A (warm cardioplegia):

Normothermic blood 37˚C was collected from the oxygenator by means of ¼ inch tubing via side way from the recycle line, then using one of the roller heads of the heart lung machine. Infusion of the blood cardioplegia solution was done into the aortic root, through the cardioplegia cannula inserted into the ascending aorta. The tubing was connected to a syringe pump containing K^+ in a concentration of 2 mEq/ml. Cardiac arrest was achieved by intermittent infusion of normothermic hyperkalemic blood in the aortic root. The initial dose of cardioplegia is given with the roller pump at a rate of 300 ml/min and the syringe pump of K^+ at a rate of 150 ml/h for 3 min to deliver a total dose of 900 ml of blood cardioplegia. 2ml bolus may be given at the beginning to enhance immediate diastolic cardiac arrest. The subsequent doses of cardioplegia are given every 15-20 minutes at a rate of 200 ml/min and K^+ administered at a rate of 90 ml/h for 2 minutes.

Continuous samples for blood gases and k^+ level monitoring were obtained and diuretics may be given accordingly if hyperkalemia was present.

Group B (cold cardioplegia):

Patients of this group received blood cardioplegia at a temperature of 4°C, antegradly into the aortic root. For the induction of cardiac arrest St. Thomas hospital cardioplegia solution was used, which is composed of moderately elevated potassium (20 mmol/L) , magnesium (16 mM) , sodium (144 mmol/L) , calcium (2.2 mmol/L) and a small additive of procaine (1 mmol/L) in an extracellular ionic matrix with pH 7.0 and osmolality (300 mosm/L). Then blood is collected from the cannula

in the aortic root (before establishing of the cardiopulmonary bypass), or directly from the oxygenator via the sampling line (after establishing of the cardiopulmonary bypass), and mixed with the crystalloid cardioplegia solution at a ratio of 1:4. Each patient received an initial dose of 15-20 ml/kg of blood cardioplegia. Subsequent doses are given every 30 minutes. Topical cardiac cooling was achieved using ice slush over the arrested heart. Systemic cooling was held to 28°C.

Data Collection:

Preoperative assessment: Patient's demographic data including: age, sex. In addition to echocardiographic data as LA, EF, pulmonary artery pressure.

Intraopetrative assessment:

1. Total cardiopulmonary bypass time and aortic cross clamp time.
2. The resumption to normal rhythm after declamping (spontaneous or with DC shock.)
3. The need for inotropic support.

Immediate post-operative assessment:

1. Low cardiac output (LCO) in the form of dose and duration of inotropic support.
2. Duration of mechanical ventilation.
3. The level of creatinine, creatine kinase (CK), its isoenzyme (CK-MB), Troponin and LDH.
4. Total drainage.
5. Neurological complications and time needed to regain consciousness.
6. Incidence of wound infection.

Statistical Analysis

Data were statistically represented in terms of range, mean, standard deviation (SD), median, and percentages. Comparison between different groups was done using student *t* test for comparing parametric data, Chi square x^2 test was performed. A probability value *p* value less than 0.05 was considered significant. All statistical calculations were done using Microsoft Excel version 7 and SPSS version 10.0.

Results

There was no statistically significant difference between the cold and warm groups in the preoperative demographic data (p value > 0.05). The mean age in the warm group was 40.82 ± 13.74 years old and the mean age in the cold group was 45.06 ± 13.06 years old. The number of males to females ratio in the warm group was 28: 22 respectively, while in the cold group was 25:25 respectively.

Bypass time showed a high statistically significant difference between warm and cold groups (p value < 0.01)were in the warm group the mean value was (72.34 ± 25.09 minutes) while in the cold group the mean value was (85.66 ± 22.9 minutes).

Spontaneous recovery of sinus rhythm without the need of DC shock was more marked in the warm group where only 4 patients (8%) in the warm group needed DC shock to regain sinus rhythm , while 17 patients (34 %) in the cold group needed DC shock to regain sinus rhythm with (*p* value < 0.01) which is considered highly significant.

The need of inotropic support was documented including the initial dose of inotropes and duration of inotropic support. The warm group showed a high statistically significant less need of inotropic support (*p* value < 0.01) with mean value (0.0482 ± 0.058 mic./kg/hour) while in cold group mean initial dose of inotropic support was (0.0842 ± 0.063 mic./kg/hour). Moreover, the mean duration of inotropic support in the warm group was less than the cold group by a high statistically significant value (p value < 0.01) as it was (13.68 ± 26.01 hours) in the warm group , while it was (26.52 ± 25.66 hours) in the cold group.

The mean postoperative LDH level was lower in the warm group than in the cold group, where in the warm group was (805.3 ± 322.71 mg/dl) while in the cold group was (1060.88 ± 500.94 mg/dl) with a high statistically significant difference (*p* value < 0.01).

The mean postoperative Troponin level was lower in the warm group than in the cold group, where in the warm group was (0.4148 ± 0.226 ng/ml) while in the cold group was (0.6404 ± 0.411 ng/ml) with a high statistically significant difference (*p* value < 0.01).

The mean postoperative CK level was lower in the warm group than in the cold group, where in the warm group was (532.78 ± 249.08 IU/L) while in the cold group was (638.14 ± 344.01 IU/L) with a statistically significant difference (*p* value < 0.05).

Similarly, the mean postoperative CK-MB level was lower in the warm group than in the cold group, where in the warm group was (78.64 ± 34.58 IU/L) while in the cold group was (103.18 ± 82.11 IU/L) with a statistically significant difference (*p* value < 0.05).

Aortic cross clamp time was found to be longer in the warm group which may be attributed to more frequent doses of cardioplegia. Mean aortic cross clamp time in the warm group was (49.5 ± 19.34 minutes), while in cold group was (44.24 ± 15.29 minutes) with statistically insignificant value (*p* value > 0.05).

The time needed for postoperative extubation was lower in the warm group by mean value (9.44 ± 6.19 hours) than the cold group (10.54 ± 4.53 hours) with statistically insignificant value (p value > 0.05)

The serum creatinine level was lower in the warm group by mean value (1.088 ± 0.216 mg/dl) than in the cold group (1.19 ± 0.392 mg/dl) with statistically insignificant value (p value > 0.05).

Five patients (10%) in the cold group had wound infection; two of them had culture and sensitivity revealing MRSA infection while only one patient (2%) in the warm group had wound infection) with statistically insignificant value (p value > 0.05).

Discussion

Our study was conducted on 100 patients who underwent elective mitral valve replacement surgery, and they were prospectively classified into 2 groups, the first group (n=50) received intermittent antegrade warm blood cardioplegia at normothermia and the second group (n=50) received intermittent antegrade cold blood cardioplegia at moderate hypothermia (28°C), clinical and laboratory investigations were performed to evaluate the safety and effectiveness of the two methods of myocardial protection.

In the current study, the total bypass time was shorter in the warm cardioplegic group compared to the cold cardioplegic group and with high statistical significance, and this correlates with the results of Calafiore which showed highly significant difference between the warm and the cold group regarding bypass time which was (67.2 ± 21.3 minutes) in the warm group while it was (76.3 ± 27.5 minutes) in the cold group.[7]

In our study, a longer cross clamp time was reported in the warm group compared to the cold group but it was of no statistical significance. This result may be due to interruption of the operative field every 15-20 minutes for the administration of cardioplegia in the warm group, which necessitates removal of the mitral retractors to avoid distortion of the aortic valve with subsequent aortic regurge and failure of delivery of the cardioplegia, whereas, in the cold group, cardioplegia is administrated every 30 minutes with less frequent interruption. Calafiore and his co-workers reported no significant difference as regard the cross clamp time between the patients underwent mitral valve surgery who received intermittent antegrade warm blood cardioplegia and those received intermittent antegrade cold blood cardioplegia with a mean cross clamp time of (45.2 ± 16.3 minutes) in the warm group versus (44.8 ± 15.2 minutes) in the cold group.[7]

In our study, spontaneous recovery to sinus rhythm without the need of DC shock was more marked in the warm group. In the Calafiore study in 1995 he had similar observations to our study were only 2 out of 250 patients in the warm group needed DC shock while 147 out of 250 patients in the cold group needed DC shock showing high statistically significant difference between the two groups.[7] Kammerer confirmed this result in 2012 in his study in minimally invasive mitral valve repair surgery where 45% of the cold group patients needed DC shock to regain sinus rhythm while only 10% in the warm group needed DC shock showing also high statistically significant difference.[8]

In our study, the need of inotropic support was documented weather the initial dose of inotropes and duration of inotropic support. The warm group showed highly statistically significant less need of inotropic support, this result correlates with the results reported by Calafiore and his co-workers who found that 20 patients in the hypothermic group needed inotropic support during weaning off bypass compared to only one patient in the normothermic group.[7]. Our results correlate also with those of Nappi and his co-workers who found that the need for inotropic support immediately after bypass and in the early postoperative period is higher in the hypothermic patients than the normothermic patients.[9]

On the contrary, Birdi and his colleagues stated that inotropic drugs were used more frequently after normothermic perfusion than after hypothermic perfusion due to the fall in the systemic vascular resistance with normothermic perfusion. However, the majority of patients received only minimal doses of inotropes.[10]

As expected the time needed for extubation postoperative was less in the warm group than the cold group with statistically insignificant value (*p* value > 0.05) as it is a sum of the need of inotropic support, bleeding tendency and neurological state which are better in the warm group.

In our study the biomarkers of cardiac injury were lower with statistically significant values in the CK and CK-MB mean values in the warm group than the cold group; moreover the mean values of the LDH and troponin levels in the warm group were lower than the cold group with highly statistically significant value. These results match with the results of Pelletier and colleagues, who also found the levels of CK, CK-MB and troponin lower in the warm than the cold group by statistically significant difference.[11] Franke and his colleagues reported a significant release of CK-MB and troponin I postoperatively in patients receiving intermittent antegrade cold blood cardioplegia than in patients receiving intermittent antegrade warm blood cardioplegia.[12]

Yau and his colleagues demonstrated that the total CK-MB release within 48 hours after the operation was lower after warm blood cardioplegia than cold blood cardioplegia, but no statistical significant difference was observed. [13] Also, Tonz and his co-workers found that the release of CK and CK-MB was higher after hypothermic bypass than normothermic bypass, but it was of no statistical significance. [14]

Chocorn and his colleagues, in a study comparing cold, warm, and tepid cardioplegia on the degree of myocardial protection, used cardiac troponin I as a specific indicator for myocardial ischemia. They found that there was a significant increase in cardiac troponin I following cold cardioplegia, and the least release of troponin I was following warm cardioplegia.[15]

On the contrary, Ascione and his colleagues in a study performed on 35 patients underwent aortic valve replacement who were prospectively randomized to intermittent antegrade warm and cold blood cardioplegia and the postoperative troponin I release was used as a marker of myocardial injury. They reported that troponin I release was markedly lower in the cold group than the warm one, and they concluded that cold blood cardioplegia is associated with less ischemic stress and myocardial injury as compared to warm blood cardioplegia in patients with aortic stenosis undergoing valve replacement surgery.[16]

However, this study was conducted on patients with aortic stenosis and hypertrophied ventricle and this might be the reason for the aforementioned result.

We conclude that Biomarkers of cardiac injury were significantly lower in the warm group than the cold group. Biomarkers of cardiac injury as CK, CK-MB, LDH and troponin are good indicators of myocardial protection as there levels were matching with the clinical data of the patients of low cardiac output and their need of inotropic support.

Finally, intermittent warm blood cardioplegia in mitral valve replacement surgery was proven to be a safe technique of myocardial protection, with a limited superiority over cold cardioplegia. Warm cardioplegia should be considered as a safe alternative which is left for surgeon preference.

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Cardioplegia Temperature. Does it Affect Postoperative Bleeding in Mitral Valve Replacement Surgery Patients?

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Background: **Hypothermia is a known risk factor for bleeding. In our study we try to focus on the real effect of hypothermia on the postoperative bleeding in mitral valve replacement surgery patients.**

Patient and Methods: **A prospective comparative study on 100 patients undergoing mitral valve replacement surgery. Number of patients received warm cardioplegia was 50 (n=50) , while number of patients received cold cardioplegia was 50 (n=50). preoperative , intraoperative and postoperative data were collected.**

Results: **The mean total postoperative bleeding in the warm group was (404 ± 252.7 ml) which was less than the mean total postoperative bleeding in the cold group (645.4 ± 464.93 ml) which was highly significant statistically (*p* value < 0.01).**

Conclusion: Intermittent antegrade warm blood cardioplegia affords better protection against postoperative bleeding than intermittent antegrade cold blood cardioplegia.

Keywords :- Mitral , Cardioplegia , Hypothermia , Bleeding

Postoperative bleeding is common, with severe bleeding (requiring transfusion of >10 units of packed red blood cells) occurring in 3 to 5 percent of patients who have undergone cardiopulmonary bypass . Such extensive bleeding is usually due to one or more of the following factors: incomplete surgical hemostasis, residual heparin effect after cardiopulmonary bypass, clotting factor depletion, hypothermia, postoperative hypotension, hemodilution (dilutional thrombocytopenia and coagulopathy), or platelet abnormalities (platelet dysfunction and thrombocytopenia)[1].

Hypothermia has well established effects on coagulation in experimental models. Hypothermia used during cardiopulmonary bypass , induce reversible platelet dysfunction and inhibited activated clotting factors[2].

It has become obvious that the endothelium appears to play an important role in the regulation of the coagulation pathways. It secrete and express compounds involved in hemostasis, thrombomodulin is one of these substances expressed by the endothelial cells, together with the protein C and protein S system. The release of these substances is markedly disturbed in hypothermic than normothermic cardiopulmonary bypass, and this may contribute to bleeding tendency observed more in hypothermic bypass[3].

Patients and Methods

One hundred patients with mitral valve disease with or without tricuspid disease were included in this study. All patients were elective and assigned to one of two groups, the first group, which included 50 patients, received intermittent antegrade warm blood cardioplegia at normothermia, this group is known as the "warm group" throughout this study. The second group, known as the "cold group" received intermittent antegrade cold blood cardioplegia at moderate hypothermia (28ºC). All patients were evaluated preoperatively, intraoperatively, and postoperatively. Particular attention was paid to all surgical problems and postoperative complications related to the technique of

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myocardial protection. The exclusion criteria in our study were Patients with ischemic mitral valve, who need CABG as well. Patients with associated aortic valve disease requiring surgery, Patients in need for Emergency or redo operations, Patients with any associated surgical cardiac intervention than the mitral surgery.

Cardiopulmonary Bypass Technique:

Cardiopulmonary bypass was instituted using heparin coated hollow fiber membrane oxygenator. Systemic heparin sulphate was given in a dose of 4 mg/Kg to achieve an activated clotting time greater than 400 seconds. The activated clotting time "ACT" was done initially before giving heparin to determine the baseline value, then after giving the dose of heparin before starting the cardiopulmonary bypass and then regularly every 30 min. during the bypass to ensure proper anticoagulation. Priming was accomplished using 1000-1500ml. of a mixture of crystalloid (ringer´s or lactated ringer´s solution) and a colloid, the total volume of priming was 25 ml/Kg.

The mean perfusion pressure was between 60 and 90 mmHg, lower pressure was managed by giving vasoconstrictor agents as adrenaline or phenylephrine, and higher pressure was managed by proper sedation by anesthetic drugs as propofol, sometimes vasodilators as nitrates were used. In the cold group of patients, cooling to 28ºC was performed with rewarming again to 37ºC at the end of the procedure. Systemic flow was 2 L/m^2 /min at 28ºC and 2.2 L/m^2 /min at 37ºC. In the warm group of patients, the nasopharyngeal temperature was allowed to drift to 34ºC during the bypass, and the systemic blood flow was maintained at 2.2 L/m^2 /min all the time.

Surgical Technique:

All patients were submitted to mitral valve surgery via median sternotomy. Routine aorto-bicaval cannulation was done in all patients. Exposure of the mitral valve was done through left atriotomy in all cases.

Technique of Myocardial protection:

Patients were divided into two groups:

Group A: 50 patients had myocardial protection using intermittent antegrade warm blood cardioplegia.

Group B: 50 patients had myocardial protection using intermittent antegrade cold blood cardioplegia.

Group A (warm cardioplegia):

Normothermic blood 37˚C was collected from the oxygenator by means of ¼ inch tubing via side way from the recycle line, then using one of the roller heads of the heart lung machine. Infusion of the blood cardioplegia solution was done into the aortic root, through the cardioplegia cannula inserted into the ascending aorta. The tubing was connected to a syringe pump containing K^+ in a concentration of 2 mEq/ml. Cardiac arrest was achieved by intermittent infusion of normothermic hyperkalemic blood in the aortic root. The initial dose of cardioplegia is given with the roller pump at a rate of 300 ml/min and the syringe pump of K^+ at a rate of 150 ml/h for 3 min to deliver a total dose of 900 ml of blood cardioplegia. 2ml bolus may be given at the beginning to enhance immediate diastolic cardiac arrest. The subsequent doses of cardioplegia are given every 15-20 minutes at a rate of 200 ml/min and K^+ administered at a rate of 90 ml/h for 2 minutes.

Continuous samples for blood gases and k^+ level monitoring were obtained and diuretics may be given accordingly if hyperkalemia was present.

Group B (cold cardioplegia):

Patients of this group received blood cardioplegia at a temperature of 4°C, antegradly into the aortic root. For the induction of cardiac arrest St. Thomas hospital cardioplegia solution was used, which is composed of moderately elevated potassium (20 mmol/L) , magnesium (16 mM) , sodium (144 mmol/L), calcium (2.2 mmol/L) and a small additive of procaine (1 mmol/L) in an extracellular ionic matrix with pH 7.0 and osmolality (300 mosm/L). Then blood is collected from the cannula in the aortic root (before establishing of the cardiopulmonary bypass), or directly from the oxygenator via the sampling line (after establishing of the cardiopulmonary bypass), and mixed with the crystalloid cardioplegia solution at a ratio of 1:4. Each patient received an initial dose of 15-20 ml/kg of blood cardioplegia. Subsequent doses are given every 30 minutes. Topical cardiac cooling was achieved using ice slush over the arrested heart. Systemic cooling was held to 28°C.

Data Collection:

Preoperative assessment: Patient's demographic data including: age, sex. In addition to echocardiographic data as LA, EF, pulmonary artery pressure.

Intraopetrative assessment:

1. Total cardiopulmonary bypass time and aortic cross clamp time.
2. The resumption to normal rhythm (spontaneous or with DC shock.)
3. The need for inotropic support.

Immediate post-operative assessment:

1. Low cardiac output (LCO) in the form of dose and duration of inotropic support.
2. Duration of mechanical ventilation.

3. The level of creatinine, creatine kinase (CK), (CK-MB), Troponin and LDH.

Statistical Analysis

Data were statistically represented in terms of range, mean, standard deviation (SD), median, and percentages. Comparison between different groups was done using student *t* test for comparing parametric data, Chi square x^2 test was performed. A probability value *p* value less than 0.05 was considered significant. All statistical calculations were done using Microsoft Excel version 7 and SPSS version 10.0.

Results

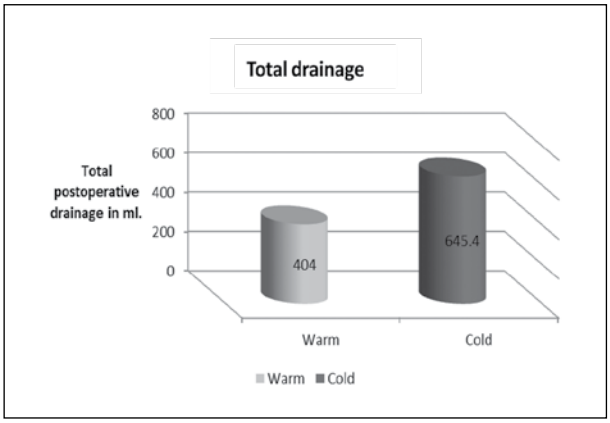
The mean age in the warm group was 40.82 ± 13.74 years old and the mean age in the cold group was 45.06 ± 13.06 years old. There was no statistically significant difference between the 2 groups (p value > 0.05).

The number of males to females ratio in the warm group was 28 : 22 respectively , while in the cold group was 25 :25 respectively , also There was no statistically significant difference between the two groups (p value > 0.05) .

Bypass time showed highly statistically difference between warm and cold groups (p value < 0.01)were in the warm group the mean value was (72.34 ± 25.09 minutes) while in the cold group the mean value was (85.66 ± 22.9 minutes).

Aortic cross clamp time was found to be longer in the warm group which may be attributed to more frequent doses of cardioplegia. Mean aortic cross clamp time in the warm group was (49.5 ± 19.34 minutes) , while in cold group was (44.24 ± 15.29 minutes) which was found to be statistically insignificant (p value > 0.05).

The mean total postoperative bleeding in the warm group was (404 ± 252.7 ml) which was less than the mean total postoperative bleeding in the cold group (645.4 ± 464.93 ml) which was highly significant statistically (p value < 0.01).



Discussion

Cardioplegia is an important strategy to facilitate cardiac surgery while limiting intraoperative myocardial injury[4].In our study, the mean total postoperative bleeding in the warm group was (404 ± 252.7 ml) which was less than the mean total postoperative bleeding in the cold group (645.4 ± 464.93 ml) which was highly significant statistically (p value < 0.01).

Our results correlate with the results of Pelletier , et al who had 6% of the cold group needed reopening for exploration for hemorhage versus only 2% in the warm group [5].

Hypothermia reduces platelets aggregation and endothelial-associated coagulation with subsequent increase in post operative bleeding and requirements of blood products. Decreased bleeding in the post operative period is associated with shorter intubation time and a lower requirements of inotropic support and so, shortens the ICU stay[6].

In the study performed by Calafiore, blood loss was similar in both normothermic and hypothermic groups, with an average amount of 400 CC in the first 12 hours, also the number of patients given blood transfusion was similar[7].

In his study, Boldt found that post operative blood loss and the need for homologous blood transfusion were higher in the hypothermic than the normothermic group. Fibrinogen level and platelet count were significantly more reduced during and after cardiopulmonary bypass in the hypothermic than the normothermic patients. He also observed that approximately 10% to 20% of patients undergoing hypothermic perfusion, exhibit inadequate hemostasis and often require homologous blood or blood products transfusion, and about 3% will need re-exploration for bleeding[3].

Tonz and his co-workers confirmed the same fact, they found that the volume of blood discharged through the mediastinal and pleural tubes until the first postoperative day was significantly higher in the hypothermic group, and that half of these patients needed fresh-frozen plasma to counteract an increasing bleeding tendency[8].

They explained this by the fact that the activation of platelet leads to decreased adhesiveness and reduced membrane binding to fibrinogen, also the increase in the fibrinolytic activity with increase in fibrin degradation products may also account for more disturbance in platelet function as these products may interfere with platelet aggregation. All these events are believed to be exacerbated by hypothermic than normothermic bypass[8].

Defect in platelet function is a very important factor that contribute to bleeding tendency, the cause of which may be related to shear stress, blood gas interaction, heparin sodium, protamin sulphate, and the non-endothelial surface of the

extracorporeal circuit. Platelet activation and aggregation is accelerated by the extracorporeal circulation, this effect is much more encountered during hypothermic than normothermic bypass. Certain markers of platelet activation as platelet membrane glycoprotein, can be detected suggesting the role of platelet dysfunction in the postoperative coagulopathy [3].

Boldt and his co-workers demonstrated that platelet count did not differ between warm and cold groups, and that the problem was the platelet function. Hypothermia dose not only disturb the platelet function during cardiopulmonary bypass, but also causes delayed recovery of platelet function in the postoperative period [3].

Boldt examined platelet aggregation in patients undergoing cardiopulmonary bypass at >34oC or <28°C, with and without aprotinin. They determined that platelet aggregation was most inhibited in the hypothermic patients, and that these patients showed the slowest recovery of platelet function. Postoperative blood loss was highest in the hypothermic group and aprotinin blunted the effects of hypothermia on platelet function in the hypothermic group but was without beneficial effect on platelet aggregation in patients undergoing warm cardiopulmonary bypass [3].

A later study by the same group examined the effect of cardiopulmonary temperature on circulating protein S and protein C, platelet aggregation and the thrombin anti-thrombin complex. Relative to the warm group, hypothermic patients demonstrated increased levels of the thrombin anti-thrombin inhibition, slower recovery of platelet function, greater blood loss, and they received more homologous blood transfusion [9].

In Germany Deppe and colleagues reached a similar conclusion in their study were they found total blood loss with need for transfusion or reoperation was less in the warm group with borderline statistical significance (p = 0.081) [10].

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The Outcome of Different Surgical Modalities For Treatment of Acute and Chronic Type A Aortic Dissection; Early Outcomes

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Objective: **To assess the outcome of 3 different surgical approaches for treatment of aortic dissection type A.**

Patients and Methods: **Between February 2012 and February 2014, 80 patients with acute and chronic aortic dissection were operated upon. All patients were routinely studied by echocardiography and CT scan to confirm the presence of aortic dissection and severity of aortic incompetence. Patients were assessed for presence of bicuspid aortic valve (BAV), Marfan syndrome, and other anomalies. Patients were divided into three groups ,Supracoronary replacement (SCR) of the ascending aorta was applied to 46 patients, 15 patients received a composite graft replacement(comp) and 19 patients were treated with the aorta valve-sparing (re-implantation technique). Acute type A aortic dissection represented 69.6%, 46% and 73.3%in group 1,2 and 3 respectively .Their mean age was 52±9.8 , 40.9±11.8 and 49.7±11.8 for group 1,2 and 3 respectively .All patients were subjected to cardiopulmonary bypass with moderate hypothermic circulatory arrest .**

Results: **Follow-up was complete for 66 patients (82.5%). Patients in SCR were older compared with Reimplantation and Comp (P = 0.003), gender (overall 83.8% male, P=0.331) presence of BAV (overall 6.3% , p= 0.001) and presence of Marfan syndrome (overall 15%, P=0.001) were comparable. Arterial Cannulation more often via femoral artery (83.8%). Mean operation time, extracorporeal circulation time, and aortic cross-clamp time differ significantly between groups (P= 0.010, P=0.001 and P=0.013respectively). also Stay in the intensive care unit (P=0.022) and time of hospitalization (P=0.045) were comparable show significant difference. Overall perioperative mortality was 17.5% and did not show significant differences between groups (Reimplantation 21.1% versus Composite 13.3% versus SCR 18.2%; P_0.842). Incidence of neurological complications was similar between groups (P=0.379). time of follow-up was 6 months post operative . Patients in Reimplantation and SCR groups required no reoperation for aortic valve failure. One patient in Composite required reoperation of prosthetic valve infective endocarditis.**

Conclusions: **In aortic dissection type A, the reimplantation technique leads to results comparable to established techniques (composite valve and supracoronary replacement). Complete excision of dissected tissues, low incidence of reoperation, and lack of anticoagulation may favour this approach in selected patients, supracoronary replacement is less surgically demanding and rapid technique and composite valve replacement is more favourable in aorto annular ectasia (Marfan syndrome) and unhealthy aortic valve leaflets.**

Key Words: Aortic dissection, reimplantation, aorta, valve reconstruction, composite replacement

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Acuteaortic dissection type A (AADA) represents a rare but life-threatening emergency situation. Therefore, immediate surgical intervention is mandatory, because medical treatment leads to an unacceptable high early mortality of 50%, and delay between occurrence of dissection and surgical treatment correlates with increased mortality[1].

Even with modern diagnostic modalities, a substantial fraction of patients with aortic dissection dies without a correct diagnosis. Untreated, acute aortic dissection is highly lethal with a mortality of 8% within the first 6 hours, 13% within 12 hours, 21% within 24 hours, and 74% in the first 2 weeks. Therefore, it is of paramount importance that the physician maintains a high index of suspicion for this condition, so that appropriate therapy can be promptly instituted. Surgery requires resection of the entry side of the dissection, typically located 2 to 5 cm above the valvular commissures at the outside curvature of the ascending aorta [2]to exclude the fragile false lumen from high-pressure blood flow. Supracoronary replacement (SCR) of the ascending aorta or composite replacement (comp) of the aortic valve and ascending aorta in cases with deteriorated aortic root or valvular insufficiency are established surgical techniques for treatment of AADA[3], [4].However, early mortality rates of 20% to 35% remain almost unchanged over the past 30 years, despite improvement of surgical techniques[1], [5]–[7]. Furthermore, the risk of redissection, secondary aneurysmal dilatation of the aortic root, and aortic insufficiency after SCR with high incidence of reoperation, as well as lifelong anticoagulation with risk for thromboembolic and bleeding complications after comp, are drawbacks of these techniques[4], [8], [9].Recently, valve-sparing techniques for replacement of the ascending aorta gained attention for use in AADA[10], [11].The reimplantation technique, especially, first described by[12]is theoretically well-suited for use in patients presenting with AADA. Complete removal of diseased tissue, excellent hemostasis, and avoidance of lifelong anticoagulation are clear advantages for treatment of the aortic root pathology in patients with morphologically unimpaired valve cusps. However, whether to use this technique in emergency patients presenting with AADA remains debatable. Prolonged operation times for valve reconstruction and the demanding technique applied under emergency conditions may bear an additional risk for the patient, who might benefit from a short and simple operation because of this unstable status. Thus, the aim of the study was the comparison supracoronary conduit with or without one or two sinuses replacement, aortic valve-sparing (namely reimplantation Tirone David 1 technique) and aortic valve replacement (namely composite graft replacement) in aortic root surgeries regarding indications and early results including morbidity and mortality.

Patients and Methods

This is a prospective study conducted on consecutive symptomatic patients with acute and chronic aortic dissection Stanford type A associated with significant - moderate to severe - aortic regurgitation. The study is carried out during the period from February 2012 to February 2014 at Kasr Al-Eini Hospital (Cairo University). These patients were operated upon using aortic valve reimplantation technique (19 patients, 23.75%), supracoronary conduit (46 patients, 57.5%) and composite graft replacement (15 patients, 18.75%). Patients were studied for aortic valve sparing versus replacement in patients undergoing aortic surgery for type A aortic dissection regarding early morbidity and mortality,by comparing the preoperative, immediate postoperative and six months follow-up echocardiographies.

	Supra-coronary (n=46)	Comp (n=15)	Reimplantation (n=19)	*p*-value
Age (years)	52.0±9.8	40.9±11.8	49.7±11.8	**0.003**
Males	37 (80.4%)	12 (80%)	18(94.7%)	0.3 NS
Females	9 (19.6%)	3 (20%)	1 (5.3%)	NS
DM	12 (%26.1)	2 (13.3%)	6 (31.6%)	0.7
Smoking	9 (19.6%)	3 (20%)	6 (31.6%)	0.6
Dyslipidemia	8 (17.4%)	1 (6.7%)	1 (5.3%)	0.3
Pregnancy	2 (4.3%)	0 (0.0%)	0 (0.0%)	0.5
Redo	3 (6.5%)	1 (6.7%)	0 (0.0%)	0.5
Traumatic	0 (0.0%)	0 (0.0%)	1 (5.3%)	0.2
Family history	2 (4.3%)	0 (0.0%)	1 (5.3%)	0.7
HTN	41 (89.1%)	2 (13.3%)	14 (73.7%)	**<0.001**
Marfan syndrome	3 (6.5%)	7 (46.7%)	2 (10.5%)	**0.001**
BAV	0 (0.0%)	4 (26.7%)	1 (5.3%)	**0.001**

Table 1. Preoperative Data and different risk factors of Patients with Aortic Dissection Type A, Subdivided by Treatment Method

	Supra-coronary (n=46)	Comp (n=15)	Reimplantion (n=19)	p-value
Onset of dissection				
Acute	32 (69.6%)	7 (46.7%)	14 (73.7%)	0.3
Sub-acute	5 (10.9%)	4 (26.7%)	1 (5.3%)	NS
Chronic	9 (19.6%)	4 (26.7%)	4 (21.1%)	NS
Hemodynamics				
Stable	41 (89.1%)	15 (100.0%)	14 (73.7%)	0.06
Unstable	5 (10.9%)	0 (0.0%)	5 (26.3%)	NS
Chest pain	39 (84.8%)	12 (80.0%)	18 (94.7%)	0.4
Stroke	3 (6.5%)	0 (0.0%)	0 (0.0%)	0.3
Myocardial Infarctoin	1 (2.2%)	0 (0.0%)	1 (5.3%)	0.6
Lower limb ischemia	5 (10.9%)	0 (0.0%)	3 (15.8%)	0.3
Shortness of breath	8 (17.4%)	7 (46.7%)	3 (15.8%)	**0.045**

Table 2. Comparison between three groups as regard clinical picture

All patients were investigated byechcardiography (transthoracic and/or transesophageal) to assess the Left ventricular dimensions and function, Aortic valve morphology and degree of aortic incompetence (graded from 1 to 4 based on ratio of jet height to LVOT height), Aortic root dimensions; Aortic annulus, Mid sinuses diameter, Sino-tubular junction diameter and Ascending aortic diameter. All patients were subjected to Contrast enhanced multislice CT of the thoracic aorta (for diameter of ascending, arch, and descending aorta) and coronary arteries to detect any associated coronary lesions.

	Supra-coronary (n=46)	Comp (n=15)	Reimplantation (n=19)	p-value
Ejection fraction	57.7 ± 6.9	51.3 ± 11.7	56.0 ± 5.5	0.03
LVED	5.9 ± 0.7	6.5 ± 0.9	6.0 ± 0.6	0.03
LVES	4.2 ± 0.6	4.9 ± 0.9	4.3 ± 0.4	0.003
Ascending Aorta diameter	23.3 ±1.8	26.9 ± 1.8	23.5 ± 1.4	<0.001
Aortic regurge				
Moderate	19 (41.3%)	3 (20.0%)	6 (31.6%)	0.3
Severe	27 (58.7%)	12 (80.0%)	13 (68.4%)	NS
Pericardial Effusion				
Mild	8 (17.4%)	3 (20.0%)	4 (21.1%)	0.4
Moderate	6 (13.0%)	0 (0.0%)	3 (15.8%)	NS
Severe	1 (2.2%)	0 (0.0%)	2 (10.5%)	
No	31 (67.4%)	12 (80.0%)	10 (52.6%)	
Aortic CT angiography				
- ***Flap extent***	4 (8.7%)	4 (26.7%)	4 (21.1%)	0.2
Ascending only	42 (91.3%)	11 (73.3%)	15 (78.9%)	NS
Whole aorta	4.4 ±0.8	4.9 ±0.6	4.5 ±0.7	0.1 NS
- ***Aortic roo*t**	5.9 ±2.8	6.5 ±1.2	5.7 ±1.1	0.6 NS
- ***Ascending aorta***				
Positive MSCT coronary angiography	2 (16.7%)	0 (0.0%)	3 (60%)	0.07
Abnormal ECG	9 (19.6%)	1 (6.7%)	4 (21.1%)	0.5

LVED, left ventricular end diastolic diameter in millimeter; LVES, left ventricular end systolic diameter in millimeter, CT, computed tomography; MSCT, multislice computed tomography; ECG, electrocardiogram

Table 3: Comparison between three groups as regard pre-operative radiological investigations:

Follow-Up

Postoperative follow-up was comparable for six months, Follow-up was obtained by written and/or telephone communication with the patients and/or home physicians. Before hospital discharge and at follow-up, valve function was re-evaluated using transthoracic color Doppler echocardiography for patients treated with the reimplantantaion technique. Aortic regurgitation was assessed semiquantitatively as follows: 0, none; I, minimal; II, mild; III, moderate; and IV,severe. Infectious, thromboembolic, and bleeding complications were recorded as required by the guidelines of the American Association for Thoracic Surgery/Society Figure 1Mode of arterial canulation of Thoracic Surgeons. After aortic valve reconstruction, patients were anticoagulated with Coumadin or aspirin (at the discretion of the individual surgeon) for 3 months. Thereafter, anticoagulation therapy was discontinued. Patient's performance was assessed regarding the classification of the New York Heart Association (NYHA).

Statistical Analysis

Data were statistically described in terms of mean ± standard deviation (± SD), median and range, or frequencies (number of cases) and percentages when appropriate. Comparison of numerical variables between the study groups was done using one-way analysis of variance (ANOVA) test for normally distributed data and Kruskal Wallis test for non-normal data. For comparing categorical data, Chi-square (c^2) test was performed. Exact test was used instead when the expected frequency is less than 5. *p* values less than 0.05 were considered statistically significant. All statistical calculations were done using computer program SPSS (Statistical Package for the Social Science; SPSS Inc., Chicago, IL, USA) release 15 for Microsoft Windows (2006).

Results

Perioperative results

*Mode of arterial cannulation:*total number of patients 80[100%], femoral cannulation 67[83.6%], axillary cannulation 8[10%], direct dissection cannulation 2[2.5%], combined cannulation 3[3.8%]. There was no significant statistical difference between the three groups (p = 0.599), as shown in Table 3, and figure 1.

The mean operation times, extracorporeal circulation times, and aortic cross-clamp times were significantly different between groups (P< 0.001, respectively). For all 3 parameters, aortic valve sparing took the longest times, and SCR was the

	Supra-coronary (n=46)	Comp (n=15)	Reimplantation (n=19)	p-value
Circulatory arrest (minutes)	22.6 ± 8.5	16.3 ± 7.9	16.9 ± 9.7	0.01
Cross clamp time (minutes)	137.5 ± 37.9	121.3 ± 39.9	177.9 ± 33.6	<0.001
Bypass time (minutes)	203.6 ± 54.0	184.5 ± 56.1	247.7 ± 40.3	0.001
Total operative time (hours)	6.5 ± 1.3	5.9 ± 1.4	7.3 ± 1.3	0.01
Left coronary implantation				
Direct	0 (0.0%)	13 (86.7%)	13 (68.4%)	
Modified Cabrol	0 (0.0%)	2 (13.3%)	5 (26.3%)	<0.001
SVG interposition	0 (0.0%)	0 (0.0%)	1 (5.3%)	
Right coronary implantation				
Direct	2 (4.3%)	12 (80.0%)	10 (52.6%)	<0.001
Modified Cabrol	2 (4.3%)	2 (13.3%)	7 (36.8%)	
SVG interposition	1 (2.2%)	1 (6.7%)	2 (10.5%)	
Mode of canulation				
Femoral	38 (82.6%)	15 (100.0%)	14 (73.7	0.6
Axillary	5 (10.9%)	0 (0.0%)	3 (15.8%)	
Direct lumen	1 (2.2%)	0 (0.0%)	1 (5.3%)	
Combined	2 (4.3%)	0 (0.0%)	1 (5.3%)	
Associated arch surgery	12 (26.1%)	2 (13.3%)	1 (5.3%)	0.1
Associated surgeries				
CABG	3 (6.5%)	0 (0.0%)	3 (15.8%)	0.4
MV	1 (2.2%)	0 (0.0%)	0 (0.0%)	NS

SVG, saphenous vein graft; CABG, coronary artery bypass grafting; MV, mitral valve surgery

Table 3. Comparison between three groups as regard operative variables

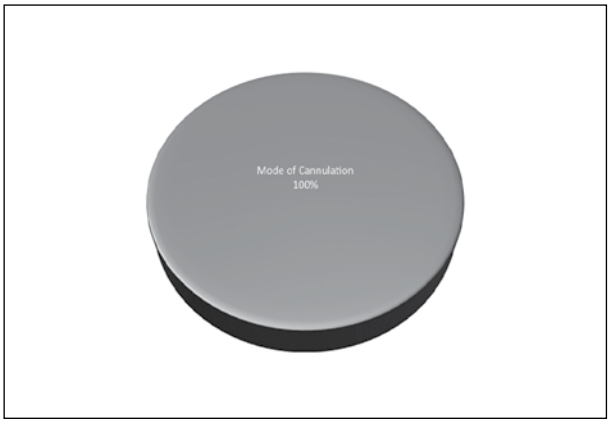

Fig 1. 1Mode of arterial canulation

shortest procedure. Although need for proximal arch replacement was equally distributed between groups, more complex aortic surgery was notpreferred in aortic valve sparing group, such as total arch replacement and elephant-trunk extension into the descending aorta, due to partly the longer operation times in aortic valve sparing group. No reimplanted valve had to be surgically corrected because of unsatisfactory result intraoperatively. Significantly, more patients from aortic valve sparing group had direct cannulation of the ascending aorta instead of femoral artery cannulation. Detailed intraopertive findings are listed in Table 3.

Post-operative results:

The overall early(30-day) post-operative mortality was 14 patients (17.5%), 5 patient (35.7%) died from myocardial failure, 4 patients (28.6%) died from massive uncontrolled bleeding, 2 patients (14.3%) died from multiorgan failure, 1 patient (7.1%) died from respiratory tract infection (pneumonia), 1 patient (7.1%) died from renal failure and one patient (7.1%) died from visceral ischemia (sever bleeding per rectum). There was no significant statistical difference between three groups. A summary of postoperative complications and morbidity is depicted in Table 4.

Post operative AR

Aortic regurgitation was assessed by color-flow Doppler techniques in the standard transthoracic and transesophageal views and graded as follows using the ratio of jet height (JH)/left ventricular outflow tract height (LVOH).There was no significant statistical difference between the SCR and Reimplantation groups, as shown in Table 5. For the three groups there were no valve related complications, except one case of prosthetic valve endocarditis in the Bentall group, as shown in Table 6 and Table 7.

A comparison of the echocardiographic dimensions preoperative and post-operative shows no significant difference among the three groups, Table 8

	Supra-coronary (n=46)	Comp (n=15)	Reimplantation (n=19)	p-value
ICU stay (hours)	109.2±78.1	88.3±50.7	171.1±129.6	0.02 NS
Mechanical ventilation (hours)	39.2±55.8	33.0±60.1	70.3±74.3	0.2 NS
Hospital Stay (days)	14.3±10.0	10.1±3.7	22.5±24.6	0.049 S
Inotropic support	16 (38.1%)	8 (57.1%)	8 (47.1%)	0.4
Re-Operation for bleeding	4 (9.8%)	1 (7.1%)	4 (23.5%)	0.3
Renal impairment	12 (29.3%)	2 (14.3%)	2 (11.8%)	0.4
Neurological complications	6 (14.6%)	2 (14.3%)	5 (29.4%)	0.4
Respiratory complications	7 (17%)	2 (14.3%)	2 (11.7%)	0.3
Sternal wound infection	11 (26.8%)	5 (35.7%)	4 (23.5%)	0.7
Mortality	8 (18.2%)	2 (14.3%)	4 (21.1%)	0.8
Pericardial Collection				
Mild	19 (52.8%)	2 (15.4%)	10 (66.7%)	
Moderate	1 (2.8%)	3 (23.1%)	2 (13.3%)	
Severe	0 (0.0%)	(7 .7%)١	0 (0.0%)	
No	16 (44.4%)	7 (53.8%)	3 (20.0%)	0.02

Table 4. Comparison between the three groups as regard post-operative morbidities and mortalities

	Supra-coronary (n=46)		Reimplantation (n=19)		P-value
	N	%	N	%	
Degree of post-operative AR					
Trivial	6	16.7	1	6.7	0.6
Mild	7	19.4	5	33.3	NS
Moderate	4	11.1	1	6.7	
No	19	52.8	8	53.3	

Table 5. Post operative degree of aortic regurgitation in group A and group B

	Supra-coronary (n=46)		Reimplantation (n=19)	
	N	%	N	%
Infective endocarditis	0	0.0	0	0.0
Prosthetic valve Failure	0	0.0	0	0.0

Table 6. Demonstrate the incidence of aortic valve preservation group A and B related complications

	Comp (n=15)	
	N	%
Prosthesis well functioning	13	100.0
Infective endocarditis of prothesis	1	7.7
Thromo-embolism	0	0.0
Malfunction	0	0.0

Table 7 Demonstrate the incidence of aortic valve replacement group C related complications

Parameter	Operation	Preoperative			Postoperativce			P-value
EF	Supra-coronary (n=36)	59.8	±	5.8	57.0	±	13.3	0.3
	Comp (n=13)	52.7	±	9.7	55.3	±	9.7	0.2
	Reimplantation(n=15)	55.4	±	6.0	57.5	±	8.6	0.2
LVED	Supra-coronary (n=36)	5.8	±	0.6	5.6	±	0.5	0.047
	Comp (n=13)	6.5	±	0.9	6.0	±	0.6	0.02
	Reimplantation(n=15)	6.0	±	0.7	5.7	±	0.6	0.2
LVES	Supra-coronary (n=36)	4.1	±	0.5	4.0	±	0.6	0.2
	Comp (n=13)	4.8	±	0.8	4.6	±	0.7	0.2
	Reimplantation (n=15)	4.3	±	0.5	4.1	±	0.7	0.3

EF, ejection fraction; LVED, left ventricular end diastolic diameter in millimeter, LVES, left ventricular end systolic diameter in millimeter.

Table 8 Comparison between echo dimensions for the three groups pre and post-operative

Discussion

Over last 40 years many surgical techniques from[13] case report till now have been developed for treatment of patients with type A aortic dissection associated with significant aortic incompetence.In many cases, the mechanism of aortic regurgitation is secondary to a root disease. In the case of aortic dissection associated with root expansive aneurysm, the dilatation of the sino-tubular junction is responsible for the loss of central coaptation of the aortic leaflets. In the case

of acute aortic dissection, the valve insufficiency is due to the loss of wall support causing cusp prolapse. In such clinical settings, the valve is anatomically normal and its replacement with prosthesis should not be considered as the best treatment, because of the well-known, prosthesis-related, long-term

complications. Nonetheless, for many years, the composite graft replacement of the aortic valve and root has been the standard method to surgically correct concomitant aortic insufficiency and root aneurysm or dissection .

In recent years, different types of valve-sparing operations have been proposed[12], [14], with many scientific papers addressing the surgical anatomy and the physiology of the aortic root, as well as the operative results.

Valve sparing aortic root reconstruction had been popularized in the last decades over the classic root replacement (Bentall) procedure because preservation of the patient's native aortic valve allows for better hemodynamics, left ventricular performance, lesser risk of endocarditis and avoidance of life long anticoagulation. However in patients with structurally impaired aortic wall tissue such as Marfan's syndrome and in those who had acute dissection with pre-existing annuloaortic ectasia on the basis of cystic medial necrosis, the incidence of aortic valve failure may be even higher and composite replacement has been recommended[15], [16].

It was difficult to compare between different aortic root reconstruction techniques, however major advantage of the reimplantation technique (Tirone David) is the almost complete resection of diseased aortic tissue, a clear advantage compared to supracommissural tube graft replacement (supra-coronary conduit) which should only be used if the sinuses are totally free (not dissected and not aneurismal) as it provides short bypass time and minimal dissection of tissues over the aortic root and therefore less bleeding.

The purpose of our study was to compare three groups of patients who underwent aortic root replacement.

Regarding Marfan syndrome patients in our study were n 12 (15%) there was significant statically difference between the three groups. While in Klaus and colleagues series Marfan patients n 11 (5%) there was no significant statistically difference between the three groups[17]. In Saczkowski R and colleagues (2014), Alberto Forteza and colleagues (2009), Sergey Leontyev and colleagues (2012), and David TE and colleagues(2013)marfanoid patients were (2.5%), (4%), (17.3%), and (36%) respectively[18]–[21].

As regard bicuspid aortic valve in our study were 5 patients (6.3%) slightly more than half percentage in David TE and colleagues(2013)[21] were (11%) and Yongshi Wang and colleagues (2013)[22] were 30 patients (10.4%) and more than reported by Vlad Gariboldi and colleagues (2007) 4.8%[23] .

As regard preoperative degree of aortic regurge in our study was moderate AR n 28 (35%) and sever AR n 52 (65%) - in our study AoD associated with no, trivial and mild AR were excluded -, inCoselli JS and colleagues (2014) 48% had moderate AR[24] while Vlad Gariboldi and colleagues (2007) reported patients with severe AR were 35.4%[23].

Regarding patients presented with cardiogenic shock in our study were 10 (12.5%) more than that reported by Qing-qi Han and colleagues (2013)[25] 14 patients (8.7%), and less than reported by Alberto Forteza and colleagues (2009) 16%[19].

Our patient's aortic root diameter in mm in our study mean ± SD n 80 (45.1 ± 7.3).

As regard mode of arterial cannulation in our study femoral access in 67 patients (83.8%), axillary in 8 (10%), aorta in 2 (2.5%) and combined in 3 (3.8%), in Alberto Forteza and colleagues (2009) Arterial cannulation was performed on femoral artery(76%), axillary artery (20%) and aortic arch (4%)[19], while Rainer G and colleagues (2000) femoral artery was cannulated in all patients n 20 (100%)[11].

Finally,we prefer femoral cannulation but we resort to axillary cannulation in case of femoral artery dissection, small calibre and atheromatus plaque affection because axillary exposure is more difficult and time consuming. We use aortic cannulation as a rapid access in case of tamponade and cardiac arrest during induction of anaesthesia but it is still not preferred so it is not used routinely.

In our study, total circulatory arrest time mean ± SD was 20.06 ±9.07 minutes we were shorter from all the following because they used antegrade cerebral perfusion for brain protection this gave them plenty of time so no need to hurry. In Rainer G and colleagues (2000) was 28 ±7minutes[11], in Klaus and colleagues (2004) was 25 ±15 minutes[17], in Alberto Forteza and colleagues (2009) was 37±23 minutes[19] and finally the longest in Qing-qi Han and colleagues (2013) was49.3 ± 22.3minutes with maximum circulatory arrest 118 minutes[25] !!.

In our study, the mean aortic cross clamp time in group A [supracoronary] was 137.54±37.93 minutes, in group B [Reimplantation] was 177.95±33.58 minutes. While In group C [Comp] was 121.33±39.86 minutes. Overall was 144.10±41.92 minutes and there was significant statistical difference between the three groups (p=0.000), showing that valve sparing procedures are significantly longer. This is similar to a study done by Klaus and colleagues (2004)[17], particularlythe supracoronary group and overall mean. The study was conducted over 295 patients between October 1990 and October 2003, the mean aortic cross clamp time in group A [supracoronary] was 74±29 minutes, in group B [Reimplantation] was 156±39 minutes. While in group C [Comp] was 108±35 minutes. The overall mean was 98±45 minutes. There was significant statistical difference between the three groups (p<0.001). Also in our study total aortic occlusion time longer than that reported in Alberto Forteza and colleagues (2009) who's mean was 113±38 minutes[19] while we were slightly shorter than that recently reported by Qing-qi Han and colleagues (2013)with a mean cross clamp time 149.4 ± 48.1minutes[25].

Regarding the total cardiopulmonary bypass time mean ± SD In group A [supracoronary] was 203.58±53.97 minutes, in

group B[Reimplantation] was 247.68±40.25 minutes. While In group C [Comp] was 184.53±56.05 minutes. Total was 210.48±55.44 minutes There was significant statistical difference between the three groups (p=0.001). This was longer than that in a study done by Klaus and colleagues (2004) [17]but in modified Betall group, we were slightly shorter. Themean extracorporeal circulation time in group A [supracoronary] was 141±54 minutes, in group B[Reimplantation] was 209±57minutes. While In group C [Comp] was 189±100 minutes. Overall mean was 166±74 minutes but still there was significant statistical difference between the three groups (p<0.001). Our study overall bypass time slightly longer than that reported in Alberto Forteza and colleagues (2009) from Madrid, Spain whose mean bypass time was 183±56 minutes[19], we were more near to Rainer G and colleagues (2000) from Lubeck, Germany with mean bypass time of 192±32 minutes[11], while we were significantly shorter than that recently reported by Qing-qi Han and colleagues (2013) from Shanghai, China with mean 239 ± 63 minutes[25].

As Regard themeanoperative time, in group A [supracoronary] was 388.8±78.6 minutes, in group B[Reimplantation] was 436.8±75 minutes. While In group C [Comp] was 354±83.4 minutes. Overall was 393.6±82.8 There was significant statistical difference between the three groups (p=0.01). This was longer than that in a study done by Klaus and colleagues (2004), where mean operative time in group A [supracoronary] was 242±68 minutes, in group B[Reimplantation] was 305±75 minutes[17]. While In group C [Comp] was 301±121 minutes. Overall mean was 267±90 minutes.There was significant statistical difference between the three groups (p<0.001). Also our study total bypass time shorter than that reported by Qing-qi Han and colleagues (2013) was 463.4 ± 129.5 minutes[25].

Regarding patients associated with concomitant arch surgery in our study we had 15 patients (18.5%), less than that reported by Klaus and colleagues (2004)study with a higher percentage (28%)[17].

As regardmean ICU stay in our result, in group A [supracoronary] was 4.55±3.25 days, in group B[Reimplantation] was 7.13±5.4 days. While in group C [Comp] was 3.68±2.11 days and total was 4.98±3.85 days, There was significant statistical difference between the three groups (p=0.022). The duration of ICU stay in our study was shorter than that in a study done by Klaus and colleagues (2004)specially in supracoronary group, Comp group and overall and longer in Reimplantation group, themean ICU stay in group A [supracoronary] was 6±7 days, in group B[Reimplantation] was 4±5 days[17]. While in group C [Comp] was 4±3 days. Overall mean was 5±6 days but there was no significant statistical difference between the three groups .

In our study, regarding the post operative complications, there was no significant statistical difference between the three groups. All the reoperations was due to reexploration for bleeding and no operartion related to valve failure (whether aortic regurge in case of supracoronary and reimplantation groups or thromboembolism or anticoagulation related bleeding in case of composite except one case of omental flap) , 9 patients needed reoperation (12.5%), renal dysfunction in 14 (19.4%), neurological complication occuredin 13 (18.1%), respiratory complication happened in 11 (15.3%) and sternal wound infection in 20 (27.8%). in Jerry Easo and colleagues (2013)analysis of the German Registry for Acute Aortic Dissection type A on 520 patients, reexploration for bleeding was required in 96 (18.5%), neurological complications in 53 (13.6%)[26]. In Alberto Forteza and colleagues (2009)reexploration for bleeding was needed in 11 (11.6%), renal failure in 4 (4.2%), neurological complication in 25 (26.3%), respiratory complication in 10 (10.5%) and sternal wound infection in 6 (6.3%)[19]. InKlaus and colleagues (2004)series,reexploration for bleeding was required in 37 (14%) and neurological complicationsoccurred in 53 (22%)[17]. Finally we had higher incidence of postoperative sternal wound infection but we did not have results which demonstrate the average incidence for proper comparison.

Regarding degree of post operative aortic regurgitation in supracoronary group there was no AR in 19(52.8%), grade 1 trivial AR in 6 (16.7%), grade 2 mild AR in 7 (19.4%), grade 3 moderate AR in 4 (11.1%) and grade 4 sever AR in no patient (0%).In Sun Kyun Ro and colleagues (2013)from Seoul, South Korea study on 196 patients, there was significant aortic regurgitation (greater than grade 2) observed in fivepatients (4.34%) [27]. In Paul P Urbanski and colleagues (2013) from Germany study on 46 patients, 33 patient (71.7%) showed no aortic insufficiency and 13 patients (38.3%) slight grade 1[28].In Qing-qi Han and colleagues (2013) there was no AR in 133 (88.1%), grade 1 trivial AR in 16 (10.6%), grade 2 mild AR in 2 (1.3%), no patient developed grade 3 moderate AR or grade 4 severe AR (0%)[25]. In Tatsuhiko Komiya and colleagues (2009) from Japan study on 13 patients with one case mortality,none of the patients had more than mild AR at the time of discharge from the hospital[29].

Regardingdegree of post operative aortic regurgitation in Reimplantation group there was no AR in 8(53.3%), grade 1 trivial AR in 1 (6.7%), grade 2 mild AR in 5 (33.3%), grade 3 moderate AR in 1 (6.7%) and grade 4 sever AR in 0 (0%). In Rainer G and colleagues (2000) there was no AR in 12 patients (66.7%), grade 1 trivial AR in 6 (33.3%), and no patient had more than mild aortic regurge[11].In John–Peder Escobar and colleagues (2013) from Stanford university California USA, study there was 202 patients (94.8%) had either no or trivial AR, 10 (4.7%) had mild AR, none had moderate to sever AR, and 1 (0.5%) had sever AR who subsequently underwent AVR[21].In Coselli JS and colleagues (2014) report on 83 patients, there was one patients with severe AR (1.22%) who underwent surgery and there was no early post operative valve related complication[24]. In Tirone David and colleagues (2013) from Toronto, Canada study on 296 patients, there was moderate aortic insufficiency in 9 patients (3.1%) and sever aortic insufficiency developed in 2 patients (0.7%)[21].

Finally in our Reimplantation group, there was no native aortic valve related complication like infective endocarditis or aortic valve failure, in the early post operative period.

As regard early post operative aortic valve prosthesis follow up in Composite group all patients (14 ptn) had no aortic valve prosthesis related complication such as malfunctioning prosthesis, thrombo-embolism or infective endocarditis except one case (7.7%) of early post operative infective endocarditis on metallic prosthesis. In Carlo Bassano and colleagues (2001) from Rome, Italy, study on 37 patient who underwent aortic root replacement using composite graft, echocardiography study showed a normally functioning prosthetic valve in all patients and, there were no instances of thromboembolism[30]. In David T and colleagues (2003) report patients who underwent Bentall, follow up revealed there was no reported cases with infective endocarditis or malfunctioning aortic valve but one case (4.7%) suffered from anti coagulant related haemorrhage[16]. While in Hyun-Chel Joo and colleagues (2012) study on 218 patients reported that prosthetic valve related complications there was 9 patients(4.1%) had anticoagulant related haemorrhage and 3 patients (1.4%) experienced prosthetic valve endocarditis[31] .

Finally we found that Composite had lower incidence of valve related complications .

In our study, early post operative mortality was 14 patients (17.5%), 5 patients (35.7%) died from myocardial failure, 4 patients (28.6%) died from massive uncontrollable bleeding, 2 patients (14.3%) died from multiorgan failure, 1 patient (7.1%) died from respiratory tract infection (pneumonia), 1 patient (7.1%) died from renal failure and one patient (7.1%) died from visceral ischaemia (severe bleeding per rectum), there was no significant statistical difference between three groups regarding mortality. In Rainer G and colleagues (2000) study There were 2 postoperative deaths: 1 patient died 12 days postoperatively of multiorgan failure and the other died 22 days postoperatively due to an acute respiratory distress syndrome; thus the 30-day hospital mortality was 10%[11].In Klaus and colleagues (2004) study Overall early (30-day) mortality was 24% and did not differ statistically significant between groups. Reasons for early mortality have been myocardial failure (44%), cerebral ischemia (25%), uncontrolled bleeding (10%), multiorgan failure (10%), sepsis (6%), and abdominal ischemia because of malperfusion (6%) and did not differ between groups[17].In Alberto Forteza and colleagues (2009),hospital mortality was 15% (16\105). Six patients died as a result of intraoperative hemorrhage, four due to low cardiac output, two from neurological damage, two from sepsis and two from postoperative multiple organ failure[19].In Qing-qi Han and colleagues (2013) study, a total of 21 patients died during hospitalization (n=10, 6.2%) or follow-up (n=11, 6.8%). Causes of death during hospitalization were gastrointestinal tract necrosis (n=3), gastrointestinal hemorrhage (n=2), sepsis (n=2), acute renal failure (n=1), pulmonary failure (n=1), and stroke (n=1). Causes of death during follow-up were stroke (n=2), ruptured abdominal aortic aneurysm (n=1), pneumonia (n=1), lung cancer (n=1), acute myocardial infarction (n=1), chronic renal failure (n=1), undefined accident (n=1), surgical repair of acute aortic dissection (n=1), car accident (n=1), and pancreatic cancer (n=1)[25]. Patients were followed up with a mean time of 5.1 ± 2.96 years (2-12 years).In Jerry Easo and colleagues (2013),postoperative mortality was 20.2% for DeBakey type I dissection patients in GERAADA, with a tendency for lower postoperative mortality for hemiarch replacement compared to total arch replacement (18.7% vs. 25.7%) failing to be statistically significant[26].In Paul P Urbanski and colleagues (2013) a total of 6 patients (median age 76, range 63-81) 13% died, on average 10 months after surgery resulting in overall survival of 87%[28]. In Yongshi Wang and colleagues (2013) the 30 day postoperative mortality was significantly higher among bicuspid aortic valve patients vs tricuspid valve (23.3 vs 8.1%) with an elevated portion of cardiogenic deaths[22].In Sun Kyun Ro and colleagues (2013), the 30-day mortality rate was 5.1% and six months follow up survivors was 90.3%[27].In Rylski B and colleagues (2014) in-hospital mortality was 11% (56\489)[32].In Sackowski R and colleagues (2014) results of 5325 screened articles, 19 observational studies met the eligibility criteria of 2402 patients, pooled early mortality rate was 18.7%, indicating that early postoperative mortality of patients suffered from ascending aortic dissection is still catastrophic range from 10-30%[18].

Finally, the three techniques mentioned in the study are effective in the management of type A aortic dissection, provided that the techniques are properly individualized for every patient.

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Surgery For Aortic Root Abscess: Prosthetic Versus Native Valve Endocarditis

Amr Rouchdy;

Alaa Farouk

Objective: **Comparison of the surgical outcome for patients with aortic root abscess and valve prosthetic aortic valve endocarditis and native aortic valve endocarditis.**

Methods: **Between January 2009 and January 2014, 27 patients underwent surgery for aortic valve infective endocarditis and aortic root abscess in Cairo University Hospitals. 14 patients had prosthetic aortic valve endocarditis (group A) and 13 patients had native aortic valve endocarditis (group B). Surgery included debridement of necrotic tissues, reconstruction of the annulus with patches, repair of fistulae and valve replacement. Patients were followed for six months postoperatively.**

Results: **The mean age of patients was 42±9.27 years for group A and 41.9±10.05 years for patients in group B. The mean ejection fraction (%) was 50.4 ± 7.98 for group A and 55.4±7.7 for group B. Surgery was emergent in 4 patients (14.7%) and urgent in 13 patients (48.1%). The cross- clamp time was 208.4±17.95 in group A versus 191.1 ± 21.2 min in group B with a *P value of* 0.0158. Early mortality was 22.2% (6/27). Causes of mortality were low cardiac output (2), multi-organ failure (2), bleeding (1) and stroke (1). 14.8% of patients had late recurrence of endocarditis and died during the follow up.**

Conclusion: **Despite the considerable morbidity and mortality, surgery of aortic root abscesses is a live saving procedure mostly of urgent nature. Prosthetic aortic valve endocarditis is associated with increased risk of mortality and morbidity**

Infective endocarditis is a disastrous illness associated with high morbidity and mortality. Despite the advances in antimicrobial therapy, approximately one-third of patients with active endocarditis will require surgery to save the patient's life and eradicate the infection, and yet may yield a poor outcome [1-5]. Depending on how promptly the disease is diagnosed with the appropriate antibiotics started, on whether the infected valve is native or prosthetic, and on the virulence of the microorganism, the infection may extend into the valve annulus and surrounding tissues causing abscess and fistulae [6].

The incidence of infective endocarditis in patients with prosthetic valves is 0.3% to 1.2% per year, and such patients represent 1% to 5% of all patients with infective endocarditis [7], and periannular complications occur in approximately 9.8% to 40% of patients with aortic valve endocarditis, with a higher incidence in prosthetic valve endocarditis (PVE) compared with native valve endocarditis (NVE), and in Staphylococcal infections compared with other organisms [8].

Endocarditis affecting the aortic valve resulting in abscess formation is particularly challenging, and requires aggressive diagnostic and therapeutic approaches as it may result in severe complications such as heart block, destruction of the aorto-mitral continuity, fistulous communication to other cardiac chambers and extrinsic compression of coronary arteries [9,10,11,12].

Due to the diversity of aortic valve endocarditis complications, and the shortage of non-randomized prospective studies, we conducted this prospective study aiming to

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analyze the outcome of surgery for Egyptian patients who had aortic valve infective endocarditis combined with aortic root abscess, and to compare the outcome for PVE versus NVE

Patients and Methods

This study was conducted at Cairo University hospitals during a 5-years period between January 2009 and January 2014, 136 patients underwent surgery for aortic valve infective endocarditis at our department, of whom 27 patients (19.8%) had aortic root abscesses formation. These patients were the subject of this study. Preoperative patient characteristics were presented in table 1.

Fourteen patients (51.8%) had prosthetic aortic valve endocarditis (PVE) with vegetations and annular abscesses (group A). 13 patients (48.2%) had native aortic valve endocarditis (NVE) All patients had aortic valve dehiscence of various degrees. 4 patients of group A had a nearly complete valve dehiscence and needed emergency operations. Persistence of fever and sepsis as well as valve dehiscence was the indications for urgent surgery. Emergency surgery was indicated for patients with highly mobile vegetation or marked valve dehiscence (rocking valve).

Endocarditis was diagnosed according to the modified Duke criteria. Transthoracic echocardiography, clinical examination and blood cultures (table2) were the base of the diagnosis for all patients. . Abscess formation was defined as necrotic tissue in the aortic annulus or root, or as aortoventricular discontinuity. Sepsis was defined as fever, leucocytosis, positive blood culture, hemodynamic instability requiring vasopressors, or organ failure.

Data collections and statistical analysis

Data were collected prospectively. Patients were actively followed up for 6 months post-operatively by a heart team composed of cardiologists and cardiac surgeons. Continuous variables are expressed as the mean ± standard deviation. Categorical qualitative data were tabulated in 2^xn tables and analyzed by chi square or Fisher exact test. Continuous variables were analyzed by student *t* test. P value <0.05 was considered significant. Microsoft Excel was used for data collection and SPSS® v 10.0 was used for analytical statistics.

Operative details

All patients had a median sternotomy, then cardiopulmonary bypass was initiated via aorto-bicaval canulation. Myocardial protection was done by systemic hypothermia to 28°c, ice slush and cold blood home-brew cardiolplegia.

The surgical strategy in all patients was the radical debridement of all infected tissue, drainage, and exclusion of myocardial abscesses from the bloodstream and reconstruction of annular defects as needed with autologous pericardium or Dacron patches, followed by 6 weeks of antibiotics according to blood and tissue cultures. In 14 patients, the infected prosthetic aortic valve was removed first, before inspecting the annulus and the abscess for location and perforation. All tissues or prosthetic valves removed were sent for culture (aerobic, anaerobic and fungal).

The aortic valve was replaced by a mechanical valve in all patients. Irrigation of the sewing ring with gentamicin was done before securing the knots. Abscesses crossing the annulus and destroying the coronary ostia necessitated a Bentall procedure. Reconstruction of the aorto-mitral continuity was needed in three patients by a Dacron patch. Five patients had a perforation into the right atrium, left atrium and right ventricle.

Reconstruction of the aortic annulus was needed in 9 patients (33.3%) by autologous pericardium sutured by running 4/0 polypropylene to the surrounding fibrous tissue. Then Teflon pledgeted sutures passed through it to hold the new valve. In two cases in the PVE group, a Bentall procedure was done using a double velor Dacron® graft attached to the valve with 4/0 running polypropylene sutures. The coronary ostia were reimplanted using running 5/0 polypropylene sutures supported with native pericardial strips.

Results

Preoperative patient characteristics were presented in table 1. The percentage of emergency surgeries was 21.4% in PVE group versus 7.7% in the NVE group although it did not reach statistical significance. Most patients (76.9%) of the NVE group had a rheumatic affection of the aortic valve. Three patients in each group had a concomitant mitral valve disease. Organisms isolated at preoperative blood cultures of from intraoperative specimens were shown in table (2). Cross clamp time and bypass times were significantly longer in the PVE group. Patch reconstruction of the annulus was needed in 11 patients (78.6%) of group A and in 4 patients of group B (30.7%). Operative data were listed in table (3).

The overall early (30 days) mortality was 22.2%. Two patients had low cardiac output (LCO) syndrome postoperatively and needed maximal doses of inotropic support. One patient had persistence of sepsis and end organ damage. One patient died out of surgically uncontrolled bleeding. One patient did not regain consciousness after surgery; he had a preoperative embolic cerebral stroke. Postoperative mortality and morbidity were shown in Table (4). All survivals completed the course of 6 weeks of postoperative antibiotics in the hospital.

Follow up

Three patients had recurrence of endocarditis on the 3rd, 5th and 6 months respectively. All readmitted to the hospital and received antibiotics according to their blood cultures. One patient died shortly after due to septicemia (group B). One patient was reoperated upon for valve dehiscence (group A), but died due to failure to wean of bypass. (Table 4)

Characteristics(n=27)	Group A(n=14)	Group B(n=13)	*P* value
Age (years)	42 ± 9.27	41.9±10.05	NS
Females	8 (57.1%)	7(53.8%)	NS
LVEF (%)	50.4 ± 7.98	55.4±7.7	NS
Emergency	3(21.4%)	1(7.7%)	NS
Urgent	8(57.1%)	5(38.5%)	NS
Elective	3(21.4%)	7(53.8%)	NS
Positive blood culture at surgery	6 (42.8%)	4(30.7%)	NS
Heart failure	2 (14.2%)	1(7.7%)	NS
Renal insufficiency	4 (28.5%)	3(23.1%)	NS
Diabetes mellitus	2(14.2%)	2(15.4%)	NS
Cerebral embolism	2(14.2%)	1(7.7%)	NS
Renal/splenic embolism	1(7.14%)	2 (15.4%)	NS
Rheumatic aortic valve disease	-	10(76.9%)	
Calicific aortic valve	-	1(7.7%)	
Bicuspid aortic valve	-	2(15.4%)	
Concomitant mitral valve disease	3(21.4%)	3(23.1%)	NS
Concomitant mitral valve endocarditis	2(14.2%)	2(15.4%)	NS

Table 1. Demographic and preoperative clinical characteristics

Organism (n=27)	Group A(n=14)	Group B(n=13)	*P* value
Staphylococcus aureus	4 (28.57%)	2(15.4%)	NS
Staphylococcus epidermidis	2 (14.2%)	1(7.7%)	NS
Coagulase-negative staphylococci	1 (7.1%)	1(7.7%)	NS
Streptococci species	1 (7.1%)	2(15.4%)	NS
Enterococci	0	1 (3.7%)	NS
Escherichia coli	2 (2.4%)	1(7.7%)	NS
Proteus	1 (3.7%)	1(7.7%)	NS
Candida	2 (7.4%)	1(7.7%)	NS
Culture negative	1 (14.8%)	3(23.1%)	NS

Table 2. Organisms isolated at the time of initial blood cultures or from intraoperative specimens

n=27	Group A(n=14)	Group B (n=13)	*P* value
Abscess in			
Aortic valve annulus	4 (28.5%)	2(15.3%)	NS
LVOT	10 (71.4%)	9(69.2%)	NS
Central fibrous body	2 (14.2%)	2(15.3%)	NS
Aortic abscess diameter(cm)	1.85±0.82	1.84±0.65	NS
Mitral valve vegetations	2 (14.2%)	2(15.3%)	NS
Destruction of coronary ostia	2 (7.4%)	0(0%)	NS
Perforation into:	4(28.5%)	1(7.7%)	NS
Left atrium	1 (7.1%)	0(0%)	NS
Right atrium	2 (14.2%)	1(7.7%)	NS
Right ventricle	1 (7.1%)	0(0%)	NS
Procedure			
AVR	14 (100%)	13 (100%)	NS
Patch reconstruction	14 (100%)	11(84.6%)	NS
Direct suture closure of the defect	0(0%)	2 (15.3%)	NS
Patch reconstruction of the annulus	11(78.6%)	4(30.7%)	0.012
Bentall procedure	2 (14.2%)	0(0%)	NS
Concomitant surgery			
MV replacement	1(7.4%)	2(15.3%)	NS
MV reconstruction	2 (14.2%)	1(7.7%)	NS
TV surgery	1 (7.1%)	1(7.7%)	NS
CPB time (min)	208.4±17.95	191.1 ± 21.2	0.0158
Cross-clamp time (min)	162±20	144.3 ± 20.5	0.016

ARR, Aortic root reconstruction; AVR, aortic valve replacement; CABG, coronary artery bypass grafting; CPB, cardiopulmonary bypass; LVOT, left ventricular outflow tract; MV, mitral valve; TV, tricuspid valve, CPB= cardiopulmonary bypass, NS=not significant

Table 3. Operative data

	Group A(n=14)	Group B(n=13)	*P* value
Early mortality	4 (28.5%)	2(15.3%)	NS
Low cardiac output	5(35.7%)	3(23%)	NS
Persistence of Sepsis>2weeks	2(14.2%)	2(15.3%)	NS
Reoperation for bleeding	2(14.2%)	1(7.7%)	NS
Temporary pacing	6 (42.8%%)	4(30.7%)	NS
Pacemaker implantation (permanent)	2 (14.2%)	0(0%)	NS
Pneumonia	1 (7.1%)	0(0%)	NS
Delayed recovery of conscious	1 (7.1%)	1(7.7%)	NS
Renal impairment (creatinine>2.5mg/dl)	3 (21.4%)	2(15.3%)	NS
Temporary dialysis	2 (14.2%)	1(7.7%)	NS
ICU stay (days)*	5.7±4	4.7±3.1	0.047
Mechanical Ventilation (hours)*	22.3±15.4	18.4±14.1	NS
Recurrence of endocarditis	2 (14.2%)	1(7.7%)	NS
late mortality	1(7.1%)	1(7.7%)	NS

NS=non significant, data expressed as mean±SD*

Table 4. Postoperative data

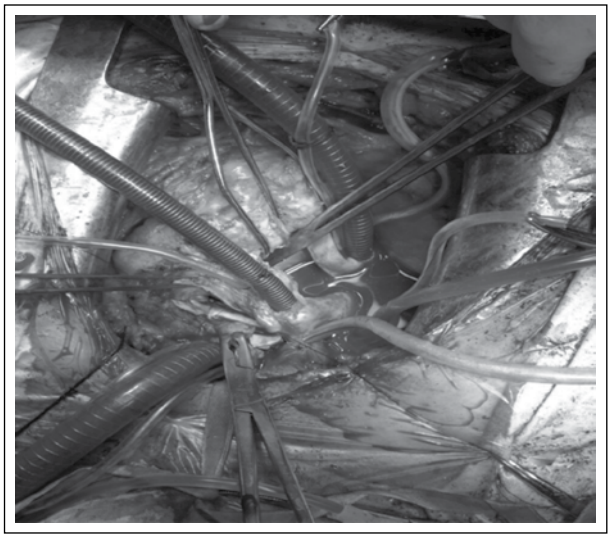

Fig 1. Subaortic abscess opening to the right atrium. The gall bladder forceps is pointing to the fistula.

Discussion

Early, prompt surgical and medical approaches are the cornerstones for the management of aortic valve endocarditis with abscess formation[13]. Despite the high morbidity and mortality, long term follow up from Leipzig[5], Toronto[2], and Berlin[14], was satisfactory. David et al reported a 44% survival at 15 years[2], and Leontyev et al reported a 46% survival at 6 years[5].

Even with low virulent organisms as streptococci, delaying surgical treatment will result in extensive damage to heart valves and surrounding tissues[6]. More aggressive strains as staph aureus on valves of the left ventricle responds better to early surgery[4] despite the higher mortality compared to other strains[15].

In our series the early mortality (30 days) was 22.2%. The mortality was higher in the PVE group than the NVE group without statistical significance. This was matching with other studies. David et al reported a 12% early mortality and 23% late deaths[2]. Leontyev et al reported a 25% early mortality[5]. Nagvi et al reported a 31% of early mortality[16]. Lee et al reported a 13.8 % of early mortality in a PVE group of 20 patients versus a 6.9 % of mortality in a NVE group of 29 patients without statistical significance[17]. The wide variability of the results is related to the percentage of prosthetic aortic valve endocarditis (PVE), staphylococci infections, and associated lesions.

PVE doubles the risk of mortality[5]. In our series 51.8% of patients had an infected prosthetic valve in aortic position. The longer ischemic time needed and the virulence of the organisms associated, and related aggressive sepsis explained the increased mortality in such group. In our series the ischemic time was 208.4±17.95 min in PVE group versus 191.1 ± 21.2 min in NVE group with a p value of 0.0158. This was explained by the time needed to extract the prosthetic valve and reconstruct the annulus.

25.9% of our patients had a staphylococci infection. The later has been found to be a predictor of mortality[2]. In our series, we used mechanical valves only to replace the infected valves. David et al in a 15 years study found that recurrence of endocarditis is not related to the type of valve used[2]. Leyh et al in Hannover found that the excellent long term results are not related to the material used for aortic root replacement[18].

Proper eradication of all infected tissues is the key for long-term freedom from recurrence. However, due to the proximity to the conduction system, heart block became an inevitable price. In our series 7.4% of patients needed a permanent pacing for persistence of complete heart block more than 2 weeks.

Conclusion

Surgical management of infective endocarditis with aortic root abscess poses a high morbidity and mortality. PVE increases the risk but without statistical significance. Proper diagnosis and early management as well as radical excision of infected tissue are the key for a better long term outcome.

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Isolated Tricuspid Valve Replacement for Severe Infective Endocarditis: Beating Heart versus Arrested Heart

Amr Rouchdy, MD

Objective **prospective evaluation of the technique of isolated tricuspid valve replacement on beating heart, compared to the classic aortic cross clamp and cardiolplegia administration.**

Methods **Between May 2004 and May 2014, 30 patients underwent surgery for isolated tricuspid valve infective endocarditis (TVIE), in Cairo University hospitals. Patients were divided into two equal groups. 15 patients had TV replacement on beating heart (Group A), while the other 15 patients had TV replacement on arrested heart and cardiolplegia administration (Group B). Patients were followed for 3 months postoperatively regarding recurrence of endocarditis and conduction abnormalities.**

Results **Operative mortality was 13.3% in group A versus 20% in group B. The mean ischemic time for group B was 43.86±9.13 min. Bypass time was insignificantly shorter in group A (71.26±7.88 min versus 87.93±8.25 min). 26.6% of patients needed inotropic support in group B versus 26.6% in group A. (p=0.028). Atrio-ventricular block occurred in 13.3% of patients in group A versus 53.3% in group B (p=0.025). There was no recurrence of infection, new onset of heart block or thrombembolic events during the follow up.**

Conclusion **Tricuspid valve replacement on beating heart was superior regarding the incidence of temporary AV block, and the need for inotropic support. However, permanent pacemaker implantation, bypass time and mortality were comparable.**

Tricuspid valve infective endocarditis (TVIE) occurs only in 5% to 10% of cases with infective endocarditis[1]. The most common etiologies are intravenous drug abuse, pace maker implantation, central venous catheter and haemodialysis. Despite the advances in antimicrobial treatment, still surgery is needed in 25% of cases[2].

Tricuspid valve (TV) replacement on arrested heart caries the advantages of better exposure of the valve, no movement of the leaflets (facilitates resection the diseased segments), and no posterior movement of the annulus[3]. On the other hand, TV replacement on beating heart abolishes the risk of myocardial ischemia and aortic clamp adverse events[4, 5]. Moreover, early recognition of AV block secondary to atrioverntricular node and/ or bundle damage by septal sutures is feasible and possibly corrected[3].

The aim of this study is to evaluate prospectively tricuspid valve replacement on beating heart in comparison to the classic arrested heart with cross clamp and cardiolplegia administration.

Patients and Methods

Between May 2004 and May 2014, 30 patients underwent surgery for isolated tricuspid valve infective endocarditis (TVIE), in Cairo University hospitals. All patients had massive destruction of the tricuspid valve and had a tissue valve replacement. Redo patients, and patients with other valve diseases were excluded.

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Patients were divided into two equal groups. 15 patients had TV replacement on beating heart (Group A), while the other 15 patients had TV replacement on arrested heart and cardiolplegia administration (Group B). Transthoracic echocardiography and blood cultures were the key for the diagnosis of infective endocarditis. Presences of huge mobile vegetations, more than moderate tricuspid regurge, and / or pulmonary emboli (abscesses) were the indications for surgery. Valve replacement was done whenever residual tricuspid valve tissue after resection of diseased segments is not amenable for repair by autologous pericardium.

Surgical technique

All patients had a median sternotomy. Cardiopulmonary bypass was initiated via aorto-bicaval canulation. In group "B" myocardial protection was achieved by moderate hypothermia (30°c), and antegrade cold blood cardiolplegia. In Both groups the right atrium was opened after snaring the superior and inferior vena cavies. The tricuspid valve was inspected for infection and regurge. All infected tissues and vegetation were resected and sent for cultures.

The Decision of tricuspid valve replacement was taken intra-operatively, when repair is impossible due to lack of healthy tissues and proper leaflet cooptation could never been achieved . The annulus was reconstructed as needed by autologous pericardium. Remaining healthy leaflets and chordae was left in place to avoid ballooning of the right ventricle.

In both groups, interrupted, pledgeted 2/0 braided polyethylene sutures were taken around the annulus. Valve seizers designated for the type of the stented tissue valve used to define the proper size. The valve was fixed in place with care to avoid passing the needle in the area of the anteroseptal commisures. After tightening the sutures in group"A", the heart rhythm was noticed for 5 minutes. Whenever, a conduction abnormality was noticed the sutures around the anteroseptal commisures were cut and a pericardial strip bridge was used to fix the valve to avoid this area.

The right atrium was closed by continuous 4/0 polypropylene sutures in an inverted vertical mattress pattern. Rewarming, and recirculation was needed in group B. Weaning of bypass and routine decanulation and closure was done.

Data Collection and statistical analysis

Preoperative, operative, and postoperative data were collected prospectively and tabulated using Microsoft Excel® program. Continuous variables were expressed as mean ± standard deviation and analyzed by student *t* test. Categorical data expressed as percentages and analyzed by Chi square test or exact Fisher test as appropriate. Statistical analysis was done using SPSS version 10 (SPSS Inc, Chicago, IL). A *p* value less than 0.05 was considered as statistically significant.

Follow up

Patients were followed for 3 months postoperatively regarding recurrence of endocarditis and conduction abnormalities.

Results

Patient characteristics were shown in table (1). The main etiologies for TV infective endocarditis were infection on a permanent pacemaker wire, intravenous drug abuse and haemodialysis. Most patients had grade 3-4 tricuspid regurge. Preoperative echocardiography showed huge vegetations in all patients. Operative data were listed in table (2).

	Group A	Group B	*P* Value
Age (years)	32.26±11	30.46±12	NS
Male sex	13(86.6%)	12(80%)	NS
Permanent pace maker infection	0(0%)	1(6.6%)	NS
Intravenous drug abuse	7(46.6%)	9(60%)	NS
Haemodialysis	4(26.6%)	3(20%)	NS
Unknown etiology	4(26.6%)	2(13.3%)	NS
Atrial fibrillation	2(13.3%)	3(20%)	NS
LVEF (%)	58±8	58.3±7.1	NS
TAPSE	1.54±0.2	1.52±0.21	NS
Pulmonary embolization**	2(13.3%)	4(26.6%)	NS

*G=grade, NS=non significant, LVEF= left ventricular ejection fraction, TAPSE=***tricuspid annular plane systolic excursion** *, ** presented with bilateral lung pyemic abscesses*

Table (1) Preoperative patient characteristics

	Group A	Group B	*P* Value
Ischemic time (min)	-	43.86±9.13	-
Bypass time (min)	71.26±7.88	87.93±8.25	NS
Size 29	3(20%)	4(26.6%)	NS
Size 31	11(73.3%)	9(81.8%)	NS
Size 33	1(6.6%)	2(13.3%)	NS
St Jude Epic® porcine valve	6(40%)	7(46.6%)	NS
Medtronic Hancock® porcine valve	9(60%)	8(53.3%)	NS

Table (2) Operative data

Six Patients with pulmonary emboli had bilateral multiple pyemic abscesses. Two of them had associated empyema due to ruptured abscesses. They were managed by intercostals tube drainage and appropriate antibiotics. Four patients achieved complete healing after surgery within 10-21 days. Two patients died (33.3%), one due to septicemia and one due to respiratory failure.

The overall operative mortality was 16.6% (5/30). There was no statistically significant difference between the two group regarding mortality. Causes of mortality were septic shock (1), low cardiac output (2), multiorgan failure (1) and respiratory failure (1). There were no postoperative neurological complications or new onset of renal impairment in both groups.

Postoperative results were shown in table (3). Atrioventricular (AV) block lasting less than 2 weeks was significantly less in group A. However permanent pacing was needed in 1 patient of group A versus 2 patients of group B with no statistical significance. Postoperative echocardiography showed no paravalvular leaks or residual regurge in both groups during hospital stay.

All survivors completed a 6 weeks course on antibiotics in the hospital. Vancomycin- gentamicin was the most commonly used combination. Voriconazle was used in cases of persistent sepsis or when blood cultures prove a fungal infection (4/30 patients). Echocardiography and clinical examination was done monthly after discharge. Patients were instructed to do a fever chart at home, and followed up by a weekly phone interview.

There was no recurrence of infection, new onset of heart block or thrombembolic events during the follow up. All patients received warfarin to adjust the INR around 2.5-3 and was advised to continue warfarin for life.

	Group A	Group B	*P* Value
Mortality	2(13.3%)	3 (20%)	NS
Need for inotropic support	4(26.6%)	10(66.6%)	0.028
AV block *(<2weeks)	2(13.3%)	8(53.3%)	0.025
Permanent pacemaker	1(6.6%)	2 (13.3%)	NS
ICU stay (days)	2.93±1.43	3.66±1.71	NS
Mechanical ventilation(hours)	5.8±1.65	6.02±2.39	NS

** Atrioventricular*

Table (3) Postoperative data

Discussion

TVEI is mainly a medical issue with a very good response to antibiotics[6]. Surgery is indicated in patients with persistent sepsis refractory to antibiotics, huge vegetations, previous pulmonary embolization and severe tricuspid regurge. Surgery aims to eradicate the infection and correct mechanical complications[7]. Surgical options are vegetectomy, repair with autologous pericardium, ring implantation, excision, and valve replacement[8, 9, 10]. Tricuspid valve replacement (TVR) is mandatory where it is impossible to repair the valve after total eradication of infected tissues.

TVR is a rare procedure. Only 425 patients had a TVR out of 63,000 patients who had valve replacements according to United Kingdom Heart valve Registry between 1986 and 1996[11]. In the setting of endocarditis, mechanical valves are not preferred as the main principle is to use the least possible foreign bodies[12,13].

There is no clear advantage of tissue valves over mechanical valves in the tricuspid position. Filsoufi et al reported 34 patients with TVR by a tissue valve versus 47 patients with a mechanical valve. The overall operative mortality was 22% (heart failure was the commonest cause of death). Survival at 5 and 10 years was 60% and 45% for biological valves and 69% and 59% for mechanical valves[14]. Carrier et al reported a mortality of 17% in patients who had TVR by a tissue valve versus 20% in patients with mechanical valves. One year survival rate were 67±5% with bioprosthesis and 60±13% with mechanical valves[15]. In this series, the overall operative mortality was 16.6%. Most patients were young patients with relatively good cardiac functions with no other cardiac comorbidity apart from tricuspid valve malfunction.

Temporary AV block was significantly less in the beating heart group in this series. Pfannmüller et al reported insignificant difference in the incidence of postoperative AV block between TVR with beating heart (63 patients) and arrested heart (42 patients). Pace maker implantation was needed in 6.4% patients (beating) versus 7.1% (arrested)[3] . Jokinen et al reported a rate of 11.1% AV block with pace maker implantation post tricuspid valve surgery[16].

Pulmonary embolism is a clinical finding in 75-100% of patients with TV infective endocarditis[17]. In this series, the overall incidence of bilateral lung pyemic abscesses secondary to pulmonary embolism was 18%. They had the worst outcome with a high incidence of prolonged mechanical ventilation and mortality secondary to respiratory failure.

Conclusion

Tricuspid valve replacement on beating heart was superior regarding the incidence of temporary AV block and the need for inotropic support. However, permanent pacemaker implantation, bypass time and mortality were comparable.

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Long-term Pacemaker Requirement After Aortic Valve Replacement

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Objective: **The study was performed to assess the long-term requirement of permanent pacemaker (PPM) after aortic valve replacement, and the factors that might determine the frequency of its requirement.**

Methods: **Patients who underwent isolated aortic valve replacement between March 2003 and February 2004 were followed up for up to 10 years with annual ECG and echocardiogram. The implantation of PPM was noted. Factors that can affect the need for PPM were assessed: factors related to the patient (age, hypertension, diabetes, and renal impairment), cardiac factors (ventricular function, size and hypertrophy, endocarditis and valvular pathology) or surgical factors (the size of the prosthesis, the bypass and cross-clamp times and the myocardial protection strategy).**

Results: **Among the 101 patients studied (mean age 63years, median follow-up 9 years), 24 patients required a PPM implantation (7 immediately post-surgery, and 17 in the ten-year follow-up). At 10 years, the freedom from PPM was 67%.**

Although women represented 35% of the patients, they had 54% of the pacemakers inserted (p=0.02). The presence of bundle branch block at discharge had a strong association with pacemaker requirement (p<0.05). Patients with dilated left ventricle were less likely to require a pacemaker. None of the other factors studied seems to affect the frequency of the implementation of pacemaker.

Conclusion**: There is a persistent increase in pacemaker requirement after aortic valve replacement (average 3% per year). This seems to be independent from any preoperative or operative factors and may represent a progress of the original pathology.**

Conducting system defects are common in patients with aortic valve disease. Aortic valve replacement may result in further conduction abnormalities and necessitate permanent pacemaker implantation (PPM) [1].

The incidence of permanent pacemaker (PPM) after cardiac surgery ranges between 0.8 and 34%, depending on the cardiac surgical procedure [2]. Early postoperative PPM implantation after isolated aortic valve replacement (AVR) is reported to be 3–8.5%. Several studies have already analyzed the risk factors for early postoperative need for PPM. However, only few studies analyzed the long-term PPM dependency rate of patients who required PPM implantation following cardiac surgery [3].

Liberal PPM implantation is cost-intensive and may expose patients to an avoidable risk of pacemaker complications. On the other hand, a delayed implantation increases morbidity by immobilization and the risk of sudden death caused by unpredictable conduction disorders without sufficient ventricular escape rhythm [4]. So, identifying patients at increased risk of developing conduction system abnormalities that are likely to require postoperative PPM would be of substantial clinical benefit, facilitating the planning of postoperative care [5].

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In this study, we focused on patients who received isolated aortic valve replacement (AVR). We aimed to determine the long-term outcome and the long-term PPM dependency of these patients. Furthermore, we aimed to identify the predictors of long-term pacemaker dependency in order to avoid unnecessary PPM implantations and to decide on early PPM implantation in selected patients.

Patients and Methods

This was a retrospective study included 101 patients underwent isolated aortic valve replacement in Harefield hospital-London between 1st of March 2003 and 28th of February 2004. The mean age of the study group was 63 ± 15 years, of whom 66 (65.35%) were males and 35 (34.65%) were females. The majority of surgical procedures were performed on an elective basis (83.2%), and 17 patients (16.8%) were redo.

The standard surgical approach for all patients was a median sternotomy, and the standard approach for myocardial protection includes intermittent, cold, anterograde blood cardioplegia supplemented with topical cooling.

All pre- and perioperative parameters were included in univariate analysis for association with PPM dependency. All patients underwent standard 12-lead resting electrocardiography and a complete echocardiographic evaluation before surgery. Postoperatively, resting electrocardiographs and echocardiographs were repeated and interpreted. Patients were followed up for up to 10 years (mean of 9 years) postoperatively with annual ECG and echocardiogram.

The requirement for PPM was determined by the attending cardiologist and was based on the general policy of waiting until at least the fifth postoperative day. Uniformly accepted indications are the continued presence of complete heart block, or symptomatic bradycardia. The actual decision and timing of PPM was, therefore, determined on an individual patient needs basis.

Preoperative clinical characteristics thought likely to influence the conducting system and several operative variables were analyzed to determine whether any were predictive of postoperative PPM requirement.

Patients with pre-existing PPM, Implantable defibrillator and patients who underwent associated interventions such as other valve replacement, or coronary artery bypass grafting were excluded from the study.

Methods – end points:

- Frequency of PPM implantation after AVR
- Factors affecting the need for PPM:
  - » General factors related to the patient (age, gender, hypertension, diabetes)
  - » Cardiac factors (ventricular function, size and hypertrophy, endocarditis, valvular pathology)
  - » Surgical factors (prosthetic type and size, bypass and cross-clamp times).

Statistical analysis

Statistical analyses were performed using the SPSS software. Continuous variables were expressed as median and range. For comparisons of categorical variables, the $\chi 2$ test was used. The Mann–Whitney U test was applied for comparisons of continuous variables. P-values of ≤ 0.05 were considered significant.

Results:

One hundred and one patients underwent isolated AVR with a mean age of 63 ± 15 years, of whom 66 (65.35%) were males; the median follow-up period was 9 years. During this period, 24 (23.76%) patients required PPM, of them, 7 (6.93%) patients needed early postoperative PPM insertion and 17 (16.83%) needed late postoperative PPM insertion (table 1), with an average of 3% per year increase in pacemaker requirement (fig.1). At 10 years, the freedom from PPM was 67%.

	Number (%)
Total number	101
Mean age at surgery (years) ± STD	63 ± 15
Male gender	66 (65.35%)
Median follow up (years)	9
Total PPM requirement	24 (23.76%)
Early postoperative PPM	7 (6.93%)
Late PPM	17 (16.83%)

STD= standard deviation. PPM= permanent pacemaker.

Table 1. Patients Characteristics.

Relation between demographic data and PPM requirement are listed in table 2. Although women represented 34.65% of the patients, they had 54% of the pacemakers inserted (p=0.02), otherwise, none of the preoperative factors are found to have a significant influence on postoperative PPM requirement.

Preoperative cardiac factors and nature of the aortic valve as interpreted by echocardiography and their effect on postoperative PPM requirement are demonstrated in table 3. Thirteen patients (12.87%) had mild to moderate left ventricular dysfunction, 23 (22.7%) patients with dilated LV and 25 (24.7%)

had LV hypertrophy. Preoperative left ventricular function, the presence of left ventricular hypertrophy and the pathology of the aortic valve were found to be of no statistically significant value as predictors for postoperative PPM insertion, however, patients with preoperative left ventricular dilatation had a significantly higher incidence of PPM insertion postoperatively (p=0.05).

Factors	No PPM	PPM	p value
Age (years)	62 ± 2	66 ± 3	NS
Female Male (n = 66)	63% 83%	37% 17%	p = 0.02
No DM DM (n = 8)	76% 75%	24% 25%	NS
No hypertension Hypertension (n = 46)	76% 76%	24% 24%	NS
NYHA class	2.45 ± 0.1	2.46 ± 0.2	NS

DM= diabetes mellitus. NYHA= Neo-York Heart Association.

Table 2. General factors affecting PPM requirement.

Factors	No PPM	PPM	p value
Normal LV function Mild-mod. impairment (n = 13)	77% 69%	23% 31%	NS
No LV dilatation Dilated LV (n = 23)	72% 91%	28% 9%	p = 0.05
No LV hypertrophy LV hypertrophy (n = 25)	76% 76%	24% 24%	NS
Tricuspid aortic valve Bicuspid valve (n = 13)	76% 77%	24% 23%	NS
Not calcified valve Calcified valve (n = 72)	83% 72%	17% 26%	NS
No valvular stenosis Stenosed valve (n = 74)	81% 74%	19% 26%	NS
No regurgitation Aortic regurgitation (n = 58)	77% 76%	23% 24%	NS

LV= left ventricle.

Table 3. Cardiac factors affecting PPM requirement.

Bypass time and aortic cross-clamp time as well as the size of aortic valve prosthesis and redo surgery did not have any significant effect on postoperative PPM requirement (table 4).

Factors	No PPM	PPM	p value
1st time surgery Re-do surgery (n = 17)	74% 88%	26% 12%	NS
Bypass time (min)	99 ± 5	91 ± 7	NS
Cross clamp time (min)	72 ± 4	65 ± 7	NS
Prosthetic size (mm)	23.8 ± 0.3	22.9 ± 0.4	NS

Table 4. Surgical factors affecting PPM requirement.

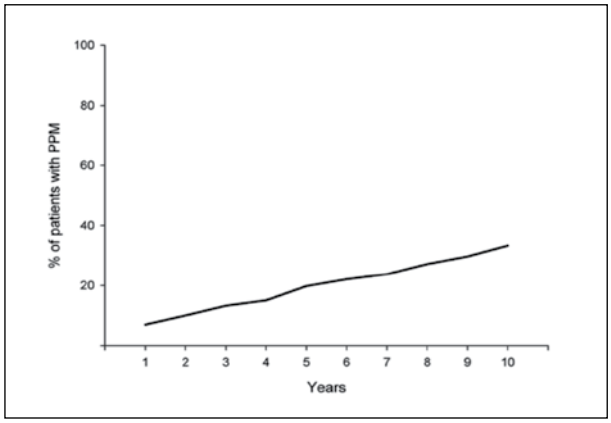

Fig. 1: Percent of patients required PPM.

Ventricular conduction and PPM requirement:

- The presence of bundle branch block preoperatively was not associated with increased PPM requirement.
- New development of bundle branch block at the time of discharge was associated with increased long-term PPM implantation from 11% to 36% (p<0.05).

Discussion

The incidence of permanent pacemaker (PPM) implantation after cardiac surgery varies widely and is reported to be 0.8–34% [2]. In our study, the incidence of early postoperative PPM implantation was 6.93% and at ten years follow-up 24 patients (23.76%) were on PPM, with an average of 3% increase every year. Similar results were reported by Baraki et al. [6], as they observed a total of 6.6% pacemaker implantations following isolated AVR. Nardi et al.[7] described a PPM implantation rate of only 3% within the first 30 days after AVR, while Roten et al. [2] reported an implantation rate of PPM in 34% of cases after transcatheter AVR.

Several studies have already analyzed the risk factors for early postoperative need for PPM. So far, not a single preopera-

tive variable could be identified that reliably predicts the need for postoperative PPM implantation [6,7,8]. We found that female gender was a significant risk factor for postoperative need for PPM, otherwise, none of the general factors related to the patients were of statistical significance.

Del Rizzo and associates [9] evaluated all patients undergoing open heart surgery at their center during a 5.5-year period. Of the 3,448 patients included, 1.3% required PPM. Multivariate logistic regression analysis showed that aortic valve surgery (odds ratio, 8.23; p 0.001), the absence of preoperative sinus rhythm (odds ratio, 5.60; p 0.001); postoperative myocardial infarction (odds ratio, 3.46; p 0.024), and female sex (odds ratio, 2.52; p 0.003) were independent predictors of PPM.

In our study, the presence of left ventricular dilatation was found to be the only cardiac factor with statistical significance for postoperative PPM requirement, however, patients with impaired left ventricular function tended to have a higher incidence of PPM requirement but of no statistical significance, this may be attributed to the fact that only 13 patients (12.87%) had mild- moderate LV dysfunction. Nardi et al. [7] reported similar results as they found that the only predictors of PPM need following isolated AVR were the preoperative end-diastolic diameter and a septal hypertrophy. In contrast to these findings, poor ejection fraction was described as a predictor for long term PPM dependency by Onalan et al. [10].

Regarding the pathology of the aortic valve, in our study, none was found to be a predictor for postoperative PPM dependency. Nair and colleagues [11] showed that the presence of calcific aortic stenosis, mitral annular calcification was associated with a greater need for PPM after valve replacement. In contrast to these findings, aortic regurgitation was associated with PPM in the study of Sam Dawkins et al. [1] and this was explained by the fact that Aortic valve disease, and aortic regurgitation in particular, results in fibrous thickening of the endocardium of the ventricular septum with subsequent impingement on the underlying conducting tissue.

The development of conduction defects after cardiac surgery may also be associated with total bypass and cross-clamp time, degree of myocardial cooling[12], and method of cardioplegia [13]. These presumably reflect severity of ischemic damage to the conducting system. In our study these factors did not impact on postoperative PPM requirement, which may be related, at least in part, to advances in myocardial preservation during cardiopulmonary bypass. On the contrary, prolonged cross-clamp and bypass time have been described as significant predictors for post-operative PPM requirement by Elahi MM et al. [14].

In our study, the presence of bundle branch block preoperatively was not associated with increased PPM requirement, but the new development of bundle branch block at the time of discharge was associated with significantly increased long-term PPM implantation. The same was reported by Nardi et al. [7] as they did not observe any correlations to pre-existing conducting system disorders.

Conclusion

There is a persistent increase in pacemaker requirement after aortic valve replacement (average 3% per year). It is seen more often in women, and in patients who develop postoperative bundle branch block, however, No single variable appears to reliably identify all patients who will require a postoperative PPM.

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Single Versus Double Clamp Technique in CABG

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Objectives: **as the embolic consequences of a side-biting aortic clamp, the single-clamp technique may decrease cerebrovascular accidents in coronary artery bypass grafting. However, the use of the single clamp may lead to adverse myocardial effects due to longer cross-clamp times, In this study, we sought to compare between the two techniques regarding cardiac and neurological outcome.**

Methods: **Of 200 isolated coronary bypass operations completed over a 4 year period, 100 (50%) were performed by one surgeon using exclusively the single-clamp technique and 100 (50%) were performed by a second surgeon using exclusively the two-clamp technique. Postoperative adverse events were primarily compared between these two groups.**

Results: **There were no differences between groups in terms of postoperative stroke or perioperative myocardial infarction. The two-clamp technique was not a significant predictor of stroke by logistic regression analysis.**

Conclusions: **We conclude that there are no statistically significant differences between clamp techniques with regard to stroke prevention or myocardial protection. We find no significance to change from one technique to other.**

Proposed by Buckberg(l) and developed and popularized by Salemo(2) and Aranki et al. (3), the single aortic cross-clamp technique for coronary artery bypass grafting (CABG) is based on sound theoretical grounds. By eliminating the second, partially occluding aortic clamp, this technique may potentially decrease the incidence of embolic stroke in CABG. Accordingly, the single-clamp technique has been gaining popularity among cardiac surgeons.(4)

Although avoiding the application of the conventional second clamp may decrease the number of aortic emboli, this method necessarily results in longer crossclamp times and converts the otherwise closed bypass operation to an open procedure, with increased risk of cardiac and cerebral air embolization. The open aorta may also complicate venting of the left ventricle by gravity or suction.(4)

Surgeons currently using the conventional two-clamp technique also question the potential adverse myocardial effects attendant to the extended period of aortic cross-clamping inherent in the single-clamp technique.(5)

Patients and methods

Patients:

Two hundred patients underwent isolated CABG surgery with EF more than 50%, by equally experienced cardiac surgeons at Sheikh Zayed Specialized, Nasser institute of health and Mansoura university hospitals constituted the study group. All patients having associated valvular, aged more than 80 years, have hepatic or renal dysfunction, all patients having off-pump CABG and all patients having preoperative neurological problems were eliminated,. These patients were operated upon during a 4-year period extending from 2010 to 2013. One hundred (50%) patients underwent surgery via the single-clamp technique (by 2 surgeons) while the other one hundred (50%) patients

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underwent CABG using the two-clamp technique (by 4 surgeons). Segregation into each treatment group was based upon the routine practice of the individual surgeon and not on patient characteristics.

Clinical assessment

Clinical details,were collected from patient charts and sheets. Recorded preoperative variables included Age, gender, history of hypertension, diabetes, history of chest pain, cardiac infarction, congestive heart failure, and exclusion of neurological problems history of peripheral vascular diseases. Past cerebrovascular accident (CVA), preoperative shock, renal failure, urgency of operation and intraaortic balloon pump (IABP) placement. As potential bypass patients do not undergo routine imaging for carotid disease, only a subset of patients had additional data available on preexisting carotid stenosis and/or aortic calcification. Intraoperative variables included the,, number of vessels bypassed, aortic cross-clamp time, cardiopulmonary bypass time, and need for cardioversion, external pacing, inotropic support or use of the IABP upon discontinuation of cardiopulmonary bypass, presence of any ventricular arrhythmia or presence of aortic atheroma or calcification. Postoperative variables included Icu stay, Time of post-operative ventilation, Time of regaining consciousness and muscle power, Any neurological disability , Adverse myocardial events, Stroke postoperative arrhythmia.

Operative technique

All patients underwent isolated CABG surgery using cardiopulmonary bypass and moderate systemic hypothermia (28-32°C). Myocardial preservation was achieved with topical hypothermia using iced saline, and antegrade cold blood or crystalloid cardioplegia.

In the single-clamp method, distal and proximal anastomoses were constructed during a single period of aortic occlusion. Grafting of the internal mammary artery was performed following the completion of saphenous vein anastomoses. Additional cardioplegia was delivered upon completion of each proximal anastomosis.

In the two-clamp method, proximal anastomoses were constructed following release of the initial aortic clamp and after applying a second partially occluding aortic clamp. This method allowed for early reperfusion of the heart and early release of the internal mammary artery graft. Although almost all patients in both groups underwent pedicled left internal mammary artery grafting, sequential arterial or 'Y' grafting was not used.

Statistical analysis

Determination of statistical significance was performed using the _Wilcoxson signed rank test, Mann-whitney test, Me nemmar test, Non parametric correlation coefficient test .The mean value equals the sum of the values divided by their number. The probability P value (test of proportion) for the calculated values with a degree of freedom was calculated using certain tables with a level of significance less than 0.050.The correlations are either simple or multiple. We use the simple correlation between 2 variables. The standard deviation equals the square root of the value of the square of the difference between each observation and the mean value of all observations divided by the number of observations minus 1. It measures how widely values are far from the mean.

Results

Preoperative details

Preoperatively, there were no significant statistically differences between the two groups of patients with regard to age, sex, history of medical diseases (diabetes, hypertension) or triple vessel disease, there were no significant differences in the recorded data regarding aortic calcification or carotid stenosis, between the singleclamp and the two-clamp groups.(table 1)

	Double Clamp (n = 100)	Single Clamp (n = 100)	t	P
EF	59.33 ± 5.74	59.26 ±6.65	0.080	0.937
Sex:				
Male	62	58	0.333	0.564
Female	38	42		
HTN	82	74	1.865	0.172
DM	47	56	1.621	0.203
Presence of calcification	12'	14	0.177	0.674

Table 1. Showing preoperative data in both groups.

Intra-operative details

The cross clamp time in single clamp technique was longer than that of two clamp technique, the mean cross clamp time in single clamp was 112±30 min while in two clamp technique the mean cross clamp time was 80±15.The cardiopulmonary bypass time was longer in the single clamp technique. As the mean cardiopulmonary bypass time in single clamp technique was 120± 65 min while in two clamp technique was 100±41 min.

There is no significant statistically difference between the two groups in number of vessel grafted, there was no difference in the use of a pedicled left internal mammary artery graft. There was no significant differences between the two groups regarding the mean arterial blood pressure during cardiopulmonary (mean pressure in single clamp group 62.9-8 ± 4.93 while in double

clamp group 55.78 ± 6.13). Patients in double clamp group were more likely to require cardioversion than patients in single clamp technique, while the need of inotropes and the need for usage of IABP were more in single clamp.(table2)

	Double Clamp (n =100)	Single Clamp (n = 100)	t	P
Need of DC	50.	38	2.922	0.087
Need of inotrop	61	72	2.716	0.099
Need of IAB	5	10 -	1.802	0.179

Table 2. Showing intraoperative datails bot l groups.

Postoperative details

There were no statistically differences between groups in the incidence of perioperative myocardial infarction, hospital mortality, or permanent stroke. There was also no difference in myocardial adverse events.

Stroke occurred in 10 patients from single clamp group which represents 10%, while in double clamp group 8 patients suffered from postoperative stroke. In single clamp group 8 patients from the 10 patients suffered from postoperative stoke were diabetic and hypertensive and this represent 80% from stroke patients. There is significant relation between stroke and age in single clamp group as the mean age of stroke patients was 64.40 ± 9.97 years while in non-stroke patients the mean age was 56.78 ± 7.56 years. There was no significant relation between number of grafts and occurrence of stroke. In double clamp technique 8 patients from 8 patients suffered from stroke were hypertensive while only 2 patients whom represents 25% were diabetic. In non-stroke patients 80.4% of patients from double clamp technique were hypertensive and only 48.9 were diabetic.

	Double Clamp (n = 100)		Single Clamp (n = 100)		X2	P
	No	%	bfo	%		
Postoperative Arrhythmia	26	*26*	22	22	0.439	0.508
Neural defect	8	8	10	10	0.244	0.621
Adverse events	5	5	8	8	0.740	0.390
Stroke	8	8	10	10	0.244	0.621

Table 3. Postoperative details

Discussion

Ischemic heart disease is a wide spread disease these days, coronary artery bypass grafting now becomes a routine operation in many centers.

In this study we present a large series of patients who were specifically analyzed to determine the relationship between the aortic clamping technique and postoperative outcome in isolated CABG surgery.

There are previous studies who conclude different results of superiority of one technique over the other:

Aranki S.F and colleagues suggest that completion of both distal and proximal anastomoses in a single extended period of aortic cross-clamping may decrease cerebrovascular complications and improve myocardial protection during CABG surgery.(3)

This was supported by the study of Hammon J.W and colleagues (5) and Loop F.D and colleagues (6).

Musumeci and coworkers in 1998 reported that the single clamp technique was not as effective as intermittent ischemic arrest in the prevention of myocardial ischemia and neurologic problems.(7).

In 2001 Kim and colleagues concluded that use of a SCT does not prevent stroke, but their study also did not have an adequate sample size to detect a significant difference in stroke occurrence. (4).

Stefaniszyn H.J and coworkers in 1984 proved experimental evidence for the superiority of the single-clamp technique includes pathologic evidence of aortic damage following clamp application and echo Doppler documentation of cerebral artery emboli following the application and removal of aortic clamps(8).

Several previous clinical studies have also correlated the single-clamp technique to a reduction in postoperative morbidity.(4).

Maura A Grega and colleagues' analysis was not statistically powered to detect a difference in stroke rate. However, in addition to an improved neurologic injury outcome with SCT, a trend toward improvement in stroke rate was observed.(9)

In our series, the study was done on 200 patients divided randomized into two groups. This number of patient is larger than the study of Dar and coworkers(10) and quietly approaches the number of patients in the study of Aranki et al(3).

Although this number of patients represents a good number but still small number in comparison with the targitive data, and strength in this number came from that the study is prospective study.

The mean age in our study was 60.48 ± 6.90 years in double clamp group and 57.54 ± 8.1 lin single clamp group. This are near the mean age of kim and colleagues study (4) in which the mean age was 65.6±12 in double clamp group and

In preoperative data there were no significant differences between the two groups of patients with regard to age, gender, history of diabetes, hypertension, this was similar to the study of Maura A Grega and colleagues(9)and kim and coworkers(4).

We have no significant difference in both groups in gender preoperative risk factors presence of radiological aortic calcifications or significant carotid stenosis.

In kim and colleagues(4) , Maura A Grega and colleagues(9), Hammon and colleagues(5) there were no significant differences between the two groups of patients with regard to age, gender, history of diabetes, hypertension, congestive heart failure, peripheral vascular disease, triple vessel disease, preoperative shock, renal failure, urgency of operation or IABP use.

Intraoperative we divide the patient randomized into the two groups 100 patients were operated by single clamp technique in which the distal anastomosis and the proximal anastomosis were done on cross clamp and arrested heart, the other 100 patients the distal anastomosis were done on cross clamp and arrested heart while the proximal were taken after removal of the cross clamp and freeing the mammary and applying a second side biting clamp.

In our series, the mean cross clamp time in single clamp was 112±30 min while in two clamp technique the mean cross clamp time was 80±15.

The cardiopulmonary bypass time was longer in the single clamp technique. As the mean cardiopulmonary bypass time in single clamp technique was 120± 65 min while in two clamp technique was 100±41 min.

While in kim and coworkers(4) study the cross-clamp time in the single-clamp group (94.9±28 min) was twice that in the two-clamp group (46.7±15 min, The cardiopulmonary bypass time was also significantly longer in the single-clamp group (118±82 vs. 88±49 min, however in Maura A Grega and colleagues(9) study the cross-clamp time in the single-clamp group 89 and in the two-clamp group 80, The cardiopulmonary bypass time was also significantly longer in the double clamp group 128 and only 115 in single clamp technique

There were also no differences between groups with regard to inotropic support, or IABP use in weaning from cardiopulmonary bypass. Patients in the two- clamp group were more likely to require cardioversion than single clamp method. This is similar to the results of kim and colleagues study (4).

In our study the mean time of ventilation in single clamp group was 16.88 ± 42.79 while in double clamp group was 22.81 ± 49.48 and this represent nonsignificant difference between the two groups. Also according to ICU stay there was non-significant difference.

The two groups are nearly equal in the occurrence of postoperative myocardial infarction. 8 cases only (8%) in single clamp technique and 5 cases (5%)in double clamp teclmique . In kim and colleagues study (4) Myocardial infarction occurred in 2.6% of the single-clamp and 0.7% of the two-clamp patients.

In Maura A Grega and colleagues study (9) two patients in the SCT group and one patient in the DCT group had an adverse myocardial outcome.

In our study there is no significant difference between the two groups in postoperative neurological events.

All postoperative neurological events were ischemic stroke, and all of them were investigated and proved by CT brain.

Stroke occurred in 10 patients from single clamp group which represents 10%, while in double clamp group 8 patients suffered from postoperative stroke.

In Maura A Grega and colleagues study(9), patients in the DCT group had a 29% (14/48) incidence of neurologic injury compared with 2.7% (1/38) in the SCT group while in kim and coworkers study(4) Stroke occurred in five single-clamp patients (1.7%) and six two-clamp patients (2.0%). There was also no difference in the incidence of stroke for higher risk patients over the age of 65 years (0.3% singleclamp, 1.2% two-clamp).

All our cases suffered from neurological complications was investigated by CT brain and this revealed that all cases are embolic stroke, and this are near to that founded by kim and colleagues as they revealed eight of 11 (72.7%) strokes appeared embolic on CT scan.

The failure of the single-clamp technique to tangibly manifest its theoretical potential for stroke prevention reinforces the need for a multi factorial approach to stroke prevention after CABG.

The single-clamp technique addresses only one potential factor and is overshadowed by the effects of multiple other potential causes of stroke in this setting. Embolic material may be liberated not only by the side-biting clamp, but also by the main cross-clamp itself, by aortic cannulation, by the perfusion jet, and by the aortic punch. Manual manipulation of the aorta may liberate debris.

The use of any aortic clamp decreased and epiaortic ultrasound use increased from 2002 to 2009, increases surgeon awareness of the potential complications associated with manipulation of the aorta.(l 1)

None of these other potential sources of emboli would be influenced by application of a side-biting clamp. Ischemic

post-CABG strokes due to carotid or intracranial stenoses or thrombosis are also not influenced by the clamping technique.

Surgeons trained using the partially occluding second clamp have been hesitant to change to the single-clamp method because of concerns that the prolonged ischemia time inherent to this technique may increase cardiac morbidity.

There is no evidence to suggest that use of the single-clamp technique results in increased cardiac morbidity.

Our data demonstrate that the clamp technique makes no difference in the need for inotropic support, pacing, or IABP use, although there is a difference in the need for cardioversion. We contend that both techniques provide excellent myocardial protection in CABG surgery.

Although the single-clamp technique was not protective for stroke in this or other overall series of patients, we do believe that it is an important and appropriate technique, especially for individual high-risk patients with severe ascending aortic arteriosclerosis detected clinically or by transesophageal echocardiography.

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Amiodarone is Safe and Effective in Preventing Post-Operative Atrial Fibrillation; Tanta Experience.

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Objective: **Postoperative atrial fibrillation POAF is a common complication after open heart surgery. We aimed to assess the safety and efficacy of amiodarone in preventing POAF in patients with known risk factors (old age, history of paroxysmal AF, low average post-op serum potassium level, prolonged p-wave duration and increase left atrial diameter) undergoing cardiac surgery in Tanta.**

Methods: **176 patients who underwent adult cardiac surgery and had a risk factor of POAF were divided in 2 groups; amiodarone group (98 patients were given prophylactic post-operative amiodarone) and placebo group (78 patients). Primary outcome (POAF) and secondary outcomes (consequences of amiodarone administration) were reported.**

Results: **Amiodarone was found significantly superior to placebo in preventing POAF and shortening post-operative intensive care unit and hospital stay, without significant side effects, and without affection of the incidence of cerebral events and mortality.**

Conclusion**: Amiodarone is safe and effective in preventing post-operative atrial fibrillation in patients with risk factors of POAF undergoing cardiac surgery in Tanta University Hospital.**

KEY WORDS **(Amiodarone, postoperative atrial fibrillation, POAF)**

Atrial Fibrillation (AF) is the most common complication after cardiac surgery [30% after coronary artery bypass graft (CABG), 40% after valve surgery, and 50% after combined CABG/valve surgery]. The peak incidence of Post-Operative Atrial Fibrillation (POAF) is between the second and fourth days post-operatively.[(1)] POAF is associated with an increased risk of post-operative stroke, increased length of intensive care unit (ICU) and hospital stays, healthcare costs and mortality.[(2)]

Risk factors for development of POAF differ greatly in many studies; some demonstrated that advanced age, hypertension, diabetes, obesity, hypercholesterolemia and leukocytosis were powerful risk factors for the occurrence of POAF.[(3)] Others developed a POAF score as a bedside tool to predict POAF and its related or accompanying complications.[(4)]

Wahby et al.[(5)] studied predictors of atrial fibrillation following open heart surgery in Tanta and found that old age, history of paroxysmal AF, low average post-op serum K level, prolonged p-wave duration and increase left atrial diameter were the 5 independent risk factors of POAF.

Chemoprophylaxis against postoperative atrial fibrillation in cardiac surgery patients remains underused, despite its effectiveness and the recommendations for its routine use by several international organizations.[(6)] Canadian Cardiovascular Society in its Atrial Fibrillation Guidelines 2010; recommended amiodarone as a first-line therapy in prevention of POAF in patients at high risk of POAF.[(7)]

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Aim of the work

The objective is to assess the safety and efficacy of amiodarone in preventing POAF in patients with known risk factors undergoing cardiac surgery in Tanta University Hospital.

Patients and Methods

This prospective study was conducted in cardiothoracic department, Tanta University Hospital; a tertiary referral hospital in Delta area in Egypt, during the period from Jan 2011 to July 2014, on 176 patients who underwent adult cardiac surgery either valve or CABG and had one or more of the 5 independent risk factors of POAF (old age, history of paroxysmal AF, low average post-op serum K level, prolonged p-wave duration and increase left atrial diameter) detected in a previous study in our department.[5]

We excluded patients who were not in sinus rhythm before surgery, requirement for class I or III anti-arrhythmic drugs for at least one week before or in the early postoperative period, off-pump technique, redo, concomitant and emergency surgery and those with congenital heart disease. For amiodarone use; we also excluded patients with known history of amiodarone hypersensitivity and those with marked sinus bradycardia (heart rate less than 50 bpm) or second or third degree AV block and cases with moderate to severe liver disease.

The presence or absence of a risk factor was reported according to the mean values in patients who had POAF in our previous study in Tanta (Wahby et al.) [5] as following:

Table 1: Risk factors of POAF

	Risk factor	CABG	Valvular
1	Old age (y)	≥ 63	≥ 41
2	History of paroxysmal AF	Present	Present
3	Low average post-op serum potassium (K) level (mmol/L)	≤ 3.5	≤ 3.9
4	Prolonged p-wave duration (msec)	≥ 120	≥ 124
5	Increased left atrial diameter (mm)	≥ 46	≥ 50

Every patient was discussed about the incidence and management of POAF and the potential side effects of amiodarone; patients were classified according to surgeon and patient preference into 2 groups:

Amiodarone group: (98 cases)

Placebo group: (78 cases)

300 mg amiodarone or placebo (5% aqueous dextrose solution) administered intravenously over 20 minutes at the time of anesthesia induction followed by 600 mg continuous intravenous infusion over 24 hours, followed by amiodarone/placebo 200 mg orally twice a day for the first 5 postoperative days.

Postoperative beta-blocker therapy was only recommended in patients with preoperative beta-blocker usage to prevent sudden beta-blocker withdrawal phenomenon.

Only episodes of POAF (irregularly irregular rhythm with a fluctuating baseline and no discernable P waves) lasting more than 1 hour or associated with hemodynamic compromise (symptomatic POAF) were taken into consideration.

The primary outcomes were the occurrence of POAF and symptomatic POAF while the secondary outcomes were to assess the advantages of amiodarone administration on the incidence of cerebral events (stroke and TIAs "transient ischemic attacks"), hospital and ICU lengths of stay and mortality.

The drawbacks of amiodarone usage as bradycardia (< 60 beats per minute) and hypotension (< 90/60 mmHg) were reported.

Statistical analysis

For qualitative data, comparison between two or more than two groups; Chi-square test (X2) was used. For quantitative data, the range, mean and standard deviation were calculated. For comparison between means of two groups; student's t-test was used. A p-value of less than 0.05 was considered statistically significant.

Results

One hundred seventy six patients underwent adult cardiac surgery; 149 valve surgery and 27 CABG surgeries, 128 (72.7%) patients were on pre-operative B-blockers, the mean age was 39.8 ± 16.9 years ranged from 18 to 76 years, the mean ischemic time was 65.8 ± 24.4 minutes ranged from 32 to 135 minutes, the mean bypass time was 81.1 ± 30.6 minutes ranged from 40 to 225 minutes.

The 2 groups (Amiodarone and placebo groups) were homogenous as regard pre and post-operative data. (Table 2)

POAF occurred in 27 (15.3%) patients which was symptomatic in 12 (6.8%), there was highly significant difference in the incidence of POAF (P-value 0.0007) and significant difference in the incidence of symptomatic POAF (P-value 0.0267) between the 2 groups. (Table 3)

Bradycardia (< 60 beats per minute) occurred in 9 (5.1%) patients and hypotension (< 90/60 mmHg) occurred in 5 (2.8%) patients after amiodarone or placebo administration, there was no significant difference in the incidence of bradycardia (P-value 0.496) and the incidence of hypotension (P-value 0.844) between the 2 groups. (Table 4)

As regard cerebral events; the incidence of stroke was 0.56 % and the incidence of TIAs was 2.8%, without significant difference between the 2 groups. (Table 4)

The mean length of ICU stay was 3.2 ± 2.6 ranged from 1 to 18 days and the mean length of hospital stay was 8.5 ± 2.9 ranged from 4 to 25 days, comparison between the 2 groups revealed significant difference in the length of ICU stay (P-value 0.031) and the length of hospital stay (P-value 0.0005) between the 2 groups, While mortality rate was 4.5% with no significant difference between the 2 groups. (Table 4)

Pre and operative data	Amiodarone group (n=98)	Placebo group (n=78)	P-value
Age (year)	40.7 ± 16.6	38.6 ± 17.3	0.207
Pre-op use of beta blockers	70 71.4%	58 74.4%	0.665
Type of surgery			
Valve surgery	81	68	0.408
CABG surgery	17	10	
Ischemic time (min)	66.4 ± 23.1	65.1 ± 26.1	0.356
Total cardio-pulmonary bypass time (min)	80.1 ± 30.3	82.4 ± 31.1	0.307

Table 2. Distribution of pre and operative data in both groups.

Primary outcomes	Amiodarone group (n=98)		Placebo group (n=78)		P-value
POAF	7	7.14%	20	25.64%	0.0007*
Symptomatic POAF	3	3.06%	9	11.54%	0.0267*

**Significant or P<0.05*

Table 3. Primary outcomes in both groups.

Secondary outcomes	Amiodarone group (n=98)		Placebo group (n=78)		P-value
Bradycardia	6	6.12%	3	3.85%	0.496
Hypotension	3	3.06%	2	2.56%	0.844
Stroke	1	1.02%	0	0%	0.371
TIAs	2	2.04%	3	3.85%	0.474
Length of ICU admission (day)	2.8 ± 2.1		3.7 ± 2.9		0.031*
Length of hospital stay (day)	7.8 ± 2.6		9.3 ± 3.1		0.0005*
Hospital mortality	4	4.08%	4	5.13%	0.741

**Significant or P<0.05*

Table 4. Secondary outcomes in both groups.

Discussion

Prophylactic amiodarone decreased the incidence of POAF in risky patients undergoing open heart surgery from 25.64% in placebo group to 7.14% but did not affect the incidence of mortality; this is consistent with Bagshaw et al.[8] and this was achieved without significant side effects as bradycardia and hypotension which is inconsistent with Patel et al.[9] who found increased probability of post-operative bradycardia and hypotension after prophylactic intravenous amiodarone; this may be explained by their use of high doses of intravenous amiodarone and they concluded that adverse effects of amiodarone seem to be related to dose and should therefore be given in the lowest dose for a short period if possible, we used low doses of intravenous amiodarone followed by oral route which may be less harmful.

We preferred to start amiodarone therapy post-operatively to decrease the overall dose of amiodarone in order to decrease its potential side effects, this was supported by the research of Buckley et al.[10] who found that there were no significant differences in patients in whom amiodarone prophylaxis was initiated pre-operatively and continued post-operatively (6 studies) compared with those in whom amiodarone prophylaxis was initiated post-operatively (8 studies), respectively (p=0.862).

We found that amiodarone prophylaxis that decrease the incidence of POAF also significantly shortened post-operative intensive care unit and hospital stay and consequently the cost of surgery, this is in agreement with Arsenault et al. [2] and Bagshaw et al. [8] who found that the mean hospital length of stay was 9.3 and 9.9 days for the amiodarone and control groups, respectively.

Finally we agree with Maraš et al.[11] in that amiodarone reduced the risk of POAF and symptomatic AF by 43% and 68% (P=0.037 and P=0.019) versus placebo in their study.

Conculsion

Amiodarone is safe and effective in preventing post-operative atrial fibrillation in patients with risk factors of POAF undergoing cardiac surgery in Tanta University Hospital.

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Predictors of Left Ventricular Mass Regression Following Aortic Valve Replacement

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Background: **Aortic stenosis (AS) is the most common valvular heart disease, and has become the most common cardiovascular disease after coronary artery disease and hypertension in developed countries. Postoperative clinical improvement and the regression of left ventricular mass after aortic valve replacement is the aim of surgical interference. Independent factors affecting this aim had been studied long time ago. Valve prosthesis-patient mismatch (PPM) is a frequent problem and was defined as a projected indexed effective orifice area less than 0.85 cm^2/m^2 . Its main hemodynamic consequence is to generate high trans-valvular gradients through normally functioning prosthetic valves. The persistence of this high gradient may hinder or delay the regression of left ventricular hypertrophy after aortic valve replacement.**

Methods: **Randomized selection of 100 patients, underwent aortic valve replacement with a single type of bio-prosthesis (Medtronic Mosaic) for pure aortic stenosis in Saud al-Babtin Cardiac Centre(SBCC). The study population showed that, 25/100 (25%) patients had prosthesis-patient mismatch of a moderate degree (indexed effective orifice area (IEOA) from 0.65 cm^2/m^2 - 0.85 cm^2/m^2). The effect of prosthesis-patient mismatch on the postoperative echocardiographic findings mainly the regression of left ventricular mass after aortic valve replacement and follow up comparison of the unmatched group with the matched group in addition to the other possible related factors through the multivariate analysis was the aim of the study.**

Results: **In multivariate analysis, hypertensive patients, preoperative New York Heart Association (NYHA) class >II and a higher preoperative left ventricular mass≥250g/m^2 are independent predictors of incomplete left ventricular mass regression. Age and Gender was found to be insignificant predictors. There was a good correlation (r = 0.755, p <0.001) between the postoperative left ventricular mass regression (LVMR) and the projected indexed effective orifice area. There was a significant reduction of left ventricle (LV) mass in both groups and a significant reduction of LV mass index among Non PPM group while it was of a no significant reduction in PPM.**

Conclusion: **This study shows that in patients with pure aortic stenosis prosthesis-patient mismatch is associated with lesser regression of left ventricular hypertrophy after aortic valve replacement. Hypertension, preoperative (NYHA) class >II and a left ventricular mass≥250g/m^2 are other independent predictors.**

Key-words: ***left ventricular mass regression, aortic valve replacement***

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The left ventricular (LV) hypertrophy is associated with a two- to three-fold increase in cardiovascular-related mortality, normalization of LV mass is therefore a crucial goal of aortic valve replacement (AVR) the extent of LV mass regression may be incomplete and we should know whether PPM is one of the causes or not.[1] There is a strong and independent relationship between the indexed EOA and the extent of LVM regression after AVR and the ideal objective is thus to obtain an indexed EOA greater than 0.8 to 0.9 cm^2/m^2 after operation. In 1978, Rahimtoola SH et al., [2] proposed that PPM can be defined when the EOA of the inserted prosthetic valve is too small in relation to body size and then subsequently

modified as: (1) when IEOA > 0.85 cm^2/m^2 , the degree of PPM is mild (not clinically significant) and PPM is present when IEOA of the implanted prosthesis ≤ 0.85 cm^2/m^2,(2) Degree of PPM is defined moderate when IEOA = 0.65- 0.85 cm^2/m^2 and severe degree when IEOA < 0.65 cm^2/m^2. PPM is a frequent problem; it occurs in 20-70% of AVR and severe PPM represents 2-10%.[3] and the main Hemodynamic impact of prosthesis–patient mismatch is to generate high trans-valvular gradients through normally functioning prosthetic valves which will evidently result in increased LV work, thus jeopardizing the regression of LV hypertrophy, with subsequently increase in early mortality with severe PPM especially in patients with LV dysfunction .The operative mortality is 3% for the patient with absent PPM, 6% for the patient with moderate PPM, 26% for the patients with severe PPM.[4] The study of the effect of prosthesis-patient mismatch (PPM) after aortic valve replacement (AVR) in patients with pure aortic stenosis on LVM regression remains controversial and challenging.[5] So, the objective of this study was to examine mainly if there is correlation between PPM and the extent of LV mass regression rather than other echocardiographic parameters after AVR and to compare the unmatched group with the matched group.

Materials and Methods

The population of the present study includes 100 patients with pure aortic stenosis (AS) or associated with mild aortic insufficiency who underwent AVR between March **2008 and March 2014 in Saud al-Babtin Cardiac Centre(SBCC). All patients received a Medtronic Mosaic bio-prosthesis, the studied patients were classified into two groups:**

- Matched group with (**no** PPM): when the IEOA> 0.85 cm^2/m^2
- Unmatched group with(PPM): when the IEOA≤0.85 cm^2/m^2

Complete echocardiographic parameters with special focus on LVMR after AVR was studied in both groups. The patients with more than mild regurgitation by color doppler echocardiography, previous myocardial infarction, previous cardiac surgery and concomitant surgical procedure other than coronary artery bypass grafting were excluded from our study. We did not enface any patients with severe PPM(IEOA≤0.65 cm^2/m^2)

Echocardiographic data

Patients were evaluated by Doppler echocardiography 0 to 7 days before operation, after three months and after six months postoperative, the preoperative and postoperative transthoracic echocardiographic studies were performed by four experienced echo-cardiographers using an Acuson 128 Computed Sonograph (Acuson, Mountain View, CA) equipped with 2.5- to 3.5-MHz transducers. Standard parasternal views including (left parasternal view with long and short-axis view), apical and subcostal views were obtained, and the dimensions of the LV were assessed using two-dimensional guided parasternal M-mode tracings, with the measurements being made according to the recommendations of the American Society of Echocardiography(ASE). If the M-mode recordings were technically inadequate, two-dimensional measurements were used. LVM was calculated with the corrected ASE formula [6]:

$$LVM = 0.8\,[1.04\,(IVSd + LVIDd + PWTd)^3 - LVID^3] - 13.6$$

Where IVSdis the end-diastolic inter-ventricular septum thickness, LVIDdis the LV end-diastolic internal diameter, and PWTdis the LV end-diastolic posterior wall thickness. The peak and mean valve gradients were calculated using the modified Bernoulli equation ($PG=4V^2$) where (V) is subvalvular velocities (m/s). [7] Valve EOA was calculated using the continuity equation and indexed with BSA.

Follow-up protocol:

The studied patients were interviewed by telephone for follow-up schedule included medical history, physical examination as the functional class according to the NYHA grades and echocardiographic evaluation, the early postoperative follow up was at 3 months after surgery, and then after 6 months postoperative for further observation.

Statistical Analysis

The collected data were organized, tabulated and statistically analyzed using SPSS software statistical computer package version 13. For quantitative data, the range, mean and standard deviation were calculated. For qualitative data, comparison between two groups and more was done using Chi-square test(X^2). For comparison between means of two groups student t-test was used. For comparison between more than two means, the F value of analysis of variance (ANOVA) was calculated, where scheffe test was performed to compare between each two means if F value was significant. Correlation between variables was evaluated using Pearson's correlation coefficient. Significance was adopted at $p<0.05$ for interpretation of results of tests of significance.[8, 9]

Results

Preoperative and Operative Data

From the results of the present study, the mean age of the studied patients as a whole (n=100) was of no statistical difference among both groups, with predominately female. Few patients had a history of tobacco use 25% (25/100), diabetes 19% (19/100), and hypertension 60% (15/25) among patients with PPM and 36% (27/75) among patients without PPM as shown in table (1).

Incidence of PPM

Among the patients of the present study (as in the Table 2) the overall incidence of PPM (EOAI≤0.85 cm^2/m^2) was 25% (25/100) and the rest of the patients were of no PPM (EOAI ≥0.85 cm^2/m^2)(75/100) 75% table (2).

Parameters	No PPM (n=75)		PPM (n=25)		X^2	P
Gender"					**0.02**	**0.889**
Males	24	32.0	7	28.0		
Females	51	68.0	18	72.0		
Age (years):						
Range	52-81		56-85			
Mean ± SD	71.38±8.46		75.44±6.23			
t-test	0.586					
P	0.533					
BSA (M^2):						
Range	1.09-2.31		1.43-2.61			
Mean ± SD	1.67±0.47		1.64±0.41			
t-test	0.837					
P	0.452					
NYHA class:					**4.25**	**0.232**
II	35	46.7%	15	60.0%		
III	35	46.7%	7	28.0%		
IV	5	6.6%	3	12.0%		
Arterial hypertension:	27	36.0%	15	60.0%	**2.73**	**0.082**
Diabetes Mellitus:	14	18.6%	5	20.0%	**5.93**	**0.843**
History of tobacco use:	17	22.6%	8	32.0%	**4.81**	**0.431**

Table 1. Demographic and clinical data of our patients.

Parameters	PPM (EOAI ≤ 0.85 cm^2/m^2) (Moderate degree)	No-PPM (EOAI ≥0.85 cm^2/m^2)
Number of patients	25	75
Percent (%)	25%	75%

Table 2. Incidence of PPM

Operative data

There was no patients taken to the operating room emergently at the time of surgery, and no patient need any procedure for aortic root enlargement, also the mean total bypass time and the mean aorta cross clamping time was of no statistical difference among patients in both groups as shown in **(table 3)**.

The distribution of prosthesis size among both groups of the studied patients was of no statistical difference as shown in table (4)

Procedure	No PPM (n=75)	PPM (n=25)	Total (n=100)	t-test	P
	Range Mean ± SD	Range	Range		
Cardiopulmonary bypass time	73-220 116.80±38.67	75-151 124.30±46.30	65-210 108.77±30.69	**0.847**	**0.387**
Aortic cross clamping time	49-165 87.75±34.98	56-136 94.80±27.34	48-165 86.49±38.35	**0.547**	**0.556**

Table 3. Cardiopulmonary and cross clamping time

Valve size (mm)	No PPM (n=75)		PPM (n=25)		X^2	P
	N	%	N	%		
19	11	14.7	6	24.0	**4.69**	**0.216**
21	25	33.3	12	48.0		
23	33	44.0	5	20.0		
25	6	8.0	2	8.0		

Table 4. ***The distribution of prosthesis size among both groups***

Prosthesis size and indexed effective orifice area (cm^2/m^2):

From the results of the present study we can found that in **non PPM** group the indexed effective orifice area (IEOA) was statistically related to the size of the prosthesis and the body surface area while in **PPM** group the IEOA was quite similar with no statistical difference in between regardless the sizes of valve prosthesisas shown in table (5).

Valve size (mm)	The measured indexed effective orifice area IEOA (cm^2/m^2)		t-test P	
	No PPM (n=75)	PPM (n=25)		
	Range Mean ± SD	Range Mean ± SD		
19 mm	0.86-0.89 0.86±0.04	0.74-0.85 0.80±0.06	0.069	0.838
21 mm	0.89-1.30 0.91±0.18	0.78-0.84 0.81±0.06	3.853	0.0001*
23 mm	0.94-1.25 0.98±0.09	0.76-0.78 0.78±0.03	6.384	0.0001*
25 mm	1.12-1.39 1.18±0.18	0.82-0.82 0.82±0.00	-	-
F-test P	18.234 0.0001*	0.403 0.674		

**Significant(P≤0.05)*

Table 5. The measured indexed effective orifice area (IEOA) and the size of the valve prosthesis.

Correlation between the IEOA and the postoperative mean transprosthetic gradient

Also, there was a significant negative correlation between postoperative IEOA of each valve prosthesis and transprosthetic gradient (TPG) across where p value =0.0001 which means that when IEOA of the prosthesis increases, the transprosthetic gradient decreases.

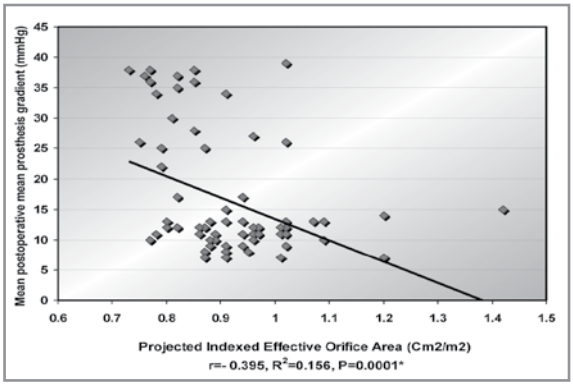

Fig 1. Correlation between the projected IEOA and the postoperative mean transprosthetic gradient.

Impact of PPM on Left Ventricular Function:

When studying patients as regards preoperative and postoperative LVEF, we found a significant improvement in postoperative LVEF in **non-PPM** (after three months LVEF=56.57±6.39 and then after six months LVEF=59.18±7.00) versus preoperative LVEF =51.87±10.50 while this improvement was non-significant in **PPM** group (after three months LVEF=52.85±10.10 and then after six months LVEF=52.05±9.93) versus preoperative LVEF = 53.30±11.42 (Table 6).

Postoperative Trans prosthetic mean and peak gradient (TPG):

From the results of the present study it is noted that, postoperative transprosthetic peak and mean gradients were significantly decreased in both groups of the studied patients during the period of follow up but the rate of decrease was significantly lower in **PPM** group than in **non PPM** group.

Impact of PPM on Left Ventricular Mass (LVM) and left ventricular mass index (LVMI):

The reduction of both peak and mean trans-valvular gradients after AVR resulted in a significant reduction of **LV mass** in both groups and a significant reduction of **LV mass index** among Non PPM group while it was of a non-significant reduction in PPM group.

Regression rate:

LVMI regression was not significantly lower in patients with **PPM** where LVMI after three months was (164.30-61.78g/m^2) and after six months was (160.20±59.58g/m^2) versus preoperative LVMI (173.36±81.00g/m^2) with regression rate about 11% after three months and 21.27% after six months. While LVMI regression was much more in patients with **Non PPM** where LVMI after three months was (131.65±51.37g/m^2) and after six months was (113.07±36.00g/m^2) versus preoperative LVMI (173.11±52.96g/m^2) with regression rate about 23.76% and 32% after three and six months respectively.

Parameters	No PPM (n=75)			F-test P	Scheffe test P*	PPM (n=25)			F-test p	Scheffe test P*
	Preoperative I	Post 3m II	Post 6m III			Preoperative I	Post 3m II	Post 6m III		
LVEDD (mm)	37-84 52.43±11.29	26-64 42.43±10.71	19-62 37.22±9.82	42.731 0.0001*	I Vs. II I Vs III II vs III	45-79 56.61±10.22	38-64 48.05±7.75	34-62 46.73±7.40	11.679 0.0001*	I vs II I vs III
LVESD (mm)	23-62 35.43±8.66	17-92 33.88±11.67	15-75 29.37±11.07	12.020 0.0001*	I vs II I vs III	26-52 37.22-9.71	24-46 32.45±8.92	18-52 29.30±8.97	5.654 0.029*	I vs III P=0.031
LVEF (%)	32-69 51.87±10.50	31-73 56.57±6.39	43-71 59.18±7.00	10.178 0.0001*	I vs II I vs III	34-57 53.30±11.42	37-63 52.85±10.10	42-73 52.05±9.93	0.562 0.418	
LVEDV (mm)	36-220 95.87±29.56	37-126 75.01±19.05	28-115 70.02±18.84	17.849 0.0001*	I vs II I vs III	52-130 91.95±23.41	48-113 82.55±20.17	49-110 77.50±19.27	3.643 0.032*	I vs III P=0.039
LVESV (mm)	12-100 51.97±18.81	12-86 43.27±16.19	12-78 37.70±15.12	11.031 0.0001*	I vs II I vs III	19-90 50.32±21.61	18-79 45.05±19.98	16.72 42.35±17.90	1.259 0.292	
PWTd (mm)	10-18 12.77±1.67	9-16 11.65±1.65	8-14 11.05±1.48	16.716 0.0001*	I vs II I vs III	10-15 11.97±1.22	9-13 11.85±1.24	8-12 10.45±1.14	7.824 0.001*	I vs II I vs III
IVSd(mm)	9-23 13.24±2.51	9-18 12.25±1.87	9-17 11.37±1.65	12.718 0.0001*	I vs II I vs III	9-18 12.69±2.20	10.13 12.27±1.69	10-12 11.90±1.55	1.006 0.363	
LV mass (GM)	103-526 320.62±83.51	157±398 246.75±59.13	116-360 218.10±57.05	37.693 0.0001*	I vs II I vs III	170-510 326.30±98.22	135-450 293.25±85.72	132-410 280.20±69.22	3.926 0.025*	I vs III P=0.030
LVMI (G/M²)	128-323 173.11±52.96	94-233 131.65±51.37	82-224 113.07±36.00	36.254 0.0001*	I vs II I vs III	84.70-380 173.36±81.00	97-336 164.30-61.78	89-325 160.20±59.58	2.260 0.123	
Peak transprosthetic gradient (mmHg)	42-55 48.62±23.21	34-51 41.48±9.37	37-45 38.22±8.56	416.210 0.0001*	I vs II I vs III	48-65 59.30±26.16	46-63 53.35±12.44	48-68 50.65±11.44	76.872 0.0001*	I vs II I vs III
Mean transpostheticgradient (mmHg)	29-39 35.62±15.22	28-34 32.75±6.75	28-37 27.55±6.24	328.476 0.0001*	I vs II I vs III	48-58 47.55±15.50	49-66 46.70±10.64	43-67 41.25±9.76	55.195 0.0001*	I vs II I vs III

**Significant (P≤0.05)*

Table 6. ***Echo-cardiographic parameters: before surgery, 3 and 6 month postoperative in both PPM and Non-PPM patients.***

Correlation between postoperative indexed effective orifice area (IEOA) and rate of LVM regression:

From the results of the studied patients there was a significant positive correlation between postoperative IEOA of each valve prosthesis and the rate of regression in the LV mass (%) after six months postoperative which means that when IEOA of the implanted valve prosthesis increases the rate of regression in LVM will also increase (Fig. 2).

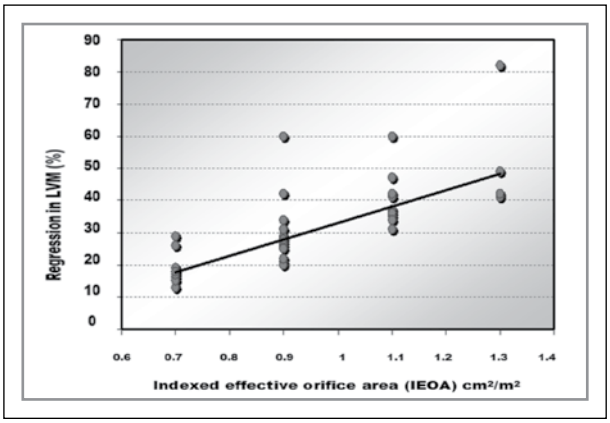

Fig 2. Correlation between the indexed effective orifice area and rate of regression in LVM (%) after 6 months postoperative.

Predictors for Incomplete LVMI regression

Hypertensive patients have lower percent of LVMI regression (19.90% after three months and 28.64 % after six months) than non-hypertensive patients (23.28% after three months and 32.27% after six months). Patients with preoperative NYHA class >2 have lower percent of LVMI regression than patients with preoperative NYHA class ≤2. Where patients with NYHA class III had a regression ratio (21.42% after three months and 30.61% after six months) and patients with NYHA class IV had a regression ratio (20.41% after three months and 25.46% after six months) than patients with preoperative NYHA class ≤2 (29.14% after three months and 37.65% after six months). Finally patients with larger LV mass index preoperative ≥ 250 g/m² have a lower incidence of regression (16.77% after three months and 27.85% after six months) than patients with lower LV mass index preoperative < 250 g/m² (20.11% after three months and 29.60% after six months) (Table 7).

Parameters	LVMI among patients (n=100)			f-test P
	Pre-operative (I)	3 month post-operative (II)	6 month post-operative (III)	
Preoperative LVMI:				
<250 g/m²	114.70-240 179.80±45.82	94.255 143.51±34.46	79-201 126.17±3087	**37.277** **0.0001***
>250 g/m²	268-380 298.67±14.53	203.-336 248.636±33.47	177-307 215.60±37.37	**18.165** **0.0001***
t-test **P**	7.695 0.0001*	5.835 0.0001*	5.907 0.0001*	
Hypertension:				
Hypertensive	122-323 216.96±43.15	94-250 165.78±31.82	84-228 157.89±37.74	**18.220.** **0.0001***
Not hypertensive	94.70-390 189.31±52.00	77-346 145.37±51.61	69-315 128±46.13	**10.942** **0.0001***
t-test **p**	2.027 0.46*	1.923 0.58	2.060 0.043*	
Preoperative NYHA class:				
II	102-323 188.55±52.22	84-243 152.39±42.60	72-224 126.03±37.84	**14.592** **0.0001***
III	94.70-390 196.43±64.77	77-346 154.73±53.66	69-315 146.17±48.49	**9.591** **0.0001***
IV	165-289 216.00±56.04	121-250 181.50±62.36	108-228 161.25±62.47	**0.741** **0.462**
f-test **P**	0.500 0.608	0.663 0.518	0.635 0.533	

**Significant(P≤0.05)*

Table 7. Predictors of postoperative LVMI

Discussion

With native heart valve disease, the thresholds between normal valve orifice and patho-physiologically important stenosis are quite broad; in addition the clinical and hemodynamic consequences are variable. Generally, patients with a native aortic valve EOA of less than 1.0 cm^2 (IEOA is 0.5-0.6 cm^2/m^2based on BSA 1.6-1.9 m^2) who have a mean trans-valvular gradient greater than 40 mmHg are judged to have severe aortic stenosis in the presence of normal cardiac output and every patient with a prosthetic heart valve has some degree of PPM because the leaflets of both mechanical and bio-prosthetic valves are mounted on frames that occupy space in the periphery of the valve where the loss of effective orifice is greater than in its central portion. This loss of EOA may or may not be clinically significant, depending on the size and type of prosthetic valve implanted. [10]

Incidence of PPM:

The overall PPM incidence in our study came in agreement with other previously mentioned studies which was 25% of the studied patients, all of them was of a moderate degree of PPM (IEOA from 0.65-0.85) $cm^2/m^2$and no severe PPM (IEOA ≤0.65) cm^2/m^2.

This incidence came parallel with the incidence obtained by **Blais et al.,2003** [4] who examined the impact of PPM on operative mortality in 1266 patients collected over 10 years and found that the incidence of moderate PPM was 38% and severe PPM was 3%. Also, the incidence came equal to that found in a study performed by **Mohty et al., 2009** [11] and included 2,576 patients (mean age 68.5±10 years;61% male) and found incidence of Moderate PPM was present in 31% of patients and severe PPM in 2%.

Age:

In our study**;** age was found to be non-significant predictor of PPM (p value =0.573) in both uni-variate and multivariate analysis, where incidence of PPM was slightly more in young patient ≤65 years of age, this is contrary with some studies [12, 5] that identified age as one of the predictors of PPM.

Gender:

In our analysis, there was a non-significant difference in LVMI regression between male and female (P value =0.182) but female gender has lower percent of LVMI regression (15% after three months and 29.14% after six months) than male gender (19.4% after three months and 29.44% after six months).Our results came in agreement with that of **Hanayma et al., 2005**[13], who found that the LV hypertrophy index of females was less likely to regress completely and in contrary, **Villari B et al., 1995** and **Tasca G et al.,2005** [14, 15] have found in their study that female gender is an independent predictor of greater LV mass regression. the results of the 3-D echocardiography study by **Kuhl et al., 2002**[16] indicate that 1-year LV mass index normalization is unrelated to gender. While, **Del Rizzo et al., 1999** [17] found that male gender was an independent predictor of LV mass regression after AVR with stentless bioprostheses. Although, some years later, **Gelsomino et al., 2001** [18] using another type of stentless xenograft, found that male gender negatively affected LV mass regression.

Effects of PPM on restoration LV dimensions and function:

The finding of our results, came in agreement with the previous studies[19,20]and revealed that in patients with PPM, there was a significant decrease in LV dimensions as LVEDD decreased from 56.61±10.22mm preoperative to 48.05±7.75mm after 3 months postoperative then to 46.73±7.40mm after 6months (p<0.001) also LVESD decreased significantly postoperatively where it falls from 37.22-9.71mm preoperative to 32.45±8.92mm after 3months postoperative then to 29.30±8.97mm after 6 months (p=0.029) while there was non-significant improvement in LVEF as (p=0.519) but these improvements in LV dimensions and function was significant (p=0.0001) and better in patients with No PPM than in patients with PPM. Also, These results came in agreement with **Collinson J et al., 2004** [21] who studied the effect of AVR on LV function in 47 patients who received stented bioprosthesis for isolated AS and found that after AVR all patients with No PPM had evidence of decreasing LV dimensions and improved functions as LVESD decreased from 54±10mm preoperative to 42±10mm after 4 months postoperative then to 36±8mm after 8 months (p<0.001) while LVEDD fall from 75±10mm preoperative to 61±10mm 4 months postoperative then to 52±10mm at 8 months follow up after operation (p<0.001) but these decreasing were less among patients with PPM.

In contrary with these results, **Carroll JD et al., 1983**[22] found no significant impact of PPM could be demonstrated regarding the recovery of LVEF or LV mass regression and in patients with poor preoperative LV function (LVEF <50%), the LVEF improved to a greater extent in both the groups, regardless of PPM. **Nozohoor S. et. al., 2010** [23] agreed with the previous study and found no significant impact of PPM could be demonstrated regarding the recovery of LVEF or LV mass regression.

Trans prosthetic gradient (TPG):

It is well known that there is a good relation between high trans-prosthetic pressure gradient and severity of PPM that lead to increase wall stress and impair regression of left ventricular mass, the results of our study which indicate that the presence of PPM is associated with higher trans-prosthetic gradient (TPG) and impaired LV mass regression postoperatively than in patients with No PPM and agreed with the results of a study by **Ruel M, et al., 2006** [24] who found that if patients with PPM

have a residual prosthetic stenosis (high TPG postoperative) it will be associated with impaired LV mass regression and poor recovery of LV function.

Left ventricular mass regression:

Hypertrophy is characterized by a concentric increase in muscle mass to preserve a normal relation between systolic wall stress and ejection fraction.[25]All prosthetic valves are relatively stenotic because the valve sewing ring and stents reduce the effective orifice area. After AVR, trans-valvular gradients often remain elevated, and the LV hypertrophy does not resolve completely. [26] The result of the present study revealed that, there was a significant LV mass regression (p=0.0001) early post-operative after 3 months (23.12%) while after 6 months the regression ratio was(31.87%) among the patients with no PPM but the regression was in a lesser degree among patients with PPM (16.25% & 23.31%) after 3 months and 6months respectively. **Tasca G et al., 2005** [19] found that the left ventricular mass regression were significantly (p = 0.01) lower in patients with PPM (regression rate 17%) compared to those with No PPM (regression rate 24%) three months postoperative. **Sharma UC et al., 2004** [27]Reviewed the published literature on LV mass regression (LVMR) after valve replacement for aortic stenosis over the past 23 years. They found that surgical correction of stenosis by valve replacement led to good regression of LV mass regardless of the type of valve inserted with the bulk of the hypertrophy regressing within the first 6 months of operation. **Zeitani J et al., 2004** [28] revealed in other studies, neither prosthesis size nor type was correlated with LVMR. **Nozohoor S. et al., 2010** [23] found no significant impact of PPM could be demonstrated regarding the recovery of LVEF or LV hypertrophy regression. The time course of regression in LV hypertrophy after AVR is controversial. The earliest documented evidence of consistent LV mass regression after AVR has varied between six weeks and one year. [21] The results of our study came in agreement with a study by **Gaudino M et al., 2004**[29] which demonstrating that the extent of LVMR is maximal during the first 6 postoperative months and influenced only by the preoperative degree of hypertrophy and the presence of hypertension. **Kurnik PB et al., 1999** [31], using ultrafast computed tomography, reported27% regression of LV mass at 4 months after AVR and a total of 36%regression at 8 months.

Predictors of incomplete LVM regression:

From the result of the present study, we found that, increased NYHA class>II, increased preoperative LV mass index ≥250g/m^{2}and hypertension (because of vascular and prosthetic gradient form high burden on LV wall) were independent predictors for incomplete LV mass regression. Our result came in agreement with previous studies [15][17] who found decreased age, female, increased NYHA class, increased preoperative LV mass and hypertension were to be independent predictors for incomplete LV mass regression. [31]

Impact of PPM on mortality

In our study, no post-operative mortality during the period of follow up which may be due to short period of follow up and all PPM patients were in moderate degree.

Study limitations:

Several limitations of our study should be pointed out; one limitation is the small number of patients in each group. A second limitation is the use of M-mode echocardiography to measure left ventricular mass. The use of two-dimensional or three-dimensional echocardiography or magnetic resonance imaging may provide more accurate measurements of left ventricular mass; however, these techniques are more difficult to perform, more expensive. A third limitation is only one valve prosthesis (Medtronic Mosaic bio-prosthesis) was used so there was no chance to compare the effect of usage of different types of valve prosthesis on regression of LV mass postoperatively. Another concern is that the evaluation of patients (period of follow up) was relatively short at 3 months and 6 months postoperatively, so, we can't study the impact of PPM on LV mass regression after a long period of follow up. We could not address the impact of PPM on exercise capacity and quality of life following AVR in our study. Finally, it must be recognized that the patient population studied here is relatively elderly, with a mean age of 77.48±7.46 years and it is possible that younger, more active patients may have higher gradients and less regression of left ventricular hypertrophy.

Conclusions

Independent predictors of incomplete LVMR as; presence of systemic hypertension, increased preoperative LV mass index ≥250 g/m^2, increased preoperative NYHA class > II can mostly been avoided if the patient is under close follow up preoperatively ,good medical control of hypertension, good timing and early interference once patient is indicated for surgery.

PPM is a frequent problem after AVR due to AS, PPM leads to higher trans-prosthetic gradient, persistence of preoperative symptoms, impaired LVMR, PPM can be predicted at the time of operation to ensure implantation of valve prosthesis with large IEOA (IEOA >0.85 cm^2/m^2)and as a result we can avoid it and LVMR occurs early (within the first 3months after operation).If this target is difficult to be achieved, We have to consider implantation of high performance valve prosthesis in supra annular position, tilting position, stentless valve or perform aortic root enlargement or replacement as a last option when other measures fails and when the risk benefit ratio of aortic root enlargement is considered acceptable.

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Validation of Euroscore II in Diabetic Patientsundergoingcoronary Artery Bypass Graft Surgery In Theegyptian Population

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Background: **Diabetic patients constitute a big number of patients undergoing coronary artery bypass graft surgery (CABG). The impact of diabetes on the results of this operation, especially in Egyptian patients is not well understood.**

Objective: **To Validate Euroscore II in diabetic patients undergoing coronary artery bypass graft surgery in the Egyptian population.**

Methods: **This study was performed in department of cardiothoracic surgery,faculty of medicine,CairoUniversity, Egypt fromAugust 2013 to April 2015. 245 patients were included and follow up were enrolled and evaluated for their early (30 days) mortality.**

Results: **The studied group: 245 diabetic patients were included of which 127 were IDDM patients (51.83%), 115 were NIDDM(46.9%) , 2 patients were recently discovered to be Diabetic without medication(0.8%) and one patient was accidently discovered to be diabetic(0.4%). The diabetic group had a higher risk score than the non-diabetic group. Early mortality occurred insix patientsfrom them 2 patient were Insulin dependent Diabetes mellitus and four were Non-Insulin dependent Diabetes mellitus.**

Expected EuroscoreII mortality for the studied group was 1.1325% but the mortality was 1.57 % for IDDM and 3.47% for the NIDDM with total mortality for diabetic patient was 2.5% so by calculating the area under receiver operating characteristic curve it is 0.675 which means that EuroscoreII isn't predictive of mortality in diabetic Egyptian CABG patients.

Which means that EuroscoreII isn't valid in diabetic Egyptian CABG patients. Also outcome of CABG is more related to degree of control duration of diabetes than to type only.

Conclusion: **That EuroscoreII isn't valid in diabetic Egyptian CABG patients. Also outcome of CABG is more related to degree of control duration of diabetes than to type only as EuroscoreIIconsider.**

Keywords: **Coronary Artery Bypass, Diabetes Mellitus, Outcome, Egyptian, Euroscore II , Validation.**

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Codex : o3/13/1503

The incidence of diabetes(DM) is increasing markedly and the World Health Organization estimates that by 2025, about 5.4% of the world population (300 million people) will be diabetic (1).Theincidence of diabetes especially typeII (IDDM) had reached an epidemic incidence in some western countries(2). In the developing countries the situation is even worse (3). A country like Saudi Arabia the overall prevelance of DM in adults is 23.7% of the total population (4).

Due to diffuse aggressive nature of coronary atherosclerosis in diabetics patients CABG has a better survival, relief of symptoms and less incidence to repeat revascularization when compared to PCI(5).

DM is a well-known risk factor for coronary artery disease and cardiovascular death.(6)The reported prevalence ofdiabetes among patients undergoing coronary artery bypass surgery (CABG) has been estimated to be 12-38%.(7-9)Coronary artery disease is more extensive, diffuse and distal with a rapidly progressive nature in diabetic compared with non-diabetic patients.(10-12)Traditionally it has been accepted that patients with diabetes have poorer outcome than non-diabetics following CABG.(13)There is less controversy about the role of diabetes in increasing long –term mortality of patients undergoing CABG.(7,13-16)However,there are conflicting data about the early result of CABG in diabetic patients.(13-19)However, the majority of such studies were carried out in western countries and limited information was available for the Egyptian population.(7,8,10,11)

Considering the effect of ethnicity on atherosclerosis and coronary heart disease, and the fact that it should be regarded as a risk factor when assessing potential risks associated with any surgical or medical intervention, (18, 20, 21) we decided to evaluate the early survival of diabetic patients undergoing CABG in our hospital.

Methods

During the inclusive periodAugust 2013 to April 2015Patients with any documentation of DM (even diet-control only) were included as diabetic patient, so we had 245 patients who underwent isolated CABG surgery at the Department of Cardiothoracic, faculty of medicine, Cairo Universitywere recruited.

Inclusion Criteria:

Diabetic patients with I.H.D. undergoing isolated CABG with any type of diabetes

Exclusion Criteria:

Patients with any associated valvular lesion.

Then for all patients:

A) Preoperative Parameters:

1) History taking

2) Clinical Examination

3) Investigations

- Laboratory Investigations:

1. Complete blood picture (CBC).
2. Liver and renal function tests (ALT, AST, total and direct bilirubin, prothrombin time and concentration, albumin, urea, creatinine, creatinine clearance).
3. Electrolytes (Na, K).
4. Fasting, 2 hours after postprandial blood glucose level and HBAIc.

- Electrocardiogram (ECG):
- Radiological Examination:

Plain chest x-ray (PA and lateral views) was done in the erect position after full inspiration to assess the cardiothoracic ratio.

CT chest without contrast was done for patients above 60 years old for detection of aortic calcification.

- Echocardiography (Echo):
- Coronary Angiography:

4) Preoperative Counselling

In the preoperative visit prior to surgery, a brief explanation of the steps of the surgery and postoperative ICU stay with possible early and late postoperative complications were explained to the patients.

B) Calculation of EuroSCORE II of all the patients'

Traditional on-pump CABG and off-pump CABG had been selected according to the surgeon's preferenceand clinical indications. Insulindextrose- potassium solution was routinely infused to diabetic patients during the operation and continued for 12 to 24 hours postoperatively, so as to achieve tight glycemic control. For on-pump CABG, warm bloodcardioplegia was used to arrest the heart. Follow-up patients till one month. The primary endpoint was the early mortality. Early mortality was defined as death during hospitalization for surgery regardless of stay or within 30 days from surgery.(3)

Data entry:

Data were gathered and entered on to a computer database. In order to ensure the highest possible quality of data entry, all data were entered twice independently and any discrepancies checked and corrected.

The database was subjected to 16 out-of-range error checking operations and a further separate operation was used to identify errors of logic.

Incomplete forms were identified by the absence of information in any of 10 mandatory fields.

Statistical analysis

Statistical analysis was performed using SPSS statistical software (SPSS version 10.0.5, SPSS Inc., Chicago, IL).

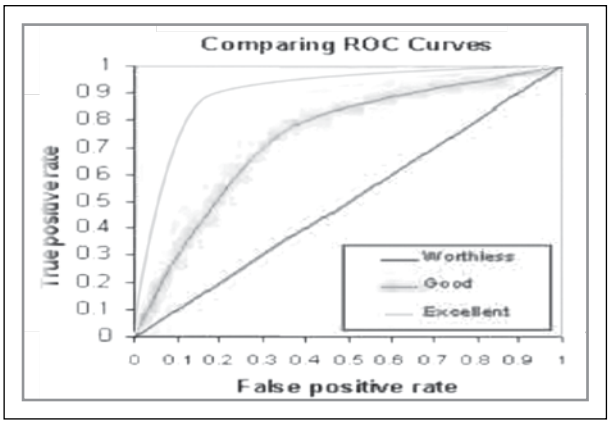
The Fisher's exact test and the Mann-Whitney test were used for univariate analysis. Receiver operating characteristics (ROC) curve was used for identification of the best cutoff value of continuous variables in predicting 30-day postoperative death as the value with the best sensitivity and specificity.

The Kaplan-Meier method and the Cox regression model were used to evaluate the impact of single variables on the long-term outcome.

The latter was used for multivariate analysis with the help of backward selection. A p less than 0.05 is to be considered statistically significant

The area under the ROC curve:

0.9-1 = excellent (A)
0.8- 0.9= good (B)
0.7-0.8=fair(C)
0.6-0.7=poor (D)
0.5-0.6= fail (F)



Results

245 diabetic patients were included in the study of which 127 were IDDM patients (51.8%), 115 were NIDDM(46.9%) , 2 patients were recently discovered to be Diabetic without medication(0.8%) and one patient was accidently discovered to be diabetic(0.4%). The diabetic group had a higher risk score than the non-diabetic group. Early mortality occurred in six patients from them 2 patients were Insulin dependent Diabetes mellitus and four were Non-Insulin dependent Diabetes mellitus.

Expected EuroscoreII mortality for the studied group was 1.1325% but the mortality was 1.57 % for IDDM and 3.47% for the NIDDM with average mortality 2.5 % so by calculating the area under receiver operating characteristic curve it is 0.675 which means that EuroscoreII isn't predictive of mortality in diabetic Egyptian CABG patients.

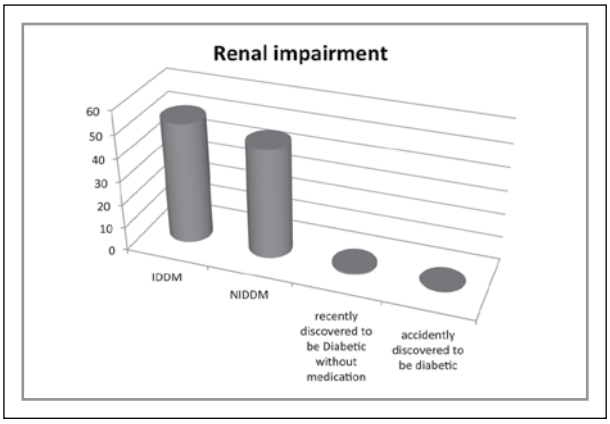


Fig 1. The distribution of patients among the studied group according to type of diabetes

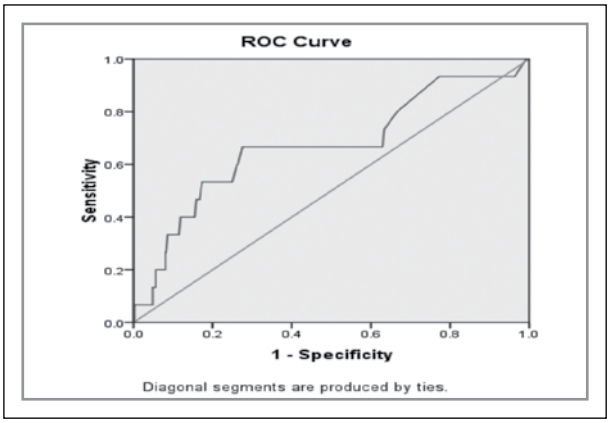


Fig 2. ROC Curve:

Which means that EuroscoreII isn't valid in diabetic Egyptian CABG patients. Also outcome of CABG is more related to degree of control and duration of diabetes than to type only.

Discussion

Risk prediction in current cardiac surgical practice plays an important role in surgical decision-making preoperative patient education & consent, it also enable comparison between centers.

Over the last decade patients undergoing coronary artery bypass graft (CABG) have been increasing rapidly in Egypt due to increasing number of I.H.D.

The Egyptian population is different from the Western population, from which most of the current risk stratification models, including EuroSCOREII, have been developed. Documented cardiac risk factors also varied markedly between

countries. (23)The difference lies in patient demographics, delayed clinical presentation due to socioeconomic, cultural and geographical reasons, inequitable distribution of medical facilities and different treatment patterns.

The prevalence of diabetes is rising owing to an increasingly aged and obese population. (22)Arteriosclerosis is responsible for 80% of deaths in patients with DM. (17)The adverse impact of DM on the outcome of coronary artery disease patients is related to its atherosclerotic, pro-inflammatory, and pro-thrombotic effects. (6)However, the majority of such studies were carried out in western countries and limited information was available for the Egyptianpopulation.

We have therefore to analyze the prediction ability of Euroscore II on the patients undergoing CABG in Egypt aiming to assess the applicability of the Euroscore II in Egyptian patient undergoing CABG.

245 diabetic patients undergoing CABG surgery in El KasrAlainy hospital were included in the study of which 127 were IDDM patients (51.83%), 115 were NIDDM(46.9%) , 2 patients were recently discovered to be Diabetic without medication(0.8%) and one patient was accidently discovered to be diabetic(0.4%).

Only diabetic Patients with I.H.D. undergoing isolated CABG will be included and Patients with any associated valvular lesion will be excluded .

Early mortality occurred in six patients from them 2 patient were Insulin dependent Diabetes mellitus and four were Non-Insulin dependent Diabetes mellitus.

Expected EuroscoreII mortality for the studied group was 1.1325% but the mortality was 1.57 % for IDDM and 3.47% for the NIDDM with total mortality for diabetic patients was 2.5 % so by calculating the area under receiver operating characteristic curve it is 0.675 which means that EuroscoreII isn't predictive of mortality in diabetic Egyptian CABG patients.

Which means that EuroscoreII isn't valid in diabetic Egyptian CABG patients. Also outcome of CABG is more related to degree of control duration of diabetes than to type only.

So by calculating the area under receiver operating characteristic curve it was 0.675 which means that Euroscore II isn't predictive of mortality in Egyptian CABG patients.

Which means that Euroscore II isn't valid in Egyptian CABG patients as it underestimates the risk.

This result like that from:

Spain

A multicenter study 2013: their result was that the risk profile in Spanish patients is high. Crude mortality is acceptable, closer to the value predicted by EuroSCORE II than by EuroSCORE. Both models show failure in calibration; EuroSCORE by over-prediction and EuroSCORE II by under-prediction of surgical risk (24)

Turkey

They had the conclusion that EuroSCORE II significantly underestimated mortality risk for Turkish cardiac patients. . (25)

But unlike that are from:

Finland

Their conclusion was that The EuroSCORE II performs better than its original version in predicting operative mortality and morbidity after isolated CABG. Its ability to predict 30-day mortality in high-risk patients is of particular importance. The EuroSCORE II is also a good predictor of late postoperative survival**.** (26)

Conclusions

EuroscoreII isn't predictive of mortality in diabeticEgyptian CABG patients.

Which means that EuroscoreII isn't valid in diabetic Egyptian CABG patients. Also outcome of CABG is more related to degree of control and duration of diabetes than to type only.

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Validation of Euroscore II in Renal Impairment Patient in EgyptianPatient Undergoing CABG

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Background: **Renal Impairment is a predictor of increased mortality in patients undergoing coronary artery bypass surgery (CABG).Euroscore II is one of the most used systems for risk evaluation in patient undergoing CABG.**

Objective: **To validate Euroscore II as a predictor of increased mortality in the Renal Impairment population submitted to CABG.**

Methods: **Prospective randomized study includes 25 ischemic patients with renal impairment who are undergoing CABG surgery performed by EL KasrELAiny staff.Renal impairment was considered when creatinine clearance<85 ml /min. Hospital operative mortality is followed up which is defined as the mortality occurring within 30 days from the date of surgery or during hospitalization, regardless of the time elapsed since the operation.**

Results: **From the25 patients involved in the study only one patient had hospital operative mortality.**

Conclusion: **Renal impairment patients submitted to CABG represent a high risk population, with increased incidence of complicationsand mortality. Euroscore II cannot be used as a predictor for hospital operative mortality in renal impairment Egyptianpatient undergoing CABG.**

Keywords: **Renal Impairment, chronic; mortality; CABG; Egyptian, validation, Euroscore II, prognostic.**

Renal Impairment is a risk marker in patientswith coronary artery disease (CAD) (1). In patients undergoingcoronary artery bypass grafting (CABG),renal Impairment is associated withlonger hospitalization and higher rates of hospital morbidity andmortality (2-4). Even from mild to moderate renal impairment implies an increasein mortality after CABG. Prognosis is even more reserved in patientswith chronic kidney disease in the terminal phase (5). Moreover,the need for dialysis procedures in the postoperative period isassociated with significant elevation of hospital mortality, and itsincidence is higher in renal impairment patients prior to cardiac surgery (4, 6, 7).Patients with renal impairment are older, have a higher prevalence of diabetes and hypertension, and these factors are also associated with higher operative mortality. Despite this association, it isbelieved thatrenal impairment is an independent markerof mortality in the long term (8). The scores ofsurgical risk usuallyuse renal impairment as a marker of increased surgical risk(9-11).

One of the most commonly used systems in Egypt is EuroscoreII, but it was not validated for renal impairment patientbefore. Documented cardiac risk factors also varied markedly between countries (12). Hence there is a doubt as to whether or not the European model for risk prediction was appropriate in Egypt.Hence there is a doubt as to whether or not the European model for risk prediction was appropriate in Egypt. Hence the question is:Is the EuroscoreII an accurate operative risk predictor for CABG in Egyptian patient with renal impairment?

We have therefore to analyze the prediction ability of Euroscore II on the renal impairment patients undergoing CABG in Egypt aiming to assess the applicability of the Euroscore II in renal impairment Egyptian patient undergoing CABG.

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Objective

This study aimed to: validate Euroscore II as a predictor of increased mortality in the Renal Impairment population undergoing CABG.

Patients and Methods:

This prospective randomized study includes 25 patients with I.H.D. and renal impairment and had CABG surgery performed by EL Kasr EL Ainy.These patients were collected prospectively from August 1, 2013 to April 31, 2015.

Inclusion Criteria:

Patients with I.H.D. and renal impairment undergoing isolated CABG.

Exclusion Criteria:

Patients with any associated valvular lesion.

Surgeries with associated procedures, such asprostheses and valvuloplasty, correction of aneurysms, andcarotid endarterectomy were excluded.

We used the preoperative risk model European System for Cardiac Operative Risk Evaluation (EuroSCORE)II to calculate the risk of each patient.

Renal impairment was considered the presence of preoperativecreatinine clearance <85 ml /min;

Creatinine clearance was calculated by the Cockcroft-Gault formula (13)for all patients and every patient with renal impairment falls into three categories:

- On dialysis (regardless of serum creatinine)
- Severely impaired renal function (cc ≤ 50 ml /min).
- Moderately impaired renal function (CC 51–85 ml /min)

Creatinine clearance (CC) (ml/min) = (140-age (years)) x weight(kg) x (0.85 if female)/ {(72 x serum creatinine (mg/dl)}.

Mortality is defined as death occurring duringa hospitalization for surgery, regardless of length of stay, or within 30 days from surgery (14). We evaluated the clinical, laboratory, hemodynamic, operative and postoperative data.

Data entry:

Data were gathered and entered into a computer database.

In order to ensure the highest possible quality of data entry, all data were entered twice independently and any discrepancies checked and corrected.

The database was subjected to 16 out-of-range error checking operations and a further separate operation was used to identify errors of logic.

Incomplete forms were identified by the absence of information in any of 10 mandatory fields.

Statistical analysis

Statistical analysis was performed using SPSS statistical software (SPSS version 10.0.5, SPSS Inc., Chicago, IL).

The Fisher's exact test and the Mann-Whitney test were used for univariate analysis. Receiver operating characteristics (ROC) curve was used for identification of the best cutoff value of continuous variables in predicting 30-day postoperative death as the value with the best sensitivity and specificity.

The Kaplan-Meier method and the Cox regression model were used to evaluate the impact of single variables on the long-term outcome.

The latter was used for multivariate analysis with the help of backward selection. A p less than 0.05 is to be considered statistically significant.

The area under the ROC curve:

ROC curves were constructed for numerical variablesreferring to the measurement of renal function compared with mortality.

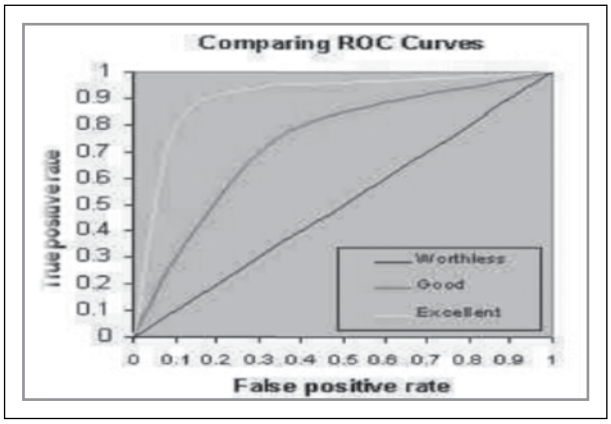
0.9-1 = excellent (A)

0.8- 0.9= good (B)

0.7-0.8=fair(C)

0.6-0.7=poor (D)

0.5-0.6= fail (F)



Results

This prospective randomized study includes 25 patients with I.H.D. and renal impairment and had CABG surgery performed by EL Kasr EL Ainy . These patients were collected prospectively from August 1, 2013 to April 31, 2015.

Of the 25 patients in the study: one patient was known to have chronic renal failure (CRF) on regular dialysis(4%), 4 patients had severely impaired renal function with creatinine clearance less than 50 ml per minute(16%) , 20 patients with renal impairment with creatinine clearance between 50-85 ml per minute(80%).

Table 1. EuroSCORE values for renal function in patients of the study:

Creatinine clearance	Euroscore II
On regular dialysis	0.6421508
Moderately impaired renal function (50-85 ml per min)	0.303553
Severely impaired renal function (Less than 50 ml per min)	0.8592256

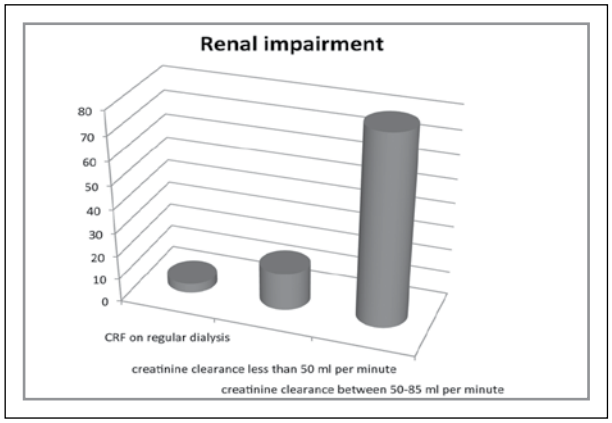


Fig 1. The distribution of patients among the studied group according to degree of renal impairment:

Preoperative EuroSCORE calculation

According to data of patients who shared in this study and after calculation of EuroSCORE II for each patient, calculation of the mean EuroSCOREII was done and it was1.1325.

Postoperative Mortality

1 case of postoperative mortality was recorded presenting 4% of the whole study.

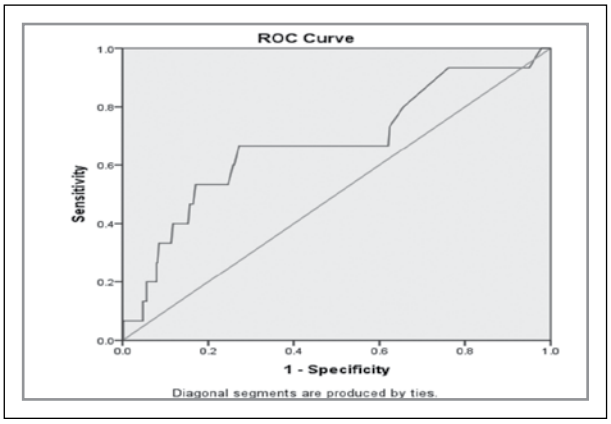


Fig 2. ROC Curve:

So by calculating the area under receiver operating characteristic curve it is 0.62 which means that Euroscore II isn't predictive of mortality in Egyptian CABG patients.

Which means that EuroscoreII isn't valid in Egyptian patient withrenal impairmentundergoing CABG.

Discussion

Renal Impairment is a risk marker in patientswith coronary artery disease (CAD) (1). In patients undergoingcoronary artery bypass grafting (CABG),renal Impairment is associated withlonger hospitalization and higher rates of hospital morbidity andmortality (2-4).Even from mild to moderate renal impairment implies an increasein mortality after CABG. Prognosis is even more reserved in patientswith chronic kidney disease in the terminal phase (5). Moreover,the need for dialysis procedures in the postoperative period isassociated with significant elevation of hospital mortality, and itsincidence is higher in renal impairment patients prior to cardiac surgery (4, 6, 7).Patients with renal impairment are older, have a higher prevalence of diabetes and hypertension, and these factors are also associated with higher operative mortality. Despite this association, it isbelieved thatrenal impairment is an independent markerof mortality in the long term (8). The scores ofsurgical risk usuallyuse renal impairment as a marker of increased surgical risk (9-11).

One of the most commonly used systems in Egypt is Euroscore II, but it was not validated in renal impairment before. Hence there is a doubt as to whether or not the European model for risk prediction was appropriate in Egypt. Hence the question is: Is the EuroscoreII an accurate operative risk predictor for CABG in Egyptian patient with renal impairment?

We have therefore to analyze the prediction ability of Euroscore II on the renal impairment patients undergoing CABG in Egypt aiming to assess the applicability of the Euroscore II in renal impairment Egyptian patient undergoing CABG.

The analysis of 25 patients in the study: one patient was known to have chronic renal failure on regular dialysis(4%), 4 patients had severely impaired renal function with creatinine clearance less than 50 ml per minute(16%) , 20 patients with renal impairment with creatinine clearance between 50-85 ml per minute(80%).

The greater number of comorbidities in the renal impairment group isa similar finding to other studies, compared to informationfrom large databases, such as the database of the STS (Societyof Thoracic Surgeons National Adult Cardiac)(3) and the databaseof the state of California(15). Patients with renal impairment have a higherprevalence of risk factors associated with increased operativemortality defined by Jones et al(9) such as advanced age, femalesex, peripheral arterial disease, left ventricular dysfunction.

The EuroSCORE(16)includes renal impairment as a risk factor formortality, as well as other factors as age, female sex, peripheral arterial diseaseand left ventricular dysfunction. The STS database points tosevere renal dysfunction as an important marker of hospitalmortality, involving severe Chronic kidney disease and dependence on dialysiswith a risk ratio from 2.9 to 3.8 on mortality3.

According to data of patients who shared in this study and after calculation of EuroSCORE II for each patient, and calculation of the mean EuroSCOREIIwas done and it was 1.1325.

1 case of postoperative mortality was recorded presenting 4% of the whole study.So by calculating the area under receiver operating characteristic curve it is 0.62 which means that EuroscoreII isn't predictive of mortality in Egyptian CABG patients with renal impairment as it underestimate the risk.

Which means that EuroscoreII isn't valid in renal impairment Egyptian patients undergoing CABG.

Conclusions

Patients with renal impairment who underwent CABG constitute a higher risk population, evolving postoperatively with higher rates of complications and in-hospital mortality.

EuroscoreII isn't predictive of mortality in renal impairment Egyptian patients undergoingCABG.

Which means that EuroscoreII isn't valid in renal impairment Egyptian patients undergoing CABG.

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Prevention and Management of Air Leaks After Thoracic Surgery

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***Background*: Postoperative air leaks after thoracic surgery are common and can influence morbidity and postoperative hospital stay. Decisions regarding management of air leaks depends on individual experiences. In this study we tried to find the best method to prevent and manage postoperative air leaks.**

***Methods:* patients underwent isolated thoracic surgery at two thoracic surgery centers in the southern region of Saudi Arabia during the period from January 2012 to the end of September 2014 were studied. Clinical presentation, diagnostic evaluation, operative and postoperative methods for prevention and management of air leaks and outcome were reviewed.**

***Results:* A total of three hundred and twelve adult patients underwent thoracic surgery were studied. After surgery 147 (47.1%) patients had an air leak. Most of patients with air leak managed conservatively, pleurodesis done for 6 patients, VATS for 3 and thoracotomy for 2 patients.**

***Conclusions:* Prolonged air leak after thoracic surgery is a preventable and easily treatable complication. Prediction, diagnosis and management of air leak can improve the quality of their lives and their hospital stay duration.**

Despite recent progress in surgical technique and improved perioperative care, prolonged air leak remains a frequent complication after thoracic surgical operations involving mobilization or resection of lung parenchyma. Air leak typically manifests as persistent bubbling in a chest tube drainage system, but may also present with increasing subcutaneous emphysema or pneumothorax in a post-operative patient[1,2,3].

Air leak is considered abnormal when still present at postoperative day 7, although a limit of 5 days is utilized in some centers . This is quite frustrating both for the patient and the surgeon[4,5].

Prolonged air leaks are undesirable because they prolong the duration of chest tube drainage with associated pain and risk of infection such as pneumonia and empyema. They also prolong hospitalization and delays adjuvant therapy if that is planned[6,7].

The management of persistent air leaks (PALs) is one of the most common problems in general thoracic surgery, especially after elective pulmonary resections. The statistically most frequent air leak is caused by alveolar-pleural fistula (APF), which is defined as a link between the pulmonary parenchyma distal to a segmental bronchus, and the pleural space. In most instances this air leak resolves spontaneously[8,9].

Numerous methods have been employed to manage persistent air leak including prolonged chest tube drainage, surgical repair, chemical pleurodesis (via the infusion of sclerosing agents such as doxycycline or talc). Recently, several reports have been published which suggest that Autologous blood pleurodesis appears to be efficacious for persistent air leaks associated with pneumothorax and with those occurring after lung resection[10-12].

This study aimed to find the best way to control air leak after thoracic surgery and how to minimize its complications .

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Materials and methods

This was a randomized, prospective study carried out at two thoracic surgery centers in the southern region of Saudi Arabia (Asser Central Hospital in Abha and Military Hospital in Khamis Mushait) and designed to study the best management of air leak after thoracic Surgery . Hundred patients underwent isolated thoracic surgery included in this study. All patients were subjected to:

Preoperative evaluation:

History, physical examination and radiological evaluation.

Before the entrance of the patients into the operating room ,they asked to stop smoking .Infection and diabetes millets controlled and steroid dose stopped or reduced trying to raise the general condition and reduced the predisposing factors for prolonged air leak. Patients given an antibiotic during induction of anesthesia that continued after surgery.

Intraoperative prevention of air leaks:

The lung tissue was handled as carefully as possible during dissection and manipulation to ensure minimal trauma. Denuding visceral pleural surfaces were avoided by carefully lysing pleural adhesions. Any obvious parenchymal tears that were identified during surgery were repaired meticulously.

A horizontal mattress suture to coapt a visceral pleura defect was helpful. Autologous tissues including the pleura, pericardium, or pericardial fat pad, were used as biologic pledgets. Teflon pledgets also were useful. We usually minimize dissection within the fissure, minimize inspiratory pressures when re-inflating the lung, careful attention to avoid overlapping parenchymal staple lines, and closing the surgical stapler slowly in thick tissues. Standard technique for lobar resection included division of parenchymal fissures using linear stapler gastrointestinal anastomosis (GIA). Bronchial closure was performed by thoraco-abdominal (TA) stapler 30 mm in all the patients. In patients undergoing sleeve lobectomy, bronchial anastomosis was performed by interrupted sutures of 4-0 absorbable monofilament material. Several techniques were used to minimize residual space and attaining pleural apposition. Mobilization of all intrapleural adhesions ,decortications of the remaining parts after partial resection and division of the inferior pulmonary ligament were often practiced and likely helpful. Rib resection and limited thoracoplasty were done in some patients. Creation of an apical pleural tent was also routine at the time of upper lobectomy. Transient diaphragmatic paralysis via injection of the phrenic nerve with a local anesthetic was routine in all lower lobe resection .We usually leave a basilar and apical chest drains within the hemithoracic cavity.

Postoperative prevention of Air Leaks:

We use adequate analgesia in all the patients. Alternate –20 cm H_2O suction was applied to the chest drain system in all the patients. Intensive postoperative respiratory physiotherapy was associated in all the cases. Fiberoptic bronchoscopy was performed in all patients to clean the airway and to rule out any bronchial problem. A chest radiography was repeated 24 h after air leaks stopped, to confirm the complete expansion of the residual lung. If a pneumothorax was present suction was installed again with –20 cm H_2O. The chest tubes were removed 24 h after the disappearance of the air leak and complete expansion of the residual lung.

If the air leak persists , it was evaluated daily and divided into 4 status according to Cerfolio RJ and coworkers 1998 [13]:

grade 1: forced expiratory only;

grade 2: expiratory only;

grade 3: inspiratory only;

grade 4: continuous (inspiratory and expiratory).

Postoperative Management of Prolonged Air Leaks :

It is of paramount importance to separate two clinical entities: does the leak originate from the alveoli through a peripheral lesion in the visceral pleura or from bronchial structures, or in other words do we face an alveolar air leak or a bronchopleural fistula. If a significant air loss was encountered and there is suspicion of a problem at the bronchial anastomosis or stump early bronchoscopy was done. In most of our patients the background was an alveolar air leak and were effectively treated by prolonged chest tube drainage, physiotherapy and pleurodesis with talc slurry or bleomycin after the residual lung was fully expanded .

If a significant air leak persisted in a patient despite above mentioned conservative measures or if water seal was not tolerated due to a larger leak, surgical revision was considered. In order to minimize the risk of pleural space infection or partial obstruction this decision was made as early as possible within a few days, when it became evident that bedside pleurodesis was ineffective. VATS used to accomplish pleural symphysis with application of sclerosing agents under vision, pleural abrasion ,decortication of surrounding lung or pleurectomy. VATS over stapling of parenchymal lesions also done . In two patients, thoracotomy done for completion lobectomy following sublobar resection in one patient , serratus anterior muscle flap with limited thoracoplasty to obliterate the pleural space in the other patient.

Statistical Analysis

The collected data were organized, tabulated and statistically analyzed using SPSS software statistical computer package version 13. For quantitative data, the range, mean and standard deviation were calculated. For qualitative data, Chi-square test were used. Correlation between variables was evaluated.

Significance was adopted at $p<0.05$ for interpretation of results of tests of significance.

Results

A total of three hundred and twelve adult patients underwent thoracic surgery during the period from January 2012 to the end of September 2014 at two thoracic surgery centers in the southern region of Saudi Arabia (Asser Central Hospital in Abha and Military Hospital in Khamis Mushait) were studied for prevention and management of air leak after thoracic surgery.

The age of the patients at time of operation ranged from 22 to 88 years with a mean of 52± 13.8 years. There were 217 (69.6%)males and 95 (30.4%)female patients (Table1).

After surgery 147 (47.1%) patients had an air leak, 118 patients of them (80.3%) had lung resection and 29 patients (19.7%) had other procedures (table 1,2).

Most of patients with air leak managed conservatively. Duration of chest tube and Hospital stay after operation were affected by the duration of air leak (table 2).

Parameter		Number	Percentage	P Value
Age	Range	22-88		
	Mean	52± 13.8		
Sex	Males	217	69.6%	0.031*
	Females	95	30.4%	
Indication for surgery	Lung mass	112	35.9%	
	Bronchiectasis	23	7.4%	
	Lung abscess	21	6.7%	
	Emphysematous bullae	35	11.2%	
	Neglected hemothorax	33	10.6%	0,787
	Tracheobronchial injury	27	8.7%	
	Empyema	13	4.2%	
	Lung injury	31	9.9%	
	Other injuries	17	5.4%	
Type of surgery	Lung resection	234	75%	0.001*
	Other procedure	78	25%	
Postoperative air leak	Air leak	147	47.1%	0,648
	No air leak	165	52.9%	

**Significant (P<0.05)*

Table 1. Patients' Characteristics, Indication for surgery, Type of surgery and Postoperative air leak.

Parameter		Number(147)	Percentage	P Value
Duration 0f air leak (days)	1-3	96	65.3%	0.034*
	4-7	37	25.2%	
	7>	14	9.5%	
Type of surgery	Lung resection	118	80.3%	0.021*
	Other procedure	29	19.7%	
Air leak management	Conservative	136	92.5%	0.013*
	Bedside pleurodesis	6	4.1%	
	VATS	3	2%	
	Thoracotomy	2	1.4%	
Duration of chest tube (days)	2-4	96	65.3%	0.029*
	5-9	28	19%	
	10-14	17	11.6%	
	15-19	6	4.1%	
Hospital stay after operation (days)	3-5	96	65.3%	0.029*
	6-10	28	19%	
	11-15	17	11.6%	
	16-20	6	4.1%	

**Significant (P<0.05)*

Table 2. Postoperative results in Patients with air leak.

Discussion

Air leaks are a common problem after pulmonary resection and can be a source of significant morbidity and mortality. Air leaks are associated with prolonged hospital stays, and infectious and cardiopulmonary complications, and they occasionally require reoperation [3,14].

Several methods have been used to control postoperative air leak. The ingenuity and experience of the surgeons greatly affect the approach in the individual patient in whom infection of any accompanying air space is absent[15] .

Our work was designed to evaluate the best way to prevent and control air leak after thoracic surgery. The age of our patients ranged from 22 to 88 years with a mean of 52± 13.8 years. This was similar to one study who had done research on age group ranged from 17 to 86 years with main age 61.9± 0.5 years and different as compared with the results of other series where age ranged from 4 to 65 years with main age 23±1.5 years [5,16] .

The predominance of male gender in our study was similar to the results of some authors [17].

Our study revealed 147 (47.1%) patients had an air leak, 118 patients of them (80.3%) had lung resection and 29 patients (19.7%) had other procedures . Several studies show an air leak to be present immediately at the completion of an operation in 28% to 60% of patients who undergo routine pulmonary resections, including both lobectomies and lesser resections[18–22]. On the morning of 1st postoperative day, an air leak is present in 26% to 48% of patients [13, 23]; on the morning of 2nd postoperative day , an air leak is present in 22% to 24%[13,24]; and on the morning of 4th postoperative day, an air leak is present in 8% [14]. In our study it was also decreasing with time.

Alternate –20 cm H_2O suction was applied to the chest drain system in all our patients through the 1st 24 hours postoperatively. While in other two studies they did not use negative suction routinely . They reported that only 7% and 12% of their patients needed to add suction to the chest tubes. The 1st one used –20 cm H_2O suction (5to 30 minutes period of suction intermittent for 24 hours) because these patients were operated for inflammatory causes as lung abscess and bronchiectasis, While the 2nd one used –10 cm H_2O suction for 24 hours because their patients had small pneumothorax developed without any clinical problems [20,24].

Bedside pleurodesis were done for 4.1% of patients with postoperative air leak in our study . Pleurodesis with autologous blood needed for 3% of patients in another study [25].

The duration of the air leak in our study was in the range of 1-18 days with mean 4.6±1.3 days . This was slightly shorter than the duration reported by some authors who reported the mean durations 7.2±1.3 and 8±1 days, while it was longer than that reported by others which was 1.7±0.5 days . This because they used fibrinogen\ thrombin coated patch to control air leak intraoperatively which is not available in our centers [10,26,27].

Prolonged air leak was found in 14 of our patients (9.5%) . This was higher than that found by others where Prolonged air leak was found in 8% and 3.6% of their patients this may be due to larger sample size and the indication for surgery was spontaneous pneumothorax [28,29].

The duration of the chest tubes drainage ranged from 2 to 19 days with mean duration 6.4±0.7 days in our patients with air leak and from 1to 6 days with a mean duration 3±0.5 in patients without air leak. The duration ranged from 1 to 17 days by others. In another studies showed that conversion of the chest tubes to water seal after a brief period of suction results in shorter time to remove the chest tubes (mean 2.7 days) than dose suction only (mean 3.8 days), the duration of the tubes drainage was ranged from 8 to 19 days in the untreated patients and was 10 days in the single fibrin glue cases and that the mean drainage duration was 11.2 days in the group without pleural tenting and 7 days in group with pleural tenting [17,28,30,31]

Hospital stay duration for our patients with air leak ranged from 3 to 20 days with mean 7.3±0.9 days. This was similar to that of other study who reported that hospital stay duration for patients after pulmonary resection with pleural tenting 8.2 days and 11.6 days for patients after pulmonary resection without pleural tenting. Also it ranged from 1 to 29 days with a mean duration 6±1.5 days in other series [30,32].

In our patients without air leak, the hospital stay duration ranged from 2 to7 days with a mean duration 3.2±0.6 days . This was similar to reported in other study that the duration ranged from 1 to 11 days with a mean 3±0.5 days in patients without air leak [17].

Conclusions

- Prolonged air leak after thoracic surgery is a preventable complication.
- Prediction, diagnosis and management of air leak intraoperatively in patients who are candidate for thoracic surgery can improve the quality of their lives and their hospital stay duration.
- Under-water seals with negative suction are effective in most cases but bedside chemical pleurodesis may be needed in some patients with prolonged air leak.
- Indications of reoperation ,nowadays, is greatly decreased or considered rare due to advances in the surgical techniques and instrumentations.

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Repair of Emphysematous Bullae in Secondary Spontaneous Pneumothorax; To What Extent!

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Objective: **Surgical management of secondary spontaneous pneumothorax (SSP) complicating chronic obstructive pulmonary disease (COPD) had been associated with serious morbidities and mortality, in a trial to improve surgical decisions and procedures; we studied how far should we go in repairing emphysematous bullae.**

Methods: **36 COPD patients complicated with SSP and underwent thoracotomy were divided in 2 equal groups; group I: limited bullectomy (removal or repair of the leaking bulla, ultra-thin walled bullae and giant bulla; average 2 ± 1.1 bullae) and group II: extended bullectomy (removal or repair of all surface bullae; average 4.9 ± 2.2 bullae), we analyzed pre-operative, operative and post-operative data.**

Results: **Limited bullectomy was found superior to extended bullectomy in decreasing the duration of operation, achievement of full lung expansion, shorting the durations of air leak, chest tube drainage, intensive care unit stay and post-operative hospital stay, this is all without affecting the rate of mortality or recurrence. Mortality (3 cases) was related to pre-operative pulmonary fibrosis and need for home oxygen therapy.**

Conclusion: **Limited bullectomy in SSP complicating COPD improved surgical outcomes. We recommend attacking the target bullae only in those fragile patients with fragile lungs, and trials of non-surgical treatment for patients with pulmonary fibrosis and those on home oxygen therapy.**

KEY WORDS **(Bullectomy, secondary spontaneous pneumothorax)**

Secondary spontaneous pneumothorax (SSP) affects patients with underlying pulmonary disease, most of which is chronic obstructive pulmonary disease (COPD). SSP differs from primary spontaneous pneumothorax (PSP) in the presence of a diseased lung and associated life threatening morbidities, which leads to higher recurrence and mortality rates in SSP, even if surgery is performed.[1]

Bullae are markedly dilated (>1centi-meter) air spaces within the lung parenchyma that are commonly secondary to COPD. The most common indications for bullectomy are severe dyspnea in the setting of a large bulla occupying at least 30% of the hemithorax and when it ruptures leading to secondary spontaneous pneumothorax (SSP).[2]

The most common indications for surgery in SSP are persistent air leak (>5–7 days of tube drainage) and recurrent pneumothorax, there are two objectives in surgery; the first is resection of bullae and the second is to create a pleural symphysis to prevent recurrences either pleural abrasions, chemical pleurodesis or pleurectomy.[3]

Video assisted thoracoscopic surgery (VATS) procedures were found superior to open thoracotomy in decreasing postoperative pain, respiratory dysfunction and hospital stay; while the latter have higher success rate and less recurrence rate especially in SSP where extensive pleural adhesions and probable inability for single-lung ventilation usually present.[4-6]

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Surgical management of SSP had been associated with serious morbidities as prolonged air leaks, pulmonary infections and respiratory failure that sometimes lead to mortality; that necessitated more studies and investigations to improve surgical decisions, procedures and clinical factors that influence the treatment outcomes of pneumothorax secondary to COPD.[7,8]

Aim of the work

The objective is to determine the necessity of repairing all emphysematous bullae during open thoracotomy for SSP complicating COPD.

Patients and Methods

This prospective study was conducted in cardiothoracic department, Tanta University Hospital; a tertiary referral hospital in Delta area in Egypt; on 36 COPD patients complicated with SSP and underwent thoracotomy during the period from October 2011 till July 2014.

Preoperative work- up:

Age, home oxygen therapy, pneumonia, diabetes mellitus, cardiovascular and cerebrovascular disease (treatment history of angina pectoris, myocardial infarction or cerebral stroke) and indications of thoracotomy were assessed.

Computed tomography (CT) was performed in all patients to study the degree of emphysema and to identify pulmonary fibrosis which appeared as reticular opacities with peripheral and basal predominant, honeycombing, and architectural distortion in both lungs. We used the visual scoring system of Goddard and colleagues[9] to quantify CT emphysema score, emphysema was identified as an area of low attenuation in the lungs, for scoring; the lung was divided on each side into 3 zones; upper, middle, and lower. A scale was used to grade disease severity with the following scores: 0: no emphysema; 1: 1%–25% of the lung destroyed by emphysema; 2: 26%–50% of the lung destroyed; 3: 51%–75% of the lung destroyed; and 4: 76%–100% of the lung destroyed. Total scores were obtained by adding the scores from all zones. The maximum score of 24 represented severe disease in all zones. Emphysema is considered mild if the total score of the 6 images is (0–7), moderate (8–15) and severe (16–24).

Operative work –up:

With the patient under general anaesthesia, a limited postero-lateral thoracotomy was made through the 5th intercostal space, sparing the serratus anterior and the rhomboid muscles. Then closure of the site of the pleural air leak by ligation, or suturing of accompanying blebs, bullectomy was done either by ligation, suturing or stapling and sometimes wedge resection was done, secure and tensionless management of the base of the bulla was our aim, the suture line was buttressed with a layer of parietal pleura when indicated to prevent a second injury for fragile lung tissue around sutures, finally abrasions to the parietal pleura were done with a role of polypropylene mesh or a piece of cautery scratch pad; so the parietal pleura was roughened and disrupted creating a raw inflamed surface to promote pleural symphysis. The incision was closed in layers using absorbable material, including the pericostal sutures. Two drains were inserted through two separate incisions and placed on suction at 25 to 50 cmH2O.

According to the extent of bullectomy; patients were randomly distributed into 2 equal groups:

Group I (Limited bullectomy): (18 cases)

Removal or repair of the target bulla (leaking one), ultra-thin walled bullae and giant bulla (a large bulla occupying at least 30% of the hemithorax).

Group II (Extended bullectomy): (18 cases)

Removal or repair of all surface bullae and blebs.

Number of repaired bullae and duration of operation (from induction till recovery of anesthesia) were reported in each group.

Postoperative work-up:

Intercostal drains were removed when the underlying lung was fully expanded with no residual air leak. Patients were discharged from the hospital when they were fully mobile and when their pain was controlled by oral analgesia. Patients were followed up every 6 weeks by clinical and radiological examination.

Full lung expansion was evaluated daily with chest X ray. Durations of air leak, chest tube drainage, intensive care unit stay and postoperative hospital stay were reported. Major postoperative complications such as the need for mechanical ventilation, pneumonia, empyema, hospital mortality (in-hospital death after surgery) and the need for re-thoracotomy were reported. Recurrence was defined as a further ipsi-lateral pneumothorax after removal of the chest tubes.

Statistical analysis

The collected data were organized, tabulated and statistically analyzed using SPSS software statistical computer package version 13. For qualitative data, comparison between two or more than two groups; Chi-square test (X2) was used. For quantitative data, the range, mean and standard deviation were calculated. For comparison between means of two groups; student's t-test was used. A p-value of less than 0.05 was considered statistically significant.

Results

Thirty six COPD patients complicated with SSP underwent thoracotomy; 30 for persistent air leak (more than 5-7 days) after chest tube insertion and 6 for recurrent attack pneumothorax. The mean age was 68 ± 4.8 years ranged from 58 to 77 years, the mean CT emphysema score (Goddard score) was 9 ± 3.1 ranged from 4 to 16. Pulmonary fibrosis was present in 5 cases (13.9%), pneumonia in 1 case (2.8%), cardiovascular and cerebrovascular disease in 5 cases (13.9%), diabetes mellitus in 3 cases (8.3%), and only 1 patient (2.8%) was on home oxygen therapy. There was no significant difference in all these pre-operative data between the 2 groups. (Table 1)

As regard operative data; the mean number of repaired bullae was 3.4 ± 2.3 ranged from 1 to 10 bullae, and the mean duration of operation was 96.6 ± 32 ranged from 55 to 180 minutes. There were highly significant decreases in the number of repaired bullae and the duration of operation in group I (Limited bullectomy) compared to group II (Extended bullectomy) (P-value = 0.0001). (Table 2)

In the early post-operative period: 5 cases needed mechanical ventilation (13.9%) with no significant difference between the 2 groups, full lung expansion was achieved more and earlier in group I (Limited bullectomy) in all post-operative days that was significant in the 1st 3 days after surgery, the need for re-thoracotomy in group II was 4 folds that in group I and all was for prolonged post-operative air leak. (Table 3)

Durations of air leak, chest tube drainage, intensive care unit stay and postoperative hospital stay were significantly shorter in group I (Limited bullectomy) than group II (Extended bullectomy), while there were no significant differences in the incidence of post-operative infections (pneumonia and empyema) between the 2 groups. (Table 3)

Finally there were no significant differences in the incidence of hospital mortality or recurrence of secondary spontaneous pneumothorax between the 2 groups. Recurrence occurred in 2 cases (one in each group) during an average period of follow up 18 ± 9.4 ranged from 3 to 36 months. Three cases died after surgery, they were all mechanically ventilated due to respiratory failure after surgery, two of them was in group II and had pre-operative pulmonary fibrosis and the third was in group I and was on home oxygen therapy. (Table 3)

Pre-operative data	**Group I** (Limited bullectomy) **(18 cases)**	**Group II** (Extended bullectomy) **(18 cases)**	**P-value**
Age (year)	69.4 ± 4.7	68.2 ± 4.9	0.225
CT emphysema score "Goddard score"	8.4 ± 3	9.6 ± 3.2	0.145
Pulmonary fibrosis	2 (11.1%)	3 (16.7%)	0.629
Home oxygen therapy	1 (5.6%)	0 (0%)	0.311
Pneumonia	1 (5.6%)	0 (0%)	0.311
Cardiovascular and cerebrovascular disease	2 (11.1%)	3 (16.7%)	0.629
Diabetes mellitus	2 (11.1%)	1 (5.6%)	0.546
Indications of thoracotomy	16 (88.9%)	14 (77.8%)	0.371
• Persistent air leak			
• Recurrent attack	2 (11.1%)	4 (22.2%)	

Table (1) Distribution of pre-operative data in both groups.

Operative data	**Group I** (Limited bullectomy) **(18 cases)**	**Group II** (Extended bullectomy) **(18 cases)**	**P-value**
Number of repaired bullae	2 ± 1.1	4.9 ± 2.2	0.0001*
Duration of operation (min)	77.3 ± 18.6	115.8 ± 31.3	0.0001*

**Significant or P<0.05*

Table (2) Distribution of operative data in both groups.

Post-operative data and complications		Group I (Limited bullectomy) (18 cases)	Group II (Extended bullectomy) (18 cases)	P-value
Need for mechanical ventilation		3 (16.7%)	2 (11.1%)	0.629
Full lung expansion	1st day	14 (77.8%)	7 (38.9%)	0.018*
	3rd day	14 (77.8%)	8 (44.4%)	0.040*
	5th day	15 (83.3%)	10 (55.6%)	0.070
	7th day	15 (83.3%)	12 (66.7%)	0.248
Need for re-thoracotomy		1 (5.6%)	4 (22.2%)	0.148
Duration of air leak (day)		4.8 ± 2.7	8.4 ± 5.4	0.009*
Duration of chest tube drainage (day)		6.5 ± 3.1	9.8 ± 5.5	0.016*
Pneumonia		2 (11.1%)	4 (22.2%)	0.371
Empyema		2 (11.1%)	3 (16.7%)	0.629
Length of ICU admission (day)		2.6 ± 1.7	3.9 ± 2.9	0.049*
Length of hospital stay (day)		8.3 ± 4.6	11.5 ± 5.5	0.035*
Hospital mortality		1 (5.6%)	2 (11.1%)	0.546
Recurrence		1 (5.6%)	1 (5.6%)	1

**Significant or P<0.05*

Table (3) Distribution of post-operative data in both groups.

Discussion

SSP occurs in the presence of underlying pulmonary disease, which most often is COPD. The treatment strategy for SSP with COPD should differ from that for PSP because of the higher mortality and morbidity, lower healing rate and higher recurrence rate in SSP after chest tube drainage. Elderly patients with SSP and emphysematous change of lung have marginal pulmonary function and often limited cardiopulmonary reserve. However, a much more aggressive surgical approach is sometimes needed with appropriate evaluation of the risk and benefit of surgical treatment as the occurrence of pneumothorax in those fragile patients can be life-threatening.[7]

The recurrence rate in COPD patients with SSP who had conservative treatment (chest tube drainage) ranges from 41% to 47%, Furthermore, the reported mortality in COPD patients with SSP ranges from 1% to 17%.[10] As a result of the higher recurrence rate and significant mortality, the American College of Chest Physicians (ACCP)[11] and British Thoracic Society (BTS)[3] recommended surgery after the first recurrence of SSP to prevent a potentially lethal event. In recent reports, after publication of the ACCP and BTS guidelines for management of pneumothorax, the postoperative mortality rates for COPD patients complicated with SSP have ranged from 0% to 9%.[4,12]

A meta-analysis of the literature comparing the different surgical approaches for treatment of spontaneous pneumothorax showed a four-fold increase in pneumothorax recurrence with a video-assisted approach compared with an open approach.[3] In our institution any COPD patient complicated with SSP is managed with open thoracotomy if he had persistent air leak (more than 5-7 days) after chest tube insertion (30 cases in our study) or recurrent attack pneumothorax (6 cases in our study).

CT emphysema score (Goddard score) ≥7 was found an independent risk factor for recurrence of SSP.[7] in our study the mean Goddard score was 9 that reflected the high possibility of recurrence in our patients.

Pulmonary fibrosis was always a risk factor of morbidity, recurrence and mortality after surgery for SSP.[7] Ota et al.[12] found that patients who had SSP and both pulmonary fibrosis and emphysema on CT images, had a higher mortality rate from respiratory failure during surgery. Therefore, they recommended non-surgical treatment for those patients; this is in agreement with our study where two cases of mortality after surgery had pre-operative pulmonary fibrosis.

As regard operative data; the mean number of repaired bullae was 3.4 ± 2.3 ranged from 1 to 10 bullae, and the mean duration of operation was 96.6 ± 32 ranged from 55 to 180 minutes. There were highly significant decreases in the number of repaired bullae and the duration of operation in group I (Limited bullectomy) compared to group II (Extended bullectomy).

In our study; limited bullectomy (removal or repair of the leaking bulla, ultra-thin walled bullae and giant bulla; average 2 ± 1.1 bullae) was found superior to extended bullectomy (removal or repair of all surface bullae; average 4.9 ± 2.2 bullae) in decreasing the duration of operation (average 77.3 minutes in the first and 115.8 minutes in the second), achievement of full lung expansion (especially in the 1st 3 days post-operatively), shorting the durations of air leak, chest tube drainage, intensive care unit stay and postoperative hospital stay. This is all without affecting the rate of mortality or recurrence.

Isaka et al.[7] did not repair all of the bullae; but concentrated on repairing only bullae with air leak and ultra-thin walled bullae, their recurrence rate (9.3%) was higher than ours (5.6%) may be because they used VATS as an initial approach and then conversion to thoracotomy was done in 44.3% of cases with diffuse bullae, giant bullae, serious pleural adhesions or failure to achieve lung collapse. In a systematic review of randomised and non-randomised trials [6]; the recurrence rates of SSP after surgery were reported to be (5.4%) for VATS and (1.1%) for open surgery but this was for both types of spontaneous pneumothorax.

Surgical management of SSP is associated with an operative mortality of 2:10%[5,13], we had 3 cases of mortality in our study (8.3%); the cause was respiratory failure after surgery in high risky patients (two cases of pulmonary fibrosis and one on home oxygen therapy.

Conclusion

Limited bullectomy in SSP complicating COPD improved lung expansion and significantly decreased the durations of operation, post-operative air leak, chest tube drainage, intensive care unit and hospital stay without affecting the rate of mortality or recurrence. We recommend attacking the target bullae only in those fragile patients with fragile lungs, and trials of non-surgical treatment for patients with pulmonary fibrosis and those on home oxygen therapy.

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Management Policy for Traumatic Chest Injury: Evaluation of the Role of Thoracoscopy

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Objectives: **To evaluate utility of video-assisted thoracoscopic surgery (VATS) as definitive management of patients with traumatic chest injury.**

Patients & Methods: **The study included 153 chest trauma patients; 105 had solitary thoracic injury and 48 had thoracic injury as a part of multiple body trauma. All patients were evaluated using the Injury Severity Scale scoring and severity of thoracic vascular, lung, cardiac and diaphragmatic injuries were graded according to the American Association for the Surgery of Trauma. Patients were categorized according to at arrival systolic blood pressure (SBP) and patients with SBP<60 mmHg underwent emergency thoracotomy and patients with SBP>60 mmHg were fully investigated and underwent thoracoscopy (therapeutic or diagnostic) and in case of diagnostic thoracoscopy, open thoracotomy was performed.**

Results: **Thoracoscopy worked good as therapeutic modality for 96 patients and as a diagnostic modality for 14 patients. Thoracotomy was applied for 42 patients with SBP<60 mmHg and 14 patients after thoracoscopic diagnosis. Four patients had traumatic diaphragmatic rupture repaired using thoracoscopy in 3 patients and in conjunction with laparoscopy in one patient. Thoracoscopy allowed removal of impacted foreign body in 47 patients had penetrating injury. Thoracotomy required significantly longer operative time, duration of CDT and total postoperative (PO) hospital stay compared to thoracoscopy. Six patients died (3.9%); 3 patients due to head and abdominal trauma, 2 had thoracotomy and one patient had thoracoscopy.**

Conclusion**: Chest injury is not uncommon event and applied policy for emergency management provided satisfactory outcome. Thoracoscopy allowed control of bleeding and air leak, retrieval of foreign bodies and management of the resultant injury in lung, diaphragm or thoracic vessels. Thoracoscopy spared thoracotomy for a high percentage of patients and provided multiple advantages in being minimally invasive require significantly shorter theater time and PO hospital stay with non-significant reduction of PO morbidities and mortalities.**

KEYWORDS: **Chest trauma, Emergency treatment, Thoracoscopy, Thoracotomy**

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The importance of thoraco-abdominal injuries results from the increasing rates of blunt thoracic and abdominal traffic injuries and of penetrating injuries, due to growing rates of criminal injuries. Differentiation and specialization of the trauma management has resulted in development of a widened indication spectrum of new diagnostic and treatment algorithms in thoracic and abdominal injuries including emergency thoracotomy, damage control, thoracic and abdominal surgeries, mini-invasive thoracoscopic and laparoscopic procedures, conservative treatment of injuries to parenchymatous abdominal organs. These procedures are included in a complex management scheme during early posttraumatic periods and are aimed at reducing posttraumatic morbidity primarily, the prevention of multiorgan failure and mortality rates [(1)].

Penetrating and blunt force mechanisms frequently result in thoracic trauma that cover the spectrum from trivial to lethal, and more than half are associated with head,

abdomen or extremity trauma. Fortunately over eighty percent of injuries can be managed non-operatively utilizing tube thoracostomy, appropriate analgesia and aggressive respiratory therapy [2].

Emergency thoracotomy is indicated for patients who are either in shock or have life threatening injuries and, as expected, have significant mortality and morbidity. Injury to the thorax directly accounts for approximately 25% of trauma related mortality and is a contributing factor in another 25%. Early mortality results from hemorrhage, catastrophic injury or associated head or abdominal trauma. Not unexpectedly, late deaths are related to sepsis and organ failure [3].

Blunt injury to the thorax most commonly results from motor vehicle collisions, motorcycle accidents, pedestrians struck and falls from height. Stab wound and gunshot wounds comprise the vast majority of penetrating injuries. In general, the mortality from penetrating injury is higher and related to vascular injury and shock. Mortality from blunt trauma often results from abdominal and, especially, head injury. Rapid assessment and interventions, such as tube thoracostomy and airway control, can be life saving. The patient's hemodynamic status drives early treatment, often necessitating emergency surgery. Detailed imaging studies are reserved for hemodynamically stable patients [4].

Thoracotomy has been the standard method to treat penetrating chest injuries owing to its safety and good exposure of the intra-thoracic cavity. For patients with penetrating chest trauma, thoracic surgeons are less likely to choose video-assisted thoracoscopic surgery (VATS) for 2 reasons. First, not all thoracic surgeons have experience with these kinds of injuries because of their low incidence. Second, irrespective of preoperative radiological workup; there is the possibility of great vessel or cardiac injury [5].

The current prospective study aimed to evaluate the utility of video-assisted thoracoscopic surgery (VATS) as a line of definitive management of patients with traumatic chest injury, either as solitary injury or as a part of multiple trauma injury.

Patients and Methods

The current study was conducted at Cardiothoracic Surgery Department at Benha University Hospital and Naser Institute since June 2010 till Oct 2014. The study protocol was approved by the Local Ethical Committee and written fully informed consent was obtained from the nearest relative attending with the patient.

All patients with chest trauma as solitary injury or as a part of multiple trauma injury were admitted to Emergency Department (ED) to receive first aid and resuscitative measures. Patients with multiple trauma were evaluated according to the anatomical site of injury by consulting the specialized surgeon. Patients were clinically evaluated using the Abbreviated Injury Scale (AIS) which is an anatomical injury scoring system on a scale of 1 to 6 grades: 1 indicated minor, 2 indicated moderate, 3 indicated serious, 4 indicated severe, 5 indicated critical and 6 indicated non-survivable injury. Then, each injury was allocated to one of six body regions including Head, Face, Chest, Abdomen, Extremities & Pelvis, External and the highest AIS score in each body region is used. The 3 most severely injured body regions have their score squared and added together to produce the Injury Severity Scale (ISS) score. The ISS provides an overall score for patients with multiple injuries taking values from 0 to 75. If an injury is assigned an AIS of 6 (unsurvivable injury), the ISS score is automatically assigned to score of 75. The ISS score is virtually the only anatomical scoring system in use and correlates linearly with mortality, morbidity, hospital stay and other measures of severity [6].

All patients had pneumothorax (PTX), hemothorax (HTX) or hemo-pneumothorax (HPTX) underwent emergency insertion of chest drainage tube (CDT) to evacuate air and allow lung inflation, evacuate and quantify blood, detect massive air leaks, and to establish an indication for thoracotomy in case of occurrence of deterioration or failure of improvement, or inappropraite decrease of leaking air or blood. Patients died once or immediately after arrival to ED and those showed acceptable and progressive response to CDT and conservative treatment were not included in the study.

Patients were categorized according to their at ED arrival hemodynamic status according to **Lorenz et al.** [7] into patient with SBP <60 mmHg, were admitted for emergency surgical word and underwent emergency investigations and surgical interference according to the anatomical site of trauma. Patients with SBP in range of 60-90 mmHg underwent emergency investigation while receiving hemodynamic support and were managed according to the finding of investigations.

Enrolled patients who proved to have chest injury and initial SBP <60 mmHg underwent thoracotomy, while patients had SBP in range of 60-90 mmHg underwent VATS, or VATS followed by thoracotomy for diagnosing and managing thoracic bleeding, assessment and repair of persistent air leak, evacuation of residual hemothorax in case of inappropriate drainage on preliminary CDT, diagnosis and repair of diaphragmatic injuries and also removal of foreign bodies such as bulette, gunshots, glass or metal or bony fragments.

VATS was performed under general anesthesia with single lung ventilation using double-lumen tube or local infltration anesthesia according to the situation. VATS was performed through 3-incision procedure using three incisions 1-2 cm long at the intercostals spaces and situated according to the site of trauma and the indication for VATS considering the possibility of requirement for thoracotomy.

Thoracic vascular, lung, cardiac and diaphragmatic injuries were graded according to intraoperative findings, as shown in table 1, according to classification of the American Association for the Surgery of Trauma: Organ Injury Scaling (AAST-OIS) and relative ISS score was calculated accordingly [8].

Statistical analysis

Obtained data were presented as mean±SD, ranges, numbers and ratios. Results were analyzed using Wilcoxon; ranked test for unrelated data (Z-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

The study included 153 chest trauma patients; 124 males (81%) and 29 females (19%) with mean age of 35.9±13.2; range: 14-64 years. Mean time lapsed till arrival to hospital was 33.2±17.6; range: 10-75 minutes. Solitary thoracic injury was detected in 105 patients (68.6%), while 48 patients (31.4%) had thoracic injury as a part of multiple body trauma. Sharp penetrating trauma was the cause of injury in 94 patients (61.4%), while 59 patients (38.6%) had blunt traumatic injury. Details of patients' enrolment data are shown in table 1.

Mean ISS scoring of studied patients was 22.9±9.4; range: 6-53; only 13 patients had ISS score of <10, 46 patients had ISS in range of 10-19, 65 patients had ISS score in range of 20-29, 23 patients had ISS score in range of 30-39 and 6 patients had ISS score of >40. Mean at arrival SBP was 85.9±21; range: 46-110 mmHg; 111 patients had at arrival SBP >60 mmHg and 42 patients had SBP <60 mmHg (Table 2).

Data				Findings
Age (years)	Strata		<20 years	23 (15%)
			20-29	32 (20.9%)
			30-39	28 (18.3%)
			40-49	49 (32%)
			50-59	16 (10.5%)
			≥60	5 (3.3%)
	Total		Number	153 (100%)
			Mean (±SD)	35.9±13.2 (14-64)
Gender		Males		124 (81%)
		Females		29 (19%)
Time lapsed between trauma (minutes)	Strata		<30	83 (54.2%)
			>30-60	50 (32.7%)
			>60	20 (13.1%)
	Total		Mean (±SD)	33.2±17.6 (10-75)
Site of injury	Solitary thoracic injury			105 (68.6%)
	Multiple body trauma			48 (31.4%)
Type and cause of trauma	Penetrating (n=94; 61.4%)	Bullet	Single	17 (11.1%)
			Multiple	7 (4.6%)
		Gunshots		15 (9.8%)
		Knives	Single	14 (9.2%)
			Multiple	9 (5.9%)
		Car accident		24 (15.7%)
		Sharp objects		8 (5.2%)
	Blunt (n=59; 38.6%)	Car accident		56 (20.3%)
		Fall from height		16 (10.5%)
		Crush injury		12 (7.8%)

Data are shown as numbers and mean±SD; percentages & ranges are in parenthesis

Table (1) At admission patients' data

			Frequency	Mean
ISS scores	Strata	<10	13 (8.5%)	7.6±0.9
		10-19	46 (30.1%)	15.1±1.9
		20-29	65 (42.5%)	25.2±2.1
		30-39	23 (15%)	34.7±1.8
		≥40	6 (3.9%)	46.5±3.4
	Total		153 (100%)	22.9±9.4 (6-53)
At ED arrival SBP	<60		42 (27.5%)	54.6±2.6 (46-59)
	>60		111 (72.5%)	97.8±9.4 (68-100)
	Total		153 (100%)	85.9±21 (46-100)

Data are shown as numbers and mean±SD; percentages & ranges are in parenthesis; ED: Emergency department; SBP: Systolic blood pressure

Table (2) At admission ISS and SBP

Forty-two patients had solitary thoracic injury and at ED arrival SBP <60 mmHg underwent emergency thoracotomy. Lung laceration causing major airway leak was detected in 26 patients (OIS-L grade-IV); 15 patients underwent segmentectomy for segmental airway laceration and 11 patients underwent lobectomy for lobar airway leak. Four patients had bronchial injury (OIS-L grade-IV) and underwent bronchial repair. Seven patients had vascular injury; one patient had right azygos vessels injury (OIS-V grade-II) that was ligated and 6 patients had vascular injury of OIS-V grade-I; 4 had internal mammary vascular injury and 2 had injury of unnamed vessels, all of bleeding vessels were ligated or cauterized according situation and for all cases hemothorax was evacuated and chest cavity was doubly drained. Five patients had cardiac injury; two patients had penetrating pericardial wound without cardiac injury (OIS-C grade-I), hemo-pericardium was evacuated and pericardial wound was repaired. Three patients had penetrating tangential myocardial wound up to, but not extending through endocardium (OIS-C II) one had cardiac tamponade and two without tamponade; hemopericardium was evacuated and myocardial and pericardial wounds were repaired (Table 3).

Among patients had at admission SBP >60 mmHg, 52 patients had persistent PTX and/or HPTX for >72 hr of CTD and underwent successful thoracoscopic management. In 16 patients, thoracoscopy defined pulmonary parenchymal tears (OIS-L-III) that were successfully approached and stapled, residual clotted blood in cases of HPTX was evacuated and persistent HPTX or PTX was controlled. In another 7 patients, CT imaging showed non-expanding intraparenchymal hematoma (OIS-L III) that showed partial resolution with persistent HTX after CDT drainage and re-imaging showed persistent non-expanding basal opacity with obliteration of cost-phrenic angle; thoracoscopic examination revealed organized hematoma that was successfully evacuated. In 5 patients, PTX was due to injuries of the terminal bronchial tree and thoracoscopic examination could identify site of the tear that was stapled. Parenchymal bleeding due to vascular injury (OIS-V I) was detected in 12 cases and source of bleeding was controlled by stabling. Ten cases had minimal but continuous oozing of site of trauma (OIS-V I) and was controlled by cauterization and/or stabling. Two patients showed evidence of pericardial bleeding on CT imaging and thoracoscopy could define pericardial injury (OIS-C I) as a source of bleeding, hematoma was evacuated and pericardial injury was repaired, (Table 4)

Thoracoscopy was beneficial as diagnostic procedure in 11 cases; where thoracoscopic examination of 7 cases revealed the presence of concealed hemorrhage indicating hidden source of bleeding and these cases underwent thoracotomy that reported expanding intra-parenchymal hematoma (OIS-L IV) with extensive lung laceration that required lobectomy in these 7 patients. In 3 cases with non-expanding intraparenchymal hematoma (OIS-L III) that showed partial resolution with persistent HTX after CDT drainage and re-imaging showed persistent non-expanding basal opacity with obliteration of cost-phrenic angle; thoracoscopic examination revealed organized hematoma that started to bleed on manipulations so shifted to open surgery for lobectomy in two and segmentectomy in one with evacuation of clotted blood. CT imaging of the 11th case defined hemo-pericardium without tamponade, thoracoscopic examination defined myocardial wound that fortunately was not extending to the endocardium (OIS-C II); sternotomy and repair of the myocardial and pericardial injury sites was conducted (Table 5).

Forty-eight patients had thoracic injury as a part of multiple trauma and showed deterioration of their hemodynamic status with increasing amount of chest drainage; all patients underwent thoracoscopy during anesthesia for management of other body trauma. Thoracoscopy could successfully deal with injury in 44 patients without shift to thoracotomy. In 23 patients (OIS-V I), bleeding parietal injured vessels were cauterized for control of bleeding. Sixteen patients had parenchymal bleeding (OIS-L I-II) and source of bleeding was controlled by stabling. Two patients had pericardial injury (OIS-C I) without definite injury to the heart or tamponade, pericardial window was cauterized for control of bleeding and pericardial hematoma was evacuated. Four patients had traumatic diaphragmatic lacerations of OIS-D II in two and OIS-D III in the other two patients; thoracoscopic repair was feasible in three patients while for the 4th patient laparoscopy was required in conjunction with thoracoscopy for completion of repair. Thoracotomy was required for three patients had concealed parenchymal hemorrhage (OIS-L III) secondary to expanding intra-parenchymal hematoma; two patients had segmentectomy and the 3rd patient had lobectomy (Table 6).

Injury anatomical site	Intraoperative findings	AAST-OIS	Frequency	Surgical procedure
Lung (n=30; 19.6%)	Lung laceration	OIS-L grade IV	15 (9.8%)	Segmentectomy
			11 (7.2%)	Lobectomy
	Bronchial injury	OIS-L grade IV	4 (2.6%)	Bronchial repair
Vessels (n=7; 4.6%)	Right azygos vascular injury	OIS-V grade II	1 (0.7%)	Ligation and evacuation of hemothorax
	Internal mammary vascular injury	OIS-V grade I	4 (2.6%)	Ligation &/or cauterization. Evacuation of hemothorax
	Unnamed vessels		2 (1.3%)	
Heart (n=5; 3.3%)	Pericardial injury	OIS-C grade I	2 (1.3%)	Evacuation of hemo-pericrdium and repair of pericardial and myocardial injury if present
	Myocardial injury not extending to endocardium without tamponade	OIS-C grade II	2 (1.3%)	
	Myocardial injury not extending to endocardium with tamponade	OIS-C grade III	1 (0.7%)	
Total			42 (27.5%)	

Data are presented as numbers; AAST-OIS: American Association for the Surgery of Trauma: Organ Injury Scaling; L: Lung; V: Vascular; C: Cardiac

Table (3) Operative findings and procedures undertaken for management of patients underwent emergency thoracotomy for solitary thoracic injury

Injury anatomical site	Intraoperative findings	AAST-OIS	Frequency	Surgical procedure
Lung	Pulmonary parenchymal tears	OIS-L grade III	16 (10.5%)	Stapling & evacuation of clotted blood
	Non-expanding intra-parenchymal hematoma		7 (4.6%)	Hematoma evacuation
	Bronchial injury	OIS-L grade II	5 (3.3%)	Bronchial repair
Vessels	Parenchymal bleeding 2ry to vascular injury	OIS-V grade I	12 (7.8%)	Cauterization &/or stapling with evacuation of blood
	Site of trauma		10 (6.5%)	
Heart	Pericardial injury	OIS-C grade I	2 (1.3%)	Evacuation of hemo-pericrdium and repair of pericardial injury
Total			52 (34%)	

Data are presented as numbers; AAST-OIS: American Association for the Surgery of Trauma: Organ Injury Scaling; L: Lung; V: Vascular; C: Cardiac

Table (4) Operative findings and procedures undertaken for patients had at ED admission SBP>60 mmHg underwent successful thoracoscopic management for solitary thoracic injury

Collectively, among 153 trauma patients, irrespective of being solitary thoracic or as a part of multiple trauma, thoracoscopy provided successful management for 96 patients (37.3%) and was diagnostic for thoracotomy in 14 patients (9.2%) and worked successfully in conjunction with laparoscope for management of diaphragmatic injury in one patient (0.6%). Thoracotomy was conducted in a total of 56 patients (36.6%); 42 patients without preliminary thoracoscopy and 14 patients after thoracoscopy for a conversion rate of 12.6%. As another advantage for thoracoscopy, it allowed removal of foreign body impacted in injured tissue in 47 patients had penetrating injury caused by bullet (Fig. 1 & 2) or gunshots (Fig. 3) impacted in parenchymatous lung tissue, pleural cavity and in pericardial cavity.

Injury anatomical site	Intraoperative findings	AAST-OIS	Frequency	Surgical procedure
Lung	Concealed hemorrhage 2ry to expanding intra-parenchymal hematoma	OIS-L grade IV	7 (4.6%)	Open lobectomy
	Non-expanding intra-parenchymal hematoma that bled on manipulation	OIS-L grade III	3 (2%)	Open lobectomy in two and segmentectomy in one patient
Cardiac injury	Myocardial injury without tamponade	OIS-C grade II	1 (0.6%)	Sternotomy for evacuation of hemo-pericrdium and repair of myocardial and pericardial injuries
Total			11 (7.2%)	

Data are presented as numbers; AAST-OIS: American Association for the Surgery of Trauma: Organ Injury Scaling; L: Lung; V: Vascular; C: Cardiac

Table (5) Operative findings and procedures undertaken for patients had at ED admission SBP>60 mmHg who underwent diagnostic thoracoscopic management and shifted to open surgery for solitary thoracic injury

Injury anatomical site	Intraoperative findings	AAST-OIS	Frequency	Surgical procedure
Vessel	Injured parietal vessels	OIS-V grade I	23 (15%)	Thoracoscopic cauterization of bleeding vessels
Lung	Parenchymal bleeding	OIS-L grade I-II	16 (10.5%)	Thoracoscopic stabling of bleeding sites
	Concealed hemorrhage 2ry to expanding intra-parenchymal hematoma	OIS-L grade IV	3 (2%)	Open segmentectomy in two and in lobectomy one patient
Heart	Pericardial injury without tamponade	OIS-C grade I	2 (1.3%)	Thoracoscopic evacuation of hemo-pericrdium and repair of pericardial injuries
Diaphragm	Diaphragmatic lacerations	OIS-D grade II	2 (1.3%)	Thoracoscopic repair
		OIS-C grade III	2 (1.3%)	Thoracoscopic repair in one and in conjunction with laparoscopy in the other
Total			48 (31.4%)	

Data are presented as numbers; AAST-OIS: American Association for the Surgery of Trauma: Organ Injury Scaling; L: Lung; V: Vascular; C: Cardiac

Table (6) Operative findings and procedures undertaken for patients for thoracic injury as a part of multiple body injuries and had at ED admission SBP>60 mmHg

Therapeutic thoracoscopy consumed significantly longer theater duration than diagnostic thoracoscopy; however, total operative time for thoracoscopy was significantly shorter than that for thoracotomy. Patients had thoracotomy showed significantly longer duration of CDT and total PO hospital stay compared to those had thoracoscopy, (Table 7).

Throughout the study period, four patients of those had multiple trauma died; 2 patients had multiple abdominal visceral injury and one patient had traumatic brain injury had died secondary to these injuries. The 4th patient had open lobectomy in addition to splenectomy secondary to stab wound in the left hypochondrium, both surgeries were conducted uneventfully

Data			Findings
Operative time (min)	Diagnostic thoracoscopy (n=14)		32±3.3
	Therapeutic (n=97)	Alone (n=96)	57±15.5*†
		+ Laparoscope (n=1)	68
	Thoracotomy (n=56)		144.2±18.3
Duration CDT (days)	Thoracoscopy (n=97)		5.8±1*
	Thoracotomy (n=56)		6.4±1.4
Duration of hospital stay (days)	Thoracoscopy (n=97)		10±2*
	Thoracotomy (n=56)		12.8±2.7

*Data are presented as mean±SD; †: significant difference versus diagnostic thoracoscopy; *: significant difference versus thoracotomy*

Table (7) Operative time and duration of chest drainage and total PO hospital stay of studied patients categorized according to the procedure undertaken

but the patient showed delayed recovery and was maintained on mechanical ventilation, but unfortunately developed early ventilation-associated pneumonia that could not respond to medical treatment and died on the 3rd PO day. While among patients had solitary thoracic injury, three patients died; one had thoracoscopic parenchymal stapling developed concealed secondary hemorrhage that failed to respond to treatment and died prior to emergency thoracotomy. Another patient had successful open myocardial wound repair, but few hours later the patient showed manifestations of disseminated intravascular coagulopathy and died within two hours. The 3rd patient had lobectomy for concealed hematoma that bled on touch with thoracoscope and shifted to open thoracotomy, but developed postoperative pneumonia that progressed to acute respiratory failure and did not respond to treatment.

Discussion

Thoracoscopy was applied for 111 chest trauma patients; thoracoscopy worked well as therapeutic modality sparing thoracotomy with all related surgical hazard for 97 patients (63.4%) and as a diagnostic modality for 14 patients wherein thoracoscopic exploration allowed proper diagnosis for these cases needed thoracotomy for management for conversion rate of 12.6%. Thoracotomy was applied for 42 patients with at admission SBP<60 mmHg and 14 patients indicated after thoracoscopic diagnosis for a total of 56 thoracotomies (36.6%). Out of the studied patients, the mortality rate was 3.9%; 2% due to causes not related to procedure undertaken.

In line with this management plan and the obtained results, **Borisov et al.**[9] analyzed their experience with treatment of 67 casualties with chest injuries using thoracoscopy under local anesthesia during draining pleural cavity and documented that the proposed algorithm can be used at any hospital rendering emergency to casualties with chest injuries independent of level of available equipment

Plaksin & Cherkasov [10] presented the treatment of 4372 patients with closed or penetrating chest trauma and found that VATS allowed persistent hemostasis and airstasis by coagulation of thoracic wall and lung vessels, suturing lung wounds, coagulated hemothorax was removed, diaphragm wounds were sutured, the pericardium wounds were revised and the character of intrathoracic lesions was reliably determined in 98% of cases with conversion rate into thoracotomy of 5.5% and the number of thoracotomies and lethality in patients with penetrating wounds of the chest became 1.5-2 times less.

Vyhnánek et al.[11] retrospectively studied the management of 195 patients with penetrating thoracic, abdominal or combined injuries and found that acute thoracotomy or laparotomy are indicated for subjects with unstable hemodynamic conditions, mini-invasive procedures have diagnostic and therapeutic benefit in stable patients, diagnostic thoracoscopy provides evidence of some injuries and therapeutically may be used to manage the source of bleeding and for targeted drainage, but non-surgical procedure is the method of choice in hemodynamically stable patients with monitoring patient's condition, including the use of x-ray imaging.

Plaksin & Petrov [12] presented management of 71 patients required re-operations after 2576 thoracotomies for diseases and injuries of the chest and showed that thoracotomy was fulfilled on 34 patients, while in 37 patients the interventions were fulfilled endoscopically and the indication for thoracoscopy were continuing intrapleural bleeding, fragmented pleurisy due to pleural empyema, not arrested chylothorax, foreign body and

mortality rate after thoracoscopy was one third less as compared with thoracotomy. **Voskresenskiĭ et al.** [13] presented 35 patients had thoracoscopy for continued bleeding, clotted hemothorax or pleura empyema after operation for thoracic trauma and concluded that VATS is an accurate and safe method for PObleeding complications in hemodynamically stable patients.

Grushka & Ginzburg [14] reviewed the role of laparoscopy and thoracoscopy in modern trauma surgery and found that minimally invasive surgery offer several advantages compared to traditional open surgery and VATS is most commonly used for evaluation of diaphragm, evacuation of retained hemothorax, and management of ongoing bleeding post-trauma, and concluded that VATS should be a tool in the trauma surgeon's armamentarium for care of select injured patients.

Kong et al. [15] reviewed 827 patients with penetrating unilateral non-cardiac wounds of the chest and found stabs predominated over gunshot wounds, PTX were more commonly associated with stabs, whilst HPTX are more commonly associated with gunshots, 96% of patients were managed non-operatively using CDT and concluded that a policy of selective conservatism is still applicable to the management of traumatic pleural collections

Four patients had traumatic diaphragmatic rupture that was repaired using thoracoscopy in three patients and in the fourth associated laparoscopy was required for completion of repair. These data indicated the feasibility of thoracoscopy as a definite therapeutic management for diaphragmatic injury and go in hand with **Bagheri et al.** [16] who analyzed 30 patients with penetrating thoracoabdominal injuries that were stable hemodynamically, thoracoscopy was used to find a probable diaphragmatic injury and detected five occult diaphragmatic injuries; three cases were repaired through a thoracoscopic approach while laparatomy was inevitable in two patients, pulmonary parenchymal lacerations were observed in two patients and were repaired through thoracoscopy and concluded that diagnostic accuracy of thoracoscopy was 100% and owing to its minimal invasiveness and therapeutic potency, it is to be performed in all clinically stable patients with penetrating thoraco-abdominal penetrating injury especially in the 8th intercostal space. Also, **Vyhnánek et al.** [17] retrospectively studied a group of subjects with blunt and penetrating diaphragmatic injuries and concluded that surgical approach was selected based on injury location and presence of associated injuries and mini-invasive approach contributes to the diagnosis of penetrating diaphragmatic injuries in patients with stable hemodynamic conditions. **Yokosuka et al.** [18] presented 5 cases of delayed massive hemothorax due to diaphragmatic injury with lower rib fractures seen in all cases; emergent VATS with mini-thoracotomy allowed clear visualization of diaphragmatic lacerations, after evacuation of blood clots, which were then sutured, homeostasis was achieved after surgery, and all patients had an uneventful POcourse.

Thoracoscopy allowed removal of foreign body impacted in injured tissue in 47 patients had penetrating injury caused by bullet or gunshots impacted in parenchymatous lung tissue, pleural cavity and in pericardial cavity. These data indicated the possibility of exploring the chest cavity using thoracoscopy and removal of insulting cause and supported that previously reported by **Borgaonkar & Borgaonkar** [19] who documented that thoracoscopy is a therapeutic option of choice for projectile thoracic injuries, provided patient is hemodynamically stable.

Thoracoscopy significantly reduced duration of PO hospitalization and non-significantly reduced PO morbidity and mortality compared to thoracotomy. In line with these data, **Shipulin et al.** [20] compared VAT and open surgery efficacy in treatment of post-traumatic coagulated hemothorax in 612 patients and found effectiveness of VAT is better than open surgeries with reduction in hospitalization days, frequency of complications, traumatic intervention and rehabilitation time and concluded that best results are achieved using VATS at the earliest in posttraumatic coagulated hemothorax.

Conclusion

Chest injury, blunt or penetrating, is not uncommon event and the applied policy for emergency management provided satisfactory outcome. Thoracoscopy allowed control of bleeding and air leak, retrieval of foreign bodies and management of the resultant injury in lung, diaphragm or thoracic vessels. Thoracoscopy spared thoracotomy for a high percentage of patients and provided multiple advantages in being minimally invasive; require significantly shorter theater time and PO hospital stay with non-significant reduction of PO morbidities and mortalities.

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Early post-Operative Results in Cases of Moderate Ischemic Mitral Regurgitation in Patients undergoing revascularization Alone Versus those undergoing revascularization plus Mitral Valve Repair.

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The purpose of this study is to determine whether the surgical management of moderate ischemic mitral regurgitation (IMR) is to revascularize only or to revascularize combined with mitral valve repair (MVR).

Methods: **In the period between April 2014 and November 2014, 40 patients with moderate IMR divided into two equal groups underwent open heart surgery at the Kasr El-Aini Hospital, Cardiothoracic Surgery Department. Group (I) had both coronary artery bypass grafting (CABG) surgery associated with MVR, while Group (II) underwent CABG surgery alone to assess the early post-operative results among patients underwent revascularization combined MVR compared to those underwent revascularization alone. All patients will be evaluated thoroughly preoperative, intra-operative, and post-operative. Particular attention will be paid to clinical findings of presence of mitral regurgitation (MR), its nature and degree, pre- and postoperative echocardiographic findings of MR, postoperative intensive care unit (ICU) events including the duration of mechanical ventilation, ICU stay and hospital stay.**

Results: **The efficacy of adding mitral valve repair to coronary artery bypass grafting is well demonstrated by the improvement of New York Heart Association (NYHA) functional class and by the decrease of mitral regurgitation grade. Moreover, CABG alone left more patients with residual mitral regurgitation. Combined CABG and MVR have no effect on survival at short-term follow-up.**

Conclusion: **At three months, our study showed a clinically meaningful advantage of adding mitral valve repair to CABG. There were no significance between-group differences in mortality. There was no effect on early survival if MVR was added to CABG in patients with coronary artery disease and moderate chronic ischemic mitral regurgitation (CIMR). However, our 3-month average follow-up is short, and the trends that are evident will likely become more significant with time.**

Key words: **Moderate, Ischemic Mitral Regurgitation, CABG, Mitral Valve Repair.**

Chronic ischemic mitral regurgitation (CIMR) can be defined as mitral regurgitation (MR) occurring as a consequence of myocardial infarction (MI) or chronic myocardial ischemia without evidence of structural pathology of the valve apparatus. [1]

Valve incompetence is the result of papillary muscles (PMs) displacement, leaflet tethering, and annular dilatation [2].

Currently there is general agreement that moderate-to-severe and severe (grade 3+ to 4+) CIMR should be corrected at the time of coronary artery bypass grafting (CABG), whereas trace-to-mild (grade 1+) CIMR does not require any surgical treatment. On the other hand, the optimal management of moderate (grade 2+) CIMR is still controversial [3]. This controversy is based in part on the lack of data from rigorous

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trials that could help to determine whether the potential benefits of mitral valve repair (MVR) outweigh the increased risks of the combined procedure [4,5].

Proponents of CABG alone for the treatment of moderate ischemic mitral regurgitation (IMR) argue that revascularization may improve regional left ventricular (LV) function and reduce the left ventricular chamber size, thereby restoring the functional integrity of the subchordal mitral valve apparatus[6,7].

Advocates for MVR in addition to CABG cite the adverse consequences of persistent ischemic mitral regurgitation and further argue that in patients with reduced LV function, mitral valve repair may prevent progressive adverse remodeling, improve cardiac function, and reduce the risk of heart failure [8,9].

Patients and Materials

Study Patients

This is a prospective randomized study done at the Cardiothoracic Surgery Department, Kasr El-Aini Hospital, Cairo University, in the period between April 2014 and November 2014. The study is conducted on 40 patients with ischemic heart disease (IHD) undergoing CABG with moderate IMR. Patients are eligible for enrollment in this study if they have been referred for on pump CABG and have moderate IMR measured by echocardiography at rest. The exclusion criteria are Patients with mild or sever IMR, Patients with MR not of ischemic origin, Patients with other valve disease warranting intervention, Off pump patients, Patients with associated left ventricular aneurysm or ischemic VSD and Redo patients.

Patients will be divided into two groups: Group I, 20 patients with IHD and moderate IMR undergoing on pump CABG for revascularization and mitral valve repair. While Group II, 20 patients with IHD and moderate IMR undergoing on pump CABG for revascularization only.

The grade of MR was evaluated by using transthoracic echocardiography (TTE) at resting conditions preoperatively. Baseline characteristics of the population are presented in Table 1. Each patient signed an informed consent form.

Clinical Study End Points

The end points of the study were to evaluate the effect of adding MVR to CABG on the clinical status of patients measured based on New York Heart Association (NYHA) functional class and on postoperative reversal of left ventricular remodeling measured based on left ventricular end-systolic diameter (LVESD), left ventricular end-diastolic diameter (LVEDD), and left ventricular ejection fraction (LVEF) and also to assess the effect of adding MVR to CABG on postoperative residual MR of grade 2+ or less.

Moreover, the effect of adding MVR to CABG on early mortality and postoperative outcomes was also evaluated.

Study procedures

Echocardiography was performed at baseline and 3 months after surgery for all patients in both study groups. The severity of IMR was assessed by means of transthoracic echocardiography (TTE), M mode, two dimension and Doppler echocardiography. The different dimensions of the cardiac chambers were measured, as well as the ejection fraction (EF), regional wall motion abnormalities (RWMA), evaluation of other valves and the grade of mitral regurgitation (MR Grade). Moderate IMR was defined by the presence of at least two of three criteria recommended by the American Society of Echocardiography: an effective regurgitant orifice area (ERO) of 0.2 to less than 0.4 cm^2, a vena contracta width of 3 to less than 7 mm, and a ratio of the mitral regurgitant jet area to the left atrial area of 20% to less than 40%. Supportive criteria included the chamber size, the eccentricity of the jet and the pulmonary-vein Doppler flow pattern.

Coronary angiography was done for each patient. The number of diseased vessels and site of lesions were estimated as well as the site of diseased vessels.

Randomization was performed after completion of baseline investigations in patients who met the eligibility criteria according to surgeons' preferences.

Surgical technique:

All surgical procedures were performed through a longitudinal median sternotomy during normothermic cardiopulmonary bypass (CPB) with intermittent antegrade warm blood cardioplegia. All patients underwent conventional multivessel CABG with the use of left internal mammary artery (LIMA) grafted to the left anterior descending (LAD) coronary artery and the great saphenous vein (GSV) was used to revascularize any other coronary artery in all the patients in the two studied groups.

In patients randomized to CABG plus MVR, the mitral valve was inspected to confirm the absence of any structural abnormalities. MVR was performed using a rigid incomplete annuloplasty ring. The recommended ring was Carpentier-Edward ring.

Ring sizing was based on the size of the anterior leaflet or on the intercommissural or intertrigonal distance, and the ring was downsized by two sizes when possible to correct for annular dilatation. Surgical data are summarized in Table 2. Postoperative intensive care unit management was standardized for all patients.

Clinical and Echocardiographic Follow-up

All patients were followed up at our outpatient clinic by our team. Clinical and TTE controls were performed. Preoperative and postoperative clinical status was determined according to the criteria of NYHA functional class and the Canadian Cardiovascular Society (CCS) for heart failure and angina. In both groups, follow-up data were obtained in 39 patients 3 months after surgery. Follow-up ended November 2014. The mean follow-up was 3 months.

Statistical Analysis

Data was collected, coded, translated to English to facilitate data manipulation and double entered into Microsoft Access and data analysis was performed using SPSS software version 18 under windows 7.

Simple descriptive analysis in the form of numbers and percentages for qualitative data, and arithmetic means as central tendency measurement, standard deviations as measure of dispersion for quantitative parametric data, and inferential statistic test:

For quantitative parametric data :

- In-depended **student t-Test** used to compare measures of two independent groups of quantitative data
- **Paired t-test** in comparing two dependent quantitative data.

For qualitative data

- **Chi square** test to compare two of more than two qualitative groups.
- **Mc-Nemar**test for paired dependant qualitative data.
  - * The level $P \leq 0.05$ was considered the cut-off value for significance.

Results

Patients

The preoperative demographics, clinical and echocardiographic characteristics of the two surgical groups (revascularization combined with mitral valve repair and revascularization alone) are shown in Table 1.

Variables	Group 1 (CABG & MVR)(n=20)	Group 2 (CABG) (n=20)	p-value	Sig.
	Mean	Mean		
Age (years)	54.3±4.9	53.9±4.7	0.8	NS
Male sex	11 (55%)	12 (60%)	0.9	NS
Female sex	9 (45%)	8 (40%)	0.9	NS
Diabetes	12 (60%)	11 (55%)	0.9	NS
Hypertension	12 (60%)	9 (45%)	0.5	NS
Previous M.I	13 (65%)	12 (60%)	0.9	NS
Mean NYHA class	2.6	2.55	0.9	NS
Two-vessel disease	4 (20%)	3 (15%)		NS
Three-vessel disease	14 (70%)	15 (75%)		NS
Four-vessel disease	2 (10%)	2 (10%)		NS
LA	4.2±0.25	4±0.4	0.07	NS
LVEF %	0.49±0.04	0.51±0.05	0.17	NS
LVESD	4.45±0.35	4.4±0.25	0.61	NS
LVEDD	6.0±0.45	5.9±0.33	0.43	NS

Table 1. Preoperative patient's characteristics

No statistically significant difference was found between the 2 groups according to preoperative demographics and clinical and echocardiographic characteristics.

Data are presented as means ± standard deviation or number (percentage) as shown. CABG, Coronary artery bypass grafting; *MVR*, mitral valve repair; *MI*, myocardial infarction; *NYHA*, New York Heart Association; *LVEF*, left ventricular ejection fraction; *LVEDD*, left ventricular end-diastolic dimension; *LVESD*, left ventricular end-systolic dimension; *LA*, left atrial dimension.

Operative Data

Operative reports for both groups were assessed and the data recorded. No statistical difference was found between the 2 groups in term of intraoperative data, except for CPB time and aortic crossclamp time (p-value <0.05).

The right coronary artery (RCA) or its posterior descending branch (PDA) was grafted in 16 patients (80%) in group I and 15 patients (75%) in group II (p=NS).

Smooth weaning off bypass was achieved in 12 patients (60 %) of group I and 8 patients (40%) in group II (p=NS). The rest of the patients needed inotropic support to achieve weaning and neither of the patients needed an intra-aortic balloon pump (IABP) support as depicted in table 2. There were no significant differences in both groups.

Postoperative Data

All the patients were discharged to the cardiothoracic intensive care unit (ICU) mechanically ventilated. Table 2 shows the mean values for the total period of mechanical ventilation in hours (hrs), mean values of the total ICU stay and mean values of hospital stay of the patients in days between both study groups. As can be seen from the table, all the differences were insignificant.

Table 2 also depicts the post-operative complications among patients in the two studied groups. As can be seen from the table, all the differences were insignificant, but we can notice that there is a case of postoperative bleeding that needed re-exploration and another case complicated with postoperative low cardiac output syndrome (LCOS) and died on the 3rd day in the ICU, all occurred in the combined CABG plus MVR group (group I). There is no statistically significant difference with p-value >0.05 between study groups.

Patients were discharged from the ICU when haemodynamically stable on no inotropic support, with no drains, and with satisfactory postoperative laboratory results and electrocardiogram (ECG).

Variables	Group 1 (CABG&MVR)(n=20) Mean	Group 2 (CABG) (n=20) Mean	p-value	Sig.
Intraoperative data:				
Bypass time (min)	91±10.2	56.25±8.7	<0.001	HS
Cross clamp time (min)	74.1±7.9	42.6±8.8	<0.001	HS
Number of grafts	2.9±0.55	2.9±0.51	0.8	NS
Inotropic support	8 (40%)	12 (60%)	0.3	NS
IABP support	0	0		
Early outcomes:				
Mechanical ventilation(hrs)	6.2±1.2	7.2±1.8	0.06	NS
ICU stay(days)	2.8±0.52	3.15±0.67	0.08	NS
Hospital stay (days)	10.35±1.22	10.15±1.18	0.6	NS
LCOS	1 (5%)	0 (0%)	0.3	NS
Re-exploration for Bleeding	1 (5%)	0 (0%)	0.3	NS
In-hospital mortality	1 (5%)	0 (0%)	0.3	NS

Data are presented as means ± standard deviation or number (percentage), as shown. CABG, Coronary artery bypass grafting; MVR, mitral valve repair; CPB, cardiopulmonary bypass; IABP, intra-aortic balloon pump; LCOS, low cardiac output syndrome; ICU, intensive care unit.

Table 2. Intraoperative and postoperative patient's data

Early Mortality and Outcome

The in-hospital (<30 days) mortality rate was 5% (One patient) in the CABG plus MVR group (group I). Cause of in-hospital death was low cardiac output syndrome (LCOS).

Follow up Data: 3-month duration:

Effect on Postoperative NYHA Class

Follow up was complete in 39 patients in both groups. Patients were called after 3 months for follow up of their NYHA classification, echocardiography data and degree of mitral regurgitation.

In assessing the patients functional state the following was found, In the CABG plus MVR group NYHA class improved from 2.6 to 1.4 ($P < .004$), but in the CABG group it improved from 2.55 to 1.75 ($P = .07$), at 3-month follow-up (Table 3). NYHA class II or greater was present in 8 (40%) patients in the CABG plus MVR group, this was statistically significant when compared to the preoperative data (p=0.004), and in 14 (70%) patients in the CABG group, this was statistically insignificant when compared to the preoperative data (p=0.07).

Echocardiographic Results

Follow-up TTE analysis was performed in 39 patients in both groups. MR grade was improved in 19 patients (95%) in the CABG plus MVR group compared with 15 (75%) patients in the CABG group ($P < .0001$). Patients in group I who had CABG plus MVR, their grade of mitral regurgitation dropped in 14 patients to absent and to grade 1 in 5 patients, while in group II who had revascularization alone patients dropped to grade 1 in 15 patients, remains as grade 2 in 4 patients, and progressed to grade 3 in only one patient. There was statistically significant difference between the two study groups (P< 0.001).

These data suggest that CABG alone left 20% of patients in moderate MR, and in only one patient, the grade of MR worsened, from moderate to severe.

There is no statistically significant difference with p-value >0.05 between other preoperative and postoperative echo findings follow up among group I (CABG & MVR group), also there is no statistically significant difference with p-value >0.05 between other preoperative and postoperative echo findings follow up among group II (CABG alone group) and finally there is no statistically significant difference with p-value >0.05 between both study groups as regards to other postoperative echo findings in the follow up period (3 month duration). Data are presented in Table 3.

	CABG + MVR group (n = 20)				CABG group (n = 20)			
	Baseline	**Follow-up**	***P* value**	**Significance**	**Baseline**	**Follow-up**	***P* value**	***Significance***
LA	4.2±0.25	4.12±0.24	0.31	NS	4.00±0.29	4.01±0.36	0.92	NS
LVEF%	0.49±0.08	0.54±0.1	0.09	NS	0.51±0.06	0.55±0.1	0.13	NS
LVESD	4.45±0.46	4.21±0.53	0.13	NS	4.4±0.4	4.11±0.6	0.08	NS
LVEDD	6.0±0.47	5.81±0.59	0.27	NS	5.9±0.52	5.65±0.44	0.11	NS
Mean NYHA class	2.6	1.4	0.004	HS	2.55	1.75	0.07	NS
Mean MR grade	2	0.26		HS	2	1.3		NS

Data are presented as means ± standard deviation as shown. CABG, Coronary artery bypass grafting; MVR, mitral valve repair; LVEDD, left ventricular end-diastolic dimension; LVESD, left ventricular end-systolic dimension; LVEF, left ventricular ejection fraction; LA, left atrial dimension; NYHA, New York Heart Association functional class; MR, mitral regurgitation.

Table 3. Clinical and echocardiographic follow-up data in all Patients

DISCUSSION

Today it is evident from several studies that CIMR is related to an adverse prognosis, and the high mortality rate observed in such patients is related not only to its presence but also more importantly to the grade of MR. However, the evaluation of CIMR only under resting conditions might underestimate the full effect of the lesion and its clinical effects. Indeed, CIMR is a dynamic lesion, and its severity can vary over time. [10-13]

Clinical studies conflict regarding the correction of moderate ischemic mitral regurgitation at the time of CABG surgery. This conflicting decision is mainly affected by the lack

of prospective studies and by the comparison of outcome in dissimilar patient groups. [3]

Authors favoring a conservative approach believe that CABG alone can be sufficient to obtain a reduction in MR postoperatively and to improve clinical symptoms. These authors suggest that myocardial revascularization alone, restoring a good myocardial perfusion, leads to an enhancement of left ventricular segmental and global kinesia, to a reduction in left ventricular dimensions, and finally to a significant reduction in MR because of restored valvular function. [5,6]

We believe that these findings are partially false, because in many patients with scarred area of myocardium after infarction, CABG could not be effective in myocardial functional improvement, left ventricular remodeling can be maintained, and postoperative reversal remodeling is not predictable.

Therefore, in our study we tracked the course of moderate ischaemic mitral regurgitation after CABG surgery alone and after doing both CABG surgery and MVR on the immediate and early outcome of IHD patients undergoing CABG and identified factors which could predict the regression of moderate IMR.

The preoperative profile of both patient groups was similar with no statistically significant differences as regards to age, sex, and risk factors for IHD, clinical status, and preoperative investigations. There was, however, a certain point in the preoperative evaluation worth mentioning.

It was found in both groups that 65% of the patients in group I had a previous posteroinferior infarction and 60% of the patients in group II had a previous posteroinferior infarction .This validates data by other authors that states that, although anterior infarctions are common to occur in IHD patients, the occurrence of IMR is more common after a posteroinferior MI. [2]

In their series on 102 patients with IMR, Calafiore and colleagues found that a posterior or inferior MI occurred in 61.3% of their patients. This could be explained by appreciating the blood supply of the papillary muscles supporting the mitral valve apparatus. The posterior papillary muscle is supplied by only one segmental artery and therefore when that is occluded, the papillary muscle invariably infarcts thus producing tethering of the posterior mitral leaflet causing mitral regurgitation. [14]

No statistical difference was found between the 2 groups in term of intraoperative data, except for CPB time ($P < 0.001$) and aortic cross clamp time ($P < 0.001$). The addition of mitral-valve repair to CABG resulted in longer durations of cardiopulmonary bypass time with a median of 91 minutes compared with 56.25 minutes in the CABG group ($P<0.001$). The aortic cross clamp time was also significantly longer in the CABG plus MVR group, with a median time of 74.1 minutes compared with 42.6 minutes in the CABG group ($P<0.001$).This is similar to the results obtained by Fattouch and colleagues. [15]

The ICU course (duration of mechanical ventilation, the dosage or length of time patients were on inotropic support, ICU stay) of both groups showed no statistical difference ($P=0.08$). This is similar to the results obtained by Tolis and colleagues and Fattouch K. and colleagues. [16, 15]

During the early post-operative period, we had a patient with a serious post-operative bleeding that needed re-exploration in the combined revascularization plus MVR group. The addition of mitral-valve repair to CABG resulted in longer durations of cardiopulmonary bypass and aortic cross-clamping as mentioned before. The longer bypass time and more complicated surgery, including the obligatory cardiotomy to perform mitral-valve repair increase the risk of post-operative bleeding in the combined-procedure group.

The in-hospital (< 30 days) mortality rate was 5% (One patient) in the CABG plus MVR group, died on the 3rd day in the ICU. The Cause of in-hospital death was low cardiac output syndrome. In-hospital mortality tended to be higher in the combined group (5%), but did not reach statistical significance. This is similar to the results of Fattouch K. and colleagues who reported in-hospital mortality in two patients (4%) in the combined revascularization plus MVR group versus one patient (1.8%) in the revascularization alone group. [15]

There were no significant differences in early morbidity and mortality in spite of that the data indicate a more complicated postoperative course for the combined group. This is similar to the results obtained by different studies. [16, 17, 18, 19, 20]

Despite the fact that adding valve repair to CABG did not affect immediate post-operative morbidity and mortality, its efficacy was well demonstrated by the improvement of postoperative NYHA class and by the decrease of post-operative mitral regurgitation grade. Functional NYHA class changed from 2.6 to 1.4 ($P = 0.004$) and from 2.55 to 1.75 ($P = 0.07$) in the CABG plus MVR and CABG only groups, respectively. These data suggest that CABG alone was less effective in improving NHYA class in patients with ischemic heart disease and concomitant moderate CIMR with respect to CABG plus MVR.

Our results are in contrast with results reported by Kim and coworkers, who observed a similar improvement in NYHA class at 2-year follow-up in their revascularization alone (from 3.12 ± 1 to 1.12 ± 0.38) and revascularization with repair (from 3.22 ± 0.82 to 1.29 ± 0.63) groups. [17]

This may be explained by the longer duration of follow up done by Kim and coworkers, in contrast with our short term follow up period (Three months only).

Furthermore, patients in group I who had CABG plus MVR, their grade of mitral regurgitation dropped in 14 patients to absent and to grade 1 in 5 patients, while in group II who had revascularization alone patients dropped to grade 1 in 15 patients, remains as grade 2 in 4 patients, and progressed to grade 3 in only one patient. There was statistically significant difference between the two study groups ($P< 0.001$).

There is discrepancy in the literature as regards to agreement with these results. In their study, Fattouch and colleagues randomly assigned 102 patients to CABG alone or CABG with mitral-valve repair and followed the patients for an average of 32 months. They reported that left ventricular reverse remodeling, the qualitative degree of mitral regurgitation and NYHA functional class improved with CABG plus mitral valve repair as compared with CABG alone. [15]

Agreement, also, arises in the proportion of patients who progressed to moderate-to-severe and severe mitral regurgitation after CABG alone. In the studies by Campwala et al, Lam et al., and Aklog et al., the proportion of patients in whom the grade of CIMR progressed after CABG alone was 25%, 22%, and 40%, respectively. [21, 22, 11]; There are however, certain points that need to be illuminated in these studies. [21, 22, 11]

In the study by Campwala and colleagues, the 37 patients (25%) in which the grade of IMR progressed had a statistically significant increase in their left ventricular (LV) size postoperatively; the LVEDD increased by 2 ± 7 mm and the LVESD by 4 ± 8 mm. Also 15% of these patients had new perioperative infarctions and 9% had a new left bundle branch block on postoperative ECG. All these factors can change the post-operative characteristics of these patients, also the study has some limitations, which the authors are the first to recognize, especially the fact that it is a retrospective observational study, including a relatively low number of patients studied and consequently, relatively few patients experiencing deterioration of the MR, and the fact that only patients who had preoperative and postoperative echocardiograms were studied. [21]

In the study by Lam et al. postoperative echocardiography was done in only 156 of their 467 patients at the discretion of the attending cardiologist. Therefore, it must be acknowledged that some of these echocardiograms may have been "clinically driven" by patient symptoms (heart failure) or physical examination (murmur); this would tend to cause over-representation of patients with more severe MR. [22]

Finally, the series by Aklog and co-authors defined moderate IMR as grade 3+, which is different than most series, including our own, which define it as 2+. Therefore; it can be argued that these investigators examined a cohort of patients with a more advanced grade of IMR preoperatively. [11]

Disagreement, however, arises in the proportion of patients whose their mean degree of MR improved with CABG alone. In their study on 49 patients with mild to moderate IMR, Tolis and colleagues showed that, the ejection fraction improved from 22.0% to 31.5% ($p < 0.05$) after CABG. The mean degree of MR improved with CABG alone from 1.73 to 0.54 ($p < 0.05$) as measured at a mean interval of 36.9 months from CABG. New York Heart Association congestive heart failure class improved from 3.3 to 1.8 ($p < 0.05$). [16]

Peter K. Smith found that significant reductions in the LVESVI were observed in both groups in their trial, although there was no significance between-group difference. Moreover, they found that 69% of their patients in the CABG-alone group had no mitral regurgitation or mild regurgitation at 1 year, as compared with 89% of patients in the combined-procedure group. These findings suggest that there was substantial reversible ischemia in both groups that was alleviated by revascularization. [23]

A reduction in the degree of mitral regurgitation with CABG alone has been reported previously also by Wong DR et al., Kang DH et al., Ryden T et al., and Mallidi HR et al. [24,18,19,25].

CIMR is usually associated to right coronary or circumflex artery disease (posterior papillary muscle), with restricted posterior leaflet motion, so that Failure to graft the right coronary artery or its posterior descending branch might influence the grade of IMR postoperatively by the fact that failure to vascularize hibernating myocardium in this territory, may impair the improvement of left ventricular contractility postoperatively thus preventing regression of mitral regurgitation. Furthermore, the development of new regional wall motion abnormalities in the inferior-posterior LV wall territory due to the development of new ischemia without infarction additionally progress IMR post-CABG due to change in regional LV geometry.

Our results agree with other authors in that sense. Campwala and colleagues found failure to graft the PDA territory as an independent predictor of postoperative IMR progression [21]. Wong and colleagues also identified inferior LV dysfunction as a predictor of worsening IMR grade postoperatively. [24]

Finally and in consideration of our data, we believe that any differences in outcome between our study and other previous studies may in part reflect differences in end points assessed, methods of classifying mitral regurgitation, and the duration of mitral regurgitation from initial diagnosis to trial enrollment, and rates of prior myocardial infarction as well as inconsistent methods used to assess the severity of mitral regurgitation.

In addition to that our study established on a relatively short follow-up period of 3 months. May be if Follow-up continued for a longer period of time, during which time differences in the durability of improvement in mitral regurgitation and any associated effects on clinical outcomes might become apparent.

Conclusion

At three months, our study showed a clinically meaningful advantage of adding mitral-valve repair to CABG. There were also no significance between-group differences in mortality. There was no effect on early survival if MVR was added to CABG in patients with coronary artery disease and moderate CIMR. However, our 3-month average follow-up is short, and the trends that are evident will likely become more significant with time.

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