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Journal of The Egyptian Society of Cardio-Thoracic Surgery

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Journal of The Egyptian Society of Cardio-Thoracic Surgery

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Guidelines for Authors

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

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The Journal of the Egyptian Society of Cardio-Thoracic 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 and 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.
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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 Figures (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 150-250 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.

Case reports and **"The way I 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, 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 or Objective, Methods, Results, Conclusions. Avoid abbreviations and acronyms. Indicate the abstract word count below the abstract.

Case reports, "the way i 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
Text should be organized as follows: Introduction, Methods, Results, Discussion Then 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 of drugs, equipment and other brand mentioned in the article within parentheses , 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
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.

FigureLegends :

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. 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 Powerpoint (.ppt) files 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

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 at least 300 dpi.

Gray scale images should be at least 300 dpi .

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, fax and e-mail address.

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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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For Date of acceptance : letter is provided from the editor.

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□ Conflict of interest statement (if appropriate).
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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

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 avoid unpleasant comments.

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 original scientific articles; new technology papers; case reports, the way i do it articles , images; and review articles. The editor and/or associate editors review correspondence, invited commentaries, editorials, surgical heritage , 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

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 and relationship of the results to the existing literature 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.

The following topics are offered to help guide the reviewer's assessment of an original scientific 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 . 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 . 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, accurateand in proper format.

New Technology

Articles describing new technology are necessarily descriptive and do not pose or test a hypothesis. These articles evaluate new devices, systems, 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 .

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, The Way I 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 se-

lective 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 . 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 .

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 .

Footnote

The reviewer remains anonymous . 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 additio

Events of Interest

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

Timing : **30 Jan-2 May2012**
Location: ..... **Cairo J.W Marriot**
Email : ..... **jegyptscts@gmail.com**

■ **30 january – 1 february 2012**

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

■ **8-9 February 2012 Kolkata.west bengal india**

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

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

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

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

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

■ **18-21 February 2012**

St. Petersburg, FL United states

12th annual international symposium on congenital heart disease

■ **14-18 march 2012**

Antalya turkey
ESTS school of thoracic surgery (theoretical course)

■ **25-28 April 2012**

Dubrovnik croatia (Hrvatska)
The 61st international congress of the european society for cardiovascular and endovascular surgery

■ **26-27 April 2012**

New yourk, NY United states
Aortic symposium 201
Sheraton hotel & towers

■ **28 April-2 May 2012**

San Francisco, CA United states
92nd annual meeting-American Association for thoracic surgery

Editorial

Cardiovascular surgeons in the most civilized revolution (spirit of 25th of January)

In Egypt ,the land of earliest civilization in history, young pharaohs ,the Egyptian youth, early in this year (25th of January 2011) demonstrated the way of greatest peaceful civilized revolution in the world what so ever .Tahrir square the heart of Cairo pumping the spirit of liberty to all parts of Egypt. Auxillary hearts working in Alexandria, Suez ,Mansoura, East and west delta ,upper Egypt ,Sinai and every spot in Egypt pumping Tahrir liberty spirit all over the country .Arab hearts were pulsating by the same rate ,rhythm and force with the Egyptian hearts all over the Arab Nation .Young cardiac surgeons were around and in Tahrir square supplying energy ,support and protection for revolution . Physicians ,surgeons and pediatricians from Kaser Al Aini ,Ain shams ,Al Azhar were the main source of medical supply ,professional help , food supply and protection to demonstrations in Tahrir square . Every square in Egypt was as well strongly supported by our young doctors all over the country .Advanced life support and specialized surgical service were efficiently given for traumatized youth around the clock. A good percentage of severely injured demonstrators was from young doctors .Our young cardiothoracic surgeons were in duty in field hospitals (in Tahrir),referral hospital ER,OR ,and wards almost all the time over the 18days of revolution (from 25th of Jan. to 11th of February). All cardiothoracic surgeons are trying to double and perfect their work in national health hospital in spite of limited resources to help our country to cross the gap .

Mohamed Abdelraouf Khalil, MD
Editor in chief Jegyptscts.

How to do it

Reconstruction of obstructed pulmonary venous channel after Senning operation.

Mohamed abdel-Raouf khalil MD cardiothoracic surgery
Fatma Elzahraa mostafa gomaa, MD pediatric cardiology

Infants and children with D TGA ,ASD (with and without previous Rashkind procedure)presenting after the first month of life form a major sector of TGA patients .In this subset of patients atrial switch operation (Senning operation) is the most suitable and practically performed operation. In our patients the most dangerous late complication is pulmonary venous obstruction.
In Redo operation to reconstruct the pulmonary venous channel;

We were confronted with the following problems:

1-Sternotomy while the pericardium is forming the whole right (free) lateral wall of the left (pulmonary venous) atrium
2-Infrior vena caval cannulation with widely based pedicled pericardial graft (starting from cardio phrenic angle) forming the left atrial wall.
3-opening and enlarging the pulmonary venous channel obstructed at the level of right phrenic nerve and pericardiophrenic artery.
4-Patching the pulmonary venous channel while the auto pericardium is consumed (in redo cases)in constructing left atrial channel
5-Severe pulmonary hypertension due to sustained pulmonary venous obstruction.

Management of these problems entailed:

-Pre, intra, and post-operative management of pulmonary hypertension by using sildenafil 1-2mg/kg/d in 3 divided doses one month before and 3month after operation ,in addition premacor was used intraoperatively (post bypass) and postoperatively for 36hours.

-Chest CT scan preoperatively to be sure that there is a space between the heart (LA channel) and sternum.

-Preparing for emergency femoral cannulation if needed

(but it was not needed as there was good space between LA and sternum)

All known precautions for resternotomy taken and safe dissection of the back of sternum and heart done

-Inferior surface of the heart dissected from diaphragm till intrathoracic part of IVC was exposed for safe cannulation.

-Cardiopulmonary bypass conducted between both cavae and aortic root , and sangenous cardioplegia given in aortic root cannula ..The left atrial channel was

opened vertically from anterior to posterior midway between cephalic and caudal ends stopping 2mm anterior to right phrenic nerve .At this point the incision was extended horizontally both in cephalic and caudal directions (in

Mohamed abdel-Raouf khalil MD,prof.and head of cardiothoracic surgery Dept.Cairo university
Fatma Elzahraa mostafa gomaa,MD(pediatric cardiology)Cairo university
Codex : o3/01/1106

inverted T shaped)with split thickness incision taking only the pericardial patch avoiding its mediastinal pleural covering layer (containing the phrenic nerve and pericardiophrenic vessels.

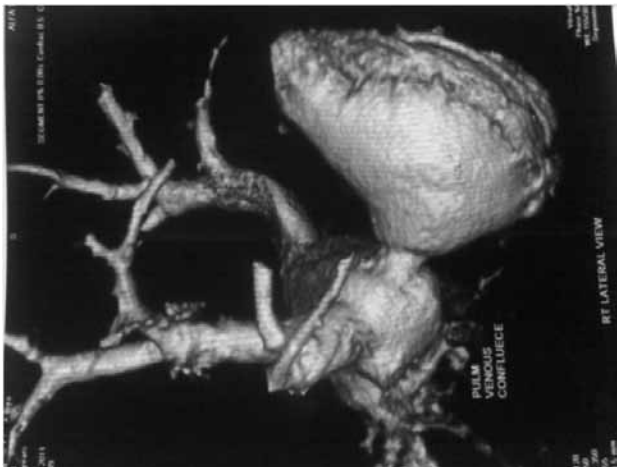
-Intracardiac view showed neoendocardial thickening of the pulmonary venous channel at the level of maximum convexity of the inner systemic venous channel.

This neointimal thickening was covered by laminated organized thrombus restricting the pulmonary venous channel to less than one centimeter. The thrombus was removed and neointimal thickening was shaved off.

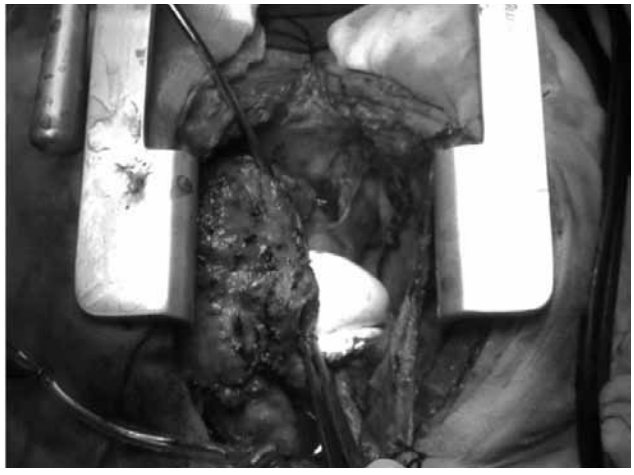
As no residual autopericardium was available for refashioning the pulmonary venous channel,a triangular (0.4mm thickness) PTFE (gortex) patch was sutured to the edge of the previously done incision in the pulmonary venous channel ,with the base of the triangular patch parallel and just anterior to RT phrenic nerve , then suture lines were carried out from both ends anteriorly to pass and maximally widen the stenosed segment of the pulmonary venous channel .

Normal sinus rhythm was resumed spontaneously after declamping the aorta .The patient passed smooth postoperative course ,weaned from ventilator after 18 hours and weaned from inotropic support after 36 hours .Post-operative Echocardiography showed no pulmonary venous obstruction and pulmonary pressure dropped from 80mmHg preoperatively, to 55mmHg 2 days after operation, and 36mmHg 3 month postoperatively (with good clinical state)

NB. Age at first operation was 14m (BW 9kg) and at second operation age was 38m (BW 17kg).



Multislice CT showing preoperative severe constriction between pulmonary venous confluence (posteriorly)and the new left atrial channel(anteriorly)



Post repair triangular gortex patch widening the constriction in the pulmonary venous channel.

Predictive value of Euroscore in Coronary artery bypass surgery

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Objectives: **preliminary goal of our study was to evaluate the validity of EuroSCORE in coronary artery bypass surgery (CABG).**
Methods: **From January 2007 to December 2010, 1883 consecutive adult patients who received CABG in our institute were collected. Patients were categorized into low-risk group (score 0–2), medium-risk group (score 3–5), and high-risk group (score 6 plus). Mean age was 62.5±10.3 years. Male-to-female ratio was 5:1. The mean score of all patients was 5.5±3.3 .*Results:* The observed overall average mortality rate was 3.1%. There were 15.4% of patients in low-risk group, 65.2% in medium-risk group, and 19.4% in high-risk group. The mortality rate was 4.1% in low-risk group, 4.3% in medium-risk group, 15.4% in high-risk group.**
Conclusion: **the EuroScore is a good predictor of mortality in CABG patients.**

Operative mortality is a good measure of quality of cardiac surgical care, as long as patient risk factors are taken into consideration. EuroSCORE is a method of calculating predicted operative mortality for patients undergoing cardiac surgery. Two risk calculators are available : the simple additive EuroSCORE and the full logistic score. The simple additive EuroSCORE model is now well established and has been validated in many patient populations across the world. It is easy to use, even at the bedside. It is very valuable in quality control in cardiac surgery and gives quite a useful estimate of risk in individual patients. However, particularly in very high risk patients, the simple additive model may sometimes underestimate the risk when certain combinations of risk factors co-exist. The full logistic version of EuroSCORE produces more accurate risk prediction for a particular high risk patient. Its main disadvantage is that the risk has to be calculated in quite a complex way .

The European System for Cardiac Operative Risk Evaluation (EuroSCORE) was developed between 1995 and 1999 to provide an evaluation model for in-hospital or 30-day mortality in cardiac surgery [1,2]. Despite demographic differences, it has been widely accepted in Europe, North America [3], and Japan [4].

Methods:

From jan 2007 to dec 2010 a total number of 1883 patients operated upon at Dar Alfouad hospital were studied. Throughout the study we strictly conformed to the definitions of risk factors described in the original publication by Nashef et al. Mortality was defined as death from any cause within the same hospital admission of operation. . Patients were divided into three risk groups: low-risk group (simple additive score 0–2), medium-risk group (simple additive score 3–5), and high-risk group (simple additive score 6 plus).

Numerical variables were presented as mean±standard deviation. A P value of less than 0.05 was considered statistically significant. The predictive values of the EuroSCORE items were tested by Yates' correction 2-test. The odds ratios were calculated. Changes in the proportion of the three risk levels from year 2007 to 2010 were examined using 2-test. Receiver operating characteristic (ROC) curves were used to assess the discriminatory ability of EuroSCORE.

Results:

There were 1574 males (83.5%) and 309 females (16.5%).The male to female ratio was 5:1. The mean age was 62.5 years ± 1.2. All patients were operated on pump. There

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were 1803 cases of pure CABG surgery (95.7%). There were 69 cases of CABG + valves surgery (3.66%). There were 11 cases of redo CABG surgeries (0.5%). The total mortality was 59 patients (3.1%). These were divided as follows: 48patients had only CABG (2.5%) and 11 patients had combined CABG and valve surgeries (0.5%). There were no mortalities in the redo CABG group. The mean EuroSCORE of our patients was 5.5±3.3 . There were 15.4% of patients in low-risk group, 65.2% in medium-risk group, and 19.4% in high-risk group. The mortality rate was 4.1% in low-risk group, 4.3% in medium-risk group, 15.4% in high-risk group.

Risk factor	%	EURO (%)	North america (%)
Age (years)	62.5	62.5	64.6
Female	16.5	27.8	30.9
Chronic pulmonary disease	2.5	3.9	15.4
Previous cardiac surgery	0.5	7.3	11.7
Creatinine>200µmol/l	1.7	1.8	2.1
Critical preoperative status	4.5	4.1	9.0
Unstable angina	11.5	8.0	21.7
Recent myocardial infarction	8.8	9.7	20.9
Pulmonary hypertension	0.9	2.0	5.7
Other than isolated CABG	3.66	36.4	18.8

Table 1. Prevalence of risk factors in our study, Europe (EURO), and America

Variables	P value
Age	0.006
Female sex	0.272
Other than isolated CABG	0.000*
Recent myocardial infarction<90 days	1.000
Unstable angina requiring i.v. nitrate	0.074
Emergency	0.000*
Critical preoperative status	0.000*
Preop EF 30–50%	0.658
Preop EF<30%	0.007*
Neurologic dysfunction	0.001*
Serum creatinine>200µmol/l	0.000*
Chronic pulmonary disease	1.000
Extracardiac arteriopathy	0.237
Previous cardiac surgery	0.370

Table 2. Predictive values of score items

Discussion:

There are two different measures that can be used to evaluate a predictive model: calibration and discrimination. Of the two, discrimination is generally regarded as more practical because model adjustments can be made to overcome poor calibration. A c-index value more than 0.7 indicates good discrimination [11]. The c-indexes of the European and North American studies were 0.76 and 0.77, respectively. In this study, the c-index was 0.73, which demonstrates that the EuroSCORE was valid in our patients.

The concept of risk stratification has been increasingly emphasized in cardiac surgery [5]. Although risk-scoring systems do not allow for decisions to be made for individual patient, they provide a tool for measuring the quality of care in cardiac institutes. In addition, the surgical results of different institutes or countries can be compared on the objective basis of the patients' risk profile. A universal risk stratification system that worked well regardless of demographic differences was needed. Several scoring systems had been used for evaluation of cardiac surgical patients before the advent of EuroSCORE [4–6]. Of these, the Parsonnet system was most notably used although it has been criticized for including subjective variables [7]. The major advantage of EuroSCORE is the clearly objective definition for each risk factor. Furthermore, the simple additive score allows the surgeon to estimate easily the surgical risk of the patient at bedside. The EuroSCORE has been validated in Europe [6,8,9], North America [3], Turkey [10], and Japan [4].

The epidemiologic differences were reflected in the prevalence of risk factors (Table 1), which was consistent with the findings between the European and North American studies [3]. The mean age of our patients was 62.5 years, which was consistent with those of the other studies. Patients aged 75 or over were 6.6% and they were less than those in the European (10%) and North American (19.1%) studies [1,3]. The elder patients usually had other risk factors. The proportion of female patients was lower than that in the European and North American studies (16.5 versus 27.8 and 30.9%). The prevalence rate of renal insufficiency (1.7%) was consistent with that in the studies conducted in Europe and North America. However, percentage of patients who had undergone previous cardiac surgery was significantly lower in our study compared to those reported in European and North American studies (0.5%, Europe: 7.3%, North America: 11.7%). This may be explained by differences in the general medical environment and the habits of general population in seeking medical resources in these parts of the world.

Conclusion:

EuroSCORE is simple and easy to use. It is useful in evaluation and comparison of surgical results and medical care. Despite differences in demographic data, risk and surgical characteristics, our study demonstrates preliminarily that EuroSCORE is valid in CABG patients.

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Blood conservation package for elective open heart procedures

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Aim : **Offering an ideal, safe and economic package for chronically stable cardiac patients**

Methodology: **Ninety patients (May.08 to Feb09) all were chronic stable cardiac illness (ischemic, valvular or adult congenital),were equally divided;**

1- group of blood conservation package (BCA) and 2-conventional group ,both groups had repeated full lab. Calculated blood loss, heterologous units transfused and hospital stay BCA include:

1- withdrawal of 1 unit of whole blood for subsequent auto -donation + Erythropoietin 40,000U S.C + iron (ferrous fumerate) I.M, 3 weeks before surgery

2- Stoppage of any anti-platelets 1 week, or oral anti-coagulants 4 days before surgery and to give fractionated heparin S.C

3-Withdrawal of 2 fresh units of whole blood and giving the patient his old withdrawn unit in O.R before full heparinization

4- Tranexamic acid 2gm I.V before and after C.P.Bybass time+ topical in field

5- Giving extra dose of 10,000U erythropoietin S.C and iron I.M on third P.O day

Conclusion: **BCP was found to be useful in reduction of need for heterologus blood products transfusion, hospital stay and cost**

Blood transfusions have been linked to increased morbidity and mortality. Blood transfusions are associated with significant risk to the patient and escalating costs to the blood bank system and hospital. There are complications majorly endangering patient's life like transmission of infectious diseases, incompatibility, febrile non-hemolytic reactions, immunosuppression, acute lung injury and acute not corrected blood loss or hemodilution1. In cardiac surgical patients, transfusion of red cells that had been stored for more than 2 weeks was associated with a significantly increased risk of postoperative complications as well as reduced short-term and long-term survival2. Blood conservation and institutions continue to vary significantly in their transfusion practices for CABG surgery 3 . The mean number of packed red blood cells (PRBCs) transfused in CABG ranges from 0 to 6.3 units per patient, and the frequency of transfusion ranges from 16% to 100%4. Perioperative bleeding requiring blood transfusion is common during cardiac operations, especially those procedures that require cardiopulmonary bypass (CPB). Cardiac operations consume as much as 10% to 15% of the nation›s blood supply and evidence suggests that this fraction is increasing, largely because of increasing complexity of cardiac surgical procedures5. The majorities of patients who have cardiac procedures using CPB have sufficient wound clotting after reversal of heparin and do not require transfusion.6

The Society of Thoracic Surgeons Workforce on Evidence Based Surgery provides recommendations for practicing thoracic surgeons based on available recommendations that appeared in the 2007 Guideline7.(table1).

Aims of this study is offering an ideal, safe and economic package for chronically stable cardiac patients by choosing a package from the guidelines and use them as routine.

Methods :

Study was conducted in, cardiothoracic surgery dept. Nasser Institute, Cairo , Egypt and, King Fahd Cardiac Center, Riyadh, KSA . Ninety patients (from May 2008 to Feb2009) all were elective chronic stable cardiac illness (ischemic, valvular

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and congenital) were equally divided into two groups, first one included blood conservation package(BCP) and group 2 was conventional group. Fifty patients underwent CABG, forty three patients were valvular and seven patients underwent congenial operations.

In BCP group the following instructions were done:

1-Withdrawal of 1 unit of whole blood for subsequent auto -donation + Erythropoietin 40,000 units (U)

Blood Conservation Intervention	Class of Recommendation (Level of Evidence)
Preoperative interventions	
Drugs that inhibit the platelet P2Y12 receptor should be discontinued before operative coronary revascularization (either on pump or off pump), if possible. The interval between drug discontinuation and operation varies depending on the drug pharmacodynamics, but may be as short as 3 days for irreversible inhibitors of the P2Y12 platelet receptor.	I (B)
Point-of-care testing for platelet adenosine diphosphate responsiveness might be reasonable to identify clopidogrel nonresponders who are candidates for early operative coronary revascularization and who may not require a preoperative waiting period after clopidogrel discontinuation.	IIb (C)
Routine addition of P2Y12 inhibitors to aspirin therapy early after coronary artery bypass graft (CABG) may increase the risk of reexploration and subsequent operation and is not indicated based on available evidence except in those patients who satisfy criteria for ACC/AHA guideline-recommended dual antiplatelet therapy (eg, patients presenting with acute coronary syndromes or those receiving recent drug eluting coronary stents).	III (B)
It is reasonable to use preoperative erythropoietin (EPO) plus iron, given several days before cardiac operation, to increase red cell mass in patients with preoperative anemia, in candidates for operation who refuse transfusion (eg, Jehovah›s Witness), or in patients who are at high risk for postoperative anemia. However, chronic use of EPO is associated with thrombotic cardiovascular events in renal failure patients suggesting caution for this therapy in individuals at risk for such events (eg, coronary revascularization patients with unstable symptoms).	IIa (B)
Recombinant human erythropoietin (EPO) may be considered to restore red blood cell volume in patients also undergoing autologous preoperative blood donation before cardiac procedures. However, no large-scale safety studies for use of this agent in cardiac surgical patients are available, and must be balanced with the potential risk of thrombotic cardiovascular events (eg, coronary revascularization patients with unstable symptoms).	IIb (A)
Drugs used for intraoperative blood management	
Lysine analogues—epsilon-aminocaproic acid (Amicar) and tranexamic acid (Cyklokapron)—reduce total blood loss and decrease the number of patients who require blood transfusion during cardiac procedures and are indicated for blood conservation.	I (A)
High-dose (Trasylol, 6 million KIU) and low-dose (Trasylol, 1 million KIU) aprotinin reduce the number of adult patients requiring blood transfusion, total blood loss, and reexploration in patients undergoing cardiac surgery but are not indicated for routine blood conservation because the risks outweigh the benefits. High-dose aprotinin administration is associated with a 49% to 53% increased risk of 30-day death and 47% increased risk of renal dysfunction in adult patients. No similar controlled data are available for younger patient populations including infants and children.	III (A)
Blood derivatives used in blood management	
Plasma transfusion is reasonable in patients with serious bleeding in context of multiple or single coagulation factor deficiencies when safer fractionated products are not available.	IIa (B)
For urgent warfarin reversal, administration of prothrombin complex concentrate (PCC) is preferred but plasma transfusion is reasonable when adequate levels of factor VII are not present in PCC.	IIa (B)
Transfusion of plasma may be considered as part of a massive transfusion algorithm in bleeding patients requiring substantial amounts of red-blood cells. (Level of evidence B)	IIb (B)
Prophylactic use of plasma in cardiac operations in the absence of coagulopathy is not indicated, does not reduce blood loss and exposes patients to unnecessary risks and complications of allogeneic blood component transfusion.	III (A)

Plasma is not indicated for warfarin reversal in the absence of bleeding.	III (A)
Use of factor XIII may be considered for clot stabilization after cardiac procedures requiring cardiopulmonary bypass when other routine blood conservation measures prove unsatisfactory in bleeding patients.	IIb (C)
When allogeneic blood transfusion is needed, it is reasonable to use leukoreduced donor blood, if available. Benefits of leukoreduction may be more pronounced in patients undergoing cardiac procedures.	IIa (B)
Use of intraoperative platelet plasmapheresis is reasonable to assist with blood conservation strategies as part of a multimodality program in high-risk patients if an adequate platelet yield can be reliably obtained.	IIa (A)
Use of recombinant factor VIIa concentrate may be considered for the management of intractable nonsurgical bleeding that is unresponsive to routine hemostatic therapy after cardiac procedures using cardiopulmonary bypass (CPB).	IIb (B)
Antithrombin III (AT) concentrates are indicated to reduce plasma transfusion in patients with AT mediated heparin resistance immediately before cardiopulmonary bypass.	I (A)
Administration of antithrombin III concentrates is less well established as part of a multidisciplinary blood management protocol in high-risk patients who may have AT depletion or in some, but not all, patients who are unwilling to accept blood products for religious reasons.	IIb (C)
Use of factor IX concentrates, or combinations of clotting factor complexes that include factor IX, may be considered in patients with hemophilia B or who refuse primary blood component transfusion for religious reasons (eg, Jehovah›s Witness) and who require cardiac operations.	IIb (C)
Blood salvage interventions	
In high-risk patients with known malignancy who require CPB, blood salvage using centrifugation of salvaged blood from the operative field may be considered since substantial data supports benefit in patients without malignancy and new evidence suggests worsened outcome when allogeneic transfusion is required in patients with malignancy.	IIb (B)
Consensus suggests that some form of pump salvage and reinfusion of residual pump blood at the end of CPB is reasonable as part of a blood management program to minimize blood transfusion.	IIa (C)
Centrifugation of pump-salvaged blood, instead of direct infusion, is reasonable for minimizing post-CPB allogeneic red blood cell (RBC) transfusion.	IIa (A)
Minimally invasive procedures	
Thoracic endovascular aortic repair (TEVAR) of descending aortic pathology reduces bleeding and blood transfusion compared with open procedures and is indicated in selected patients.	I (B)
Off-pump operative coronary revascularization (OPCABG) is a reasonable means of blood conservation, provided that emergent conversion to on-pump CABG is unlikely and the increased risk of graft closure is considered in weighing risks and benefits.	IIa (A)
Perfusion interventions	
Routine use of a microplegia technique may be considered to minimize the volume of crystalloid cardioplegia administered as part of a multimodality blood conservation program, especially in fluid overload conditions like congestive heart failure. However, compared with 4:1 conventional blood cardioplegia, microplegia does not significantly impact RBC exposure.	IIb (B)
Extracorporeal membrane oxygenation (ECMO) patients with heparin-induced thrombocytopenia should be anticoagulated using alternate nonheparin anticoagulant therapies such as danaparoid or direct thrombin inhibitors (eg, lepirudin, bivalirudin or argatroban).	I (C)
Minicircuits (reduced priming volume in the minimized CPB circuit) reduce hemodilution and are indicated for blood conservation, especially in patients at high risk for adverse effects of hemodilution (eg, pediatric patients and Jehovah›s Witness patients).	I (A)
Vacuum-assisted venous drainage in conjunction with minicircuits may prove useful in limiting bleeding and blood transfusion as part of a multimodality blood conservation program.	IIb (C)
Use of biocompatible CPB circuits may be considered as part of a multimodality program for blood conservation.	IIb (A)

Use of modified ultrafiltration is indicated for blood conservation and reducing postoperative blood loss in adult and pediatric cardiac operations using CPB.	I (A)
Benefit of the use of conventional or zero balance ultrafiltration is not well established for blood conservation and reducing postoperative blood loss in adult cardiac operations.	IIb (A)
Available leukocyte filters placed on the CPB circuit for leukocyte depletion are not indicated for perioperative blood conservation and may prove harmful by activating leukocytes during CPB.	III (B)
Topical hemostatic agents	
Topical hemostatic agents that employ localized compression or provide wound sealing may be considered to provide local hemostasis at anastomotic sites as part of a multimodal blood management program.	IIb (C)
Antifibrinolytic agents poured into the surgical wound after CPB are reasonable interventions to limit chest tube drainage and transfusion requirements after cardiac operations using CPB.	IIa (B)
Management of blood resources	
Creation of multidisciplinary blood management teams (including surgeons, perfusionists, nurses, anesthesiologists, intensive care unit care providers, house staff, blood bankers, cardiologists, etc.) is a reasonable means of limiting blood transfusion and decreasing perioperative bleeding while maintaining safe outcomes.	IIa (B)

ACC = American College of Cardiology; AHA = American Heart Association.

subcutaneous (SC) + iron (ferrous fumerate) I.M, 3 weeks before surgery.

2-Stoppage of any anti-platelets 1 week, or oral anti-coagulants 4 days before surgery and to give fractionated heparin S.C

3-Withdrawal of 2 fresh units of whole blood and giving the patient his old withdrawn unit in operating room (OR) before full heparinization .

4- Tranexamic acid 2gm intravenous (IV) before and after CPB time+ topical in field.

5- Giving extra dose of 10,000U erythropoietin SC and iron intramuscular (IM) on third postoperative (PO) day.

All patients subjected to full clinical examination, labs, and close calculations for blood loss, heterologous blood products consumptions , morbidities and mortality ratios. The preoperative, operative, and postoperative data were collected.

Statistical analysis was performed with the SPSS statistical package (SPSS Version 13.0). All the continuous variables were expressed as mean ±SD and the dichotomous variables as frequencies. The categorical variables were compared using the chi-square test, and the continuous variables were compared using Student's t-test. P values ≤0.05 were considered statistically significant. Also, the ordinal variables were compared using the nonparametric Mann-Whitney or Willcoxon signed ranks tests.

Results:

the statistical analysis showed insignificant difference as regard the clinical status of the 2 groups that may affect the current comparative study as regard the age, gender, hypertension, diabetes, etiology, renal function, and anemia, as shown in table (2).The comparison between the 2 groups has showed statistical significant differe nce as regard number of given heterologous blood products (packed RBCs , plasma, cryoprecipitate and/or, platelets) 2±1 unit for BCP group versus (vs) 9±6 unit for Conventional group (P = 0.002) ,and hospital stay 7±2 days for BCP group Vs 9±5 days in conventional group (P= 0.05),and renal affection Cr. 0.9±0.5mg% for BCP group Vs 1.1±0.8mg% in conventional group(P=0.04). Blood loss was about to show significance reduction in BCP group 0.6±0.5L in BCP group Vs1.1±0.75L in conventional group (P=0.07). While it showed insignificant difference as regard the Hb drop which 1.1±0.75gm% in BCP group compared to 10.25±1.35gm % in conventional group (P=0.19), also re- exploration for the high drainage was performed included 1 patient (2.2%) in BCP group Vs 3 patients (6.6%) in conventional group (P=0.15). Lastly as regard operative time it was 4.1±1.3hours in BCP group while in conventional group, it was 4.4±1.6 hours in without significant difference (P=0.83), table(3).

Variables	BCP (n=45)	Conventional (n=45)	P value
Age (y) (mean ±SD)	36±9.17	41±7.68	NS 0.48
Female	14(31.1)	17(37.7)	NS 0.41
Hypertension	4(8.8)	6(13.3)	NS 0.54
Diabetes mellitus	11(24.4)	4(8.8)	HS 0.009
Congenital HD	2(4.4)	3(6.6)	NS 0.96
RHD	25(55.5)	18(40.0)	NS 0.35
Stable IHD	18(40.0)	24(53.3)	NS 0.29
Renal insufficiency (Cr>1.5 mg%)	2(12.5)	7(21)	NS 0.43
Hb (gm %)	12.2±3.1	13.6±2.1	NS 0.91

Table 2: Patient's characteristics in both groups.
Y: Years, Cr :Creatinine , HD : Heart Disease IHD :Ischemic Heart Disease, Hb :Hemoglobin RHD: rheumatic heart disease, NS: non

significant, HS: highly significant.

Variables	BCP (n=45)	Conventional (n=45)	P value
Mean Hb (gm %) after 5 days, PO	9.47±1.27	10.25±1.35	NS 0.19
Heterologous blood products consumption (unit)	2±1	9±6	HS0.002
Hospital stay (D)	7±2	9±5	S 0.05
Blood loss (L)	0.6±0.5	1.1±0.75	S 0.07
5 days, PO. Cr. (gm %)	0.9±0.5	1.1±0.8	S 0.04
Re exploration for bleeding	1(2.2%)	3(6.6%)	NS 0.15
Operative hours	4.1±1.3	4.4±1.6	NS 0.83

Table 3: Postoperative differences between 2 groups.
PO: postoperative, Hb: Hemoglobin, Cr: Creatinine, L: Liters, gm: Gram, NS: non significant, HS: highly significant, S:significant.

Discussion :

There is significant practice variation associated with blood transfusion and management of bleeding in patients having operative procedures8. This variation persists despite available transfusion and blood management guidelines. Many surgeons transfuse blood products based on hemoglobin levels rather than based on patients› clinical status, despite evidence to suggest that clinical bleeding should guide transfusion decisions9. The use of allogeneic blood transfusion after coronary artery surgery is still high despite published transfusion guidelines and costly blood conservation strategies10.

Blood conservation has become one of the most important issues in cardiac surgery [29,32]. Some of blood conservation strategies are cost-efficient and simple to utilize in nearly all cardiac surgical patients without adding further risk to the patient or effort to the operating room team, including salvage of blood from surgical field using cardiotomy suction, hemodilution during CPB and retransfusion of all contents of oxygenator at the end of CPB11.

Use of other modalities, such as antifibrinolytic therapy, preoperative autologous blood donation, use of cell saving devices, and auto transfusion of shed mediastinal chest tube drainage is still limited owing to doubts about their effectiveness and inappropriateness for use in many patients12.

In this study we focused on four of the conservation techniques to have a reasonable evaluation as a package and not to evaluate each technique separately as done in the report of Hardy and colleagues 13who used erythropoietin and antifibrinolytics , together but Youshikawa and colleagues 14 used three combined package for blood conservation.

Our selection for IHD patients was based anti-platelets stoppage 10 days before surgery is safe for them which based on the advice of Mahla and colleagues.15 Choosing chronic and stable patients was to exclude the adverse effect of clopidogrel and aspirin as it may alter the results which was accompanied by tremendous blood loss reported in the study of in Berger and colleagues.16

Tranexamic acid (Cyclocaprone) was chosen in this study as an anti-fibrinolytic better than aprotinin to avoid its adverse effect either renal complications , graft occlusion post CABG or other risk related factors which was in accordance of reports of Takagi and colleagues.17

Better results were found in study done by Yamagishi I and colleagues18 as they didn't use any blood products except auto-transfusion and using mini-bypass technique in addition to pre and postoperative erythropoietin.

With regard the reduction in blood products consumption and hospital stay, in BCP group ,it was 2±1 units and 7±2 days respectively. Our results were much better than Hoynck and colleagues19 who used erythropoietin alone and they reported that blood products was 4±2 units and hospital stay was 8±5 days.

Renal impairment was less in our BCP group compared to Brown and colleagues20 which was 0.6±0.5 Vs 1.2±0.4 ,because they used aprotonin instead of tranexamic acid , although they have better less use of blood products.

Limitations of this study is the small number of patients included due to the small size of surgeon based target population. Another limitation is restricting the study to PRBC transfusion predictors only. There is a strong need in our center for determining the predictors of fresh frozen plasma and platelet transfusion in cardiac surgical procedures. The cost-efficiency of application of a blood conservation strategy targeting patients at risk of transfusion needs verification through prospective clinical studies.

Conclusion:

Auto-transfusion , erythropoietin , ferrous injections and tranexamic acid are safe and effective package in stable cardiac patients during elective open heart surgeries, that reduces the need for heterologous blood products transfusion without drop in early postoperative period , it fasten patient recovery with harmless effect on renal functions and hemodynamics. In addition, blood transfusion during or after coronary artery bypass operations were associated with increased length of intensive care unit and hospital stay.

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Impacts of intra-aortic balloon pump in surgical revascularization, Is it smart enough to heal the heart?

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***Background*: Intra-aortic balloon pump (IABP) is the most used ventricular assist device either for preoperative and perioperative support in high-risk patients undergoing coronary artery bypass grafting (CABG). Preoperative insertion proved to reduce morbidity and mortality for high-risk patients, compared to intra- or postoperative support. The aim of this study was to determine the impact of preoperative IABP use on mortality and morbidity in high-risk patients undergoing CABG.**

***Methods:* Data for 372 consecutive patients were collected and reviewed between July 2009 and June 2010 who underwent CABG. Patients receiving an IABP were identified and grouped as follows: group 1 included thirty one patients with preoperative IABP insertion for high-risk patients who defined as having at least two of the following inclusion criteria: preoperative left ventricular ejection fraction (LVEF) less than 30%, unstable angina at the time of operation despite optimal medical treatment and left main stem stenosis at least 70%. Group 2 included thirty patients with intra-operative IABP insertion when there was difficulty in weaning of cardiopulmonary bypass (CPB) in spite of maximum dose of inotropic support. Preoperative, operative, and postoperative data were recorded and statistically analyzed.**

***Results:* There was no significant difference between two groups with regards preoperative patient's characteristics. The mean cross clamp was 60.2±2.6 minutes in group 1 while it was 62.1±2.8 minutes in group 2 without significant difference, but there was significant difference between both groups with regards the mean cardiopulmonary bypass time (CBP) which was 108.7±6 minutes in group 1, while it was 126.8±7 minutes in group 2. All measurements of cardiac output were performed for 48 hours postoperatively. The mean postoperative cardiac index was 3.3±0.05 L/m2 per minute in group 1. The IABP support time was shorter in pre-operative group , it was 29.2±0.8 hours, while it was 37.9±0.9 hours in group 2, which was statistically significant (p> 0.0001). The ventilation time was shorter in group 1 which was 17.8±3.9 hours, but in group 2 it was 28.2±7.7 hours. The required period in the intensive care unit and the hospital stay time were significantly shorter in group 1. The pharmacological inotropic support was significantly higher in group 2, it was 45.8±2.5 hours, compared to group 1 which was 34.7±1.6 hours. Renal complications were higher significantly in intra-operative IABP insertion group than pre-operative one (group1). Overall hospital mortality was 6.5% , it was 3.2 % in group 1 (1 patient) and 10% in group 2 (3 patients).**

***Conclusions:* Preoperative IABP support was associated with improved cardiac performance and lower incidence of postoperative outcomes in high-risk patients underwent CABG.**

The intra-aortic balloon pump (IABP) usually is the first mechanical device used for perioperative cardiac failure . Its main effects are reduction of ventricular afterload, improvement of diastolic coronary perfusion, and enhancement of subendocardial perfusion . Afterload is reduced and diastolic pressure augmented, resulting in an increased stroke volume and cardiac output and redistribution of coronary blood flow towards ischemic areas of the myocardium . Insertion of an IABP in the failing myocardium results in a more favorable myocardial supply: demand balance . Only few studies have so far been published, specifically evaluating the benefits of preoperative intra-aortic balloon pump (IABP) support in 'high-risk' patients. These studies have shown that mortality is significantly lower in preoperatively pumped patients compared to patients receiving the IABP perioperatively.

Well-established high-risk factors for mortality and major postoperative morbidity are

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poor left ventricular function (left ventricular ejection fraction less than 0.40), diffuse coronary artery disease, left main stem stenosis greater than 70% and unstable angina at time of operation despite optimal medical treatment. The optimal timing for preoperative IABP treatment has not yet been firmly established .

The aim of the present study was to evaluate the efficacy of IABP on peri-operative period and postoperative morbidity and mortality in high risk patients undergoing coronary artery bypass grafting (CABG).

Methods:

Between July 2009 and June 2010, 372 consecutive patients who underwent CABG at King Fahad Cardiac center at King Khalid university hospital , Riyadh, KSA and other governmental and private centers in Egypt were included in this study, and all gave informed consent. All the patients who were treated with an IABP during the perioperative period were identified using our cardiac database. Patients were divided into two groups, 31 high risk patients with preoperative IABP, (group1) and group 2 included 30 patients who required intra-operative IABP insertion when there was difficulty in weaning of cardiopulmonary bypass (CPB) in spite of maximum dose of inotropic support (dopamine up to 15 µg/kg per minute, dobutamine at 5 to 10 µg/kg per minute, adrenaline, noradrenaline or amrinone 0.5 mg/kg bolus dose, or a combination thereof). The amount of pharmacological inotropic support pre- and postoperatively (during the first 24h) required to maintain an acceptable cardiac index (<2.0 l/min/m2) was monitored.

High risk was defined as having at least two of the following inclusion criteria: preoperative left ventricular ejection fraction (LVEF) less than 30% which was calculated from the preoperative ventriculography as well as from echocardiography , unstable angina at the time of operation despite optimal medical treatment, left main stem stenosis at least 70%.

All patients received a Swan-Ganz catheter preoperatively and cardiac performance was evaluated by cardiac index (L/m2 per minute), calculated from cardiac output data which measured repeatedly intra-operatively and at least 48 hours postoperatively. All preoperative clinical and patient's characters as well as operative data, were entered into our cardiac database at the time of hospitalization. Postoperative hospital mortality and morbidity rates, including all balloon-related complications, as well as required stay in intensive care unit, ventilation time and total hospital stay were registered for all patients. Hospital mortality was defined as death within same hospital admission regardless of cause.

Surgical and cardiopulmonary bypass techniques

All operations were done through a median sternotomy. Anesthesia, cardiopulmonary bypass (CPB) and surgical techniques did not change during the study period and were standardized. Myocardial revascularization with conventional technique was performed. Myocardial protection was done using cold blood intermittent cardioplegia solution which was infused into the aortic root, together with topical hypothermia (28–32°C).The internal thoracic artery was harvested as a pediculated graft whenever used as a conduit. No other arterial conduits were used in this series, but venous grafts was routinely used.

Patient characteristics

The mean age was 60.0 ± 5.8 years, and 88.5% of the patients (54 of 61) were men. There were no differences between groups. The classic risk factors for coronary artery disease were similar in all groups (Table 1).

The intra-aortic balloon pumps:

The intra-aortic balloon used was 8F 40 ml balloon Rediguard® IAB Catheter (Datascope Corp, Fairfield, New Jersy) connected to a Datascope pump (Datascope, Fairfield, NJ. USA). In group 1 all IABPs were inserted using a percutaneous route (femoral artery), preoperatively, in the intensive care unit, during 24 hours. Group 2 patients received an intra-aortic balloon pump in the operating room, if there was difficulty in weaning from CPB despite maximum doses of inotropes. There was no failure of percutaneous placement of the IABP. Unless heparin was contraindicated, patients undergoing preoperative insertion were therapeutically anticoagulated with heparin after IABP placement. The IABP support was terminated when hemodynamic stability was restored (maintaining a cardiac index < 2.0 l/min/m2 with minimal pharmacologic support).

Statistics:

Student's t-test (one sample paired test) was employed to assess differences between groups for statistical significance where appropriate. A probability level of $P<0.05$ was regarded significant. Data was expressed as mean values ± standard error of mean (mean ± SEM). The statistical analysis was done using the software program Stat View by SAS institute Inc. USA.

Results:

There was no significant difference between two groups with regards preoperative patient's characteristics (age, sex and risk factors) as shown in table 1. The mean cross clamp was 60.2±2.6 minutes in group 1 while it was 62.1±2.8 minutes in group 2 without significant difference, but there was significant difference between both groups with regards the mean cardiopulmonary bypass time (CBP) which was 108.7±6 minutes in group 1, while it was 126.8±7 minutes in group 2.(table 2). Cardiac index data is presented in table 3. All measurements of cardiac output were performed for 48 hours postoperatively. The mean postoperative cardiac index improved during the first postoperative day, which more higher in group 1, it was 3.3±0.05 L/m2 per minute. The IABP support time was shorter in pre-operative group1 , it was 29.2±0.8 hours, while it was 37.9±0.9 hours in group 2, which was statistically significant ($p>0.0001$). The IABP was removed safely without related mortality and morbidity. The ventilation time was shorter in group 1 which was 17.8±3.9 hours, but in group 2 it was 28.2±7.7 hours. The required period in the intensive care unit was significantly shorter in group 1, it was 28.4±7.7 hours while it was 100.6±13.8 hours in group 2. With regards the hospital stay time, it was significantly shorter in group 1, which was 8.8±0.5 day as shown in table 3. The pharmacological inotropic support was significantly higher in group 2, it was 45.8±2.5 hours, compared to group 1 which was 34.7±1.6 hours. Renal complications were higher significantly in intra-operative IABP insertion group than pre-operative one (group1).One patient needed dialysis and 3 patients had renal impairment in group 1, while 3 patients

needed dialysis and 6 patients had impairment in another group2. Overall hospital mortality was 6.5% , it was 3.2 % in group 1 (1 patient) and 10% in group 2 (3 patients) as displayed in table 3. Three of those patients had preoperative low LVEF <30% and developed postoperative low cardiac output, one in group 1 and other two patients were in group 2. The other cause of death that occurred was postoperative hemorrhage caused by uncontrollable coagulopathy from non-surgical bleeding.

Characteristic	Group 2 (Pre-op. IABP) 31patients	Group 1 (intra-op. IABP) 30patients	p Value
Age (years)	60.0 ± 5.8	61.1 ± 5.9	NS
Sex			
Male	29 (93.55%)	28 (93.33%)	NS
Female	2 (6.45%)	2 (6.67%)	NS
Mean LVEF%	34%±1.7	37%±2.0	NS
Diabetes mellitus	23(74.19%)	20(66.67%)	NS
Hypertension	18 (58.06%)	17(56.67%)	NS
Congestive heart failure	7 (5.11%)	8 (5.33%)	NS
Smoking history	17 (54.84%)	16 (53.33%)	NS

Table 1: Preoperative Characteristic.
LVEF: left ventricular ejection fraction, NS: no significance.

P value	Group 2 (intra-op. IABP) NO. 30	Group1 (Pre-op. IABP) NO.31	Data
CC time(minutes)	62.1±1 2.8	60.2 ±12.6	NS
CPB time(minutes)	126.8±7	108.7±6	S <0.02

Table 2 : Intra-operative data.
CC: cross clamp , CPB: cardiopulmonary bypass.

Outcome	Group1 (Pre-op. IABP) NO.31	Group 2 (intra-op. IABP) NO. 30	P value
IABP support time (hours)	29.2±0.8	37.9±0.9	HS<0.0001
Inotropic support time (hours)	34.7±1.6	45.8±2.5	HS<0.0002
Ventilation time (hours)	17.8±3.9	28.2±7.7	NS
Renal complications			
Failure	1pt.(3.2%)	3 (10%)	HS
Impaired function	3pts. (9.6%)	6(20%)	
ICU time (hours)	28.4±7.7	100.6±13.8	HS<0.0001
Hospital stay (days)	8.8±0.5	13.7±0.4	HS<0.0001
Mortality	2(6.45%)	3(10%)	NS
CI	3.3±0.05	2.6±0.07	HS<0.0001

Table 3 : Postoperative outcome.
IABP: Intra-aortic balloon pump, ICU: intensive care unit, CI: cardiac index, HS: high significant, NS: no significance.

Discussion:

The optimal timing for preoperative IABP treatment has not yet been firmly established. Because of its impact on cost, most of studies were designed to determine the optimal timing for preoperative IABP treatment on preoperative and postoperative cardiac performance (cardiac index measurements), hospital mortality rate, and postoperative morbidity rate in high-risk patients who underwent CABG .

IABP provides significant afterload reduction and may result in more favorable myocardial blood supply through augmentation of diastolic pressures. Previous studies have shown that the augmented diastolic pressure by the IABP results in a redistribution of coronary blood flow towards ischemic areas of the myocardium. The factor that leads to hemodynamic recovery in acute pump failure is reversion of ischemic myocardial dysfunction before it yields to cell necrosis, and counterpulsation acts on reversible ischemia.8

In high-risk coronary patients, difficulties in weaning from CPB because of severely disturbed cardiac performance postoperatively is known to be associated with postoperative low cardiac output, despite maximal inotropic support resulting in high postoperative mortality rate so this is an indication of intra-aortic balloon pump (IABP) insertion.9

The criteria for selecting appropriate candidates for preoperative use of the IABP remain controversial.10 In our series, IABPs were inserted before or during operation for low cardiac output syndrome. Indications for preoperative insertion of IABP has usually been reserved for patients with angina refractory to maximal medical therapy or for those with very low cardiac output preoperatively or severe left main stenosis. While indications of intraoperative insertion of IABP include difficulty of weaning of CBP, intractable arrhythmia with haemodynamic deterioration.

The two groups studied were similar regarding preoperative patient characteristics, coronary angiography data without differences statistically.

Selection bias is likely to have affected our results because the timing of insertion was based on clinical judgment and was not controlled by protocol. It would be impossible to arrange a randomized trial involving peri-operative IABP insertion mainly because of issues related to consent and sample size. This study, however, gives an accurate picture of current clinical practice.

Furthermore, the correct timing for IABP insertion is a relevant issue with better outcome reported after preoperative IABP insertion compared to intra- or postoperative support for high-risk patients. Probably preoperative IABP results in better hemodynamic stability and myocardial perfusion thus preventing progressive myocardial dysfunction. Therefore, IABP should be inserted as soon as the minimum suspect of myocardial hypoperfusion occurs.

The complications related to IABP insertion ranges from minor wound infection or hemorrhage from site of insertion, to major vascular complications as limb ischemia. There was no IABP related mortality and no IABP complications occurred in this series. This could attributed to the use of small sized catheters (8F) and more precise technique of insertion of IABP. In contrast of Christenson11 and his colleagues

where complications rate was 25%, mainly vascular and local wound infection at site of insertion. There was no statistically significant association between IABP-related complications and the short- or long-term mortality rate. Thus, they reported that complications related to the IABP should not restrict its use in high-risk patients. Arafa and colleagues12 as well as Meharwal and Trehan13 determined peripheral vascular disease to be a risk factor for major IABP-related complications, some of which could be related to hospital mortality.

In our study, patients who received pre-operative IABP showed improvement in their cardiac index which was coincided with study of Abdel-Aziz14 and his associates who reported that the cardiac performance showed marked improvement in the pre-operative IABP group. Also this study is coincided with the results of Christenson and his coworkers. 15

In our study, there was a significant linear trend between the preoperative serum creatinine level and renal impairment which stated that postoperative renal dysfunction has been correlated with poor outcome after cardiac operations.

The comparable ICU stay, need for mechanical ventilation and inotropic support between the two groups support the efficacy of early IABP in restoring hemodynamic stability. It could be possible that immediate 'early' IABP could lower the risk of complications by diminishing the need for high doses of vasoactive medications. 16

The mortality rate in this study was 3.2% in preoperative group and 10% in intra-operative group, which is in agreement with Creswell and his colleagues 17 who reported in their study that preoperative IABP insertion was associated with better survival. The lower mortality rate in our study could attributed to early decision for IABP insertion in any patient showing signs of low cardiac output or any ECG changes without hemodynamic deterioration. In a recent report, Dietl and associates18 have, in a retrospective study, demonstrated that preoperative IABP significantly improve survival, reduce hospital stay and was more cost-effective than no preoperative IABP treatment. In contrast of Karimi and coworkers19 who reported in their study that despite ongoing improvements in surgical care and myocardial protection, the early mortality rate in patients who are supported with an IABP remains high. The mortality rate of 21.89% found in their study is within the acceptable range this is in associated with the range (36% to 61%) which reported in series of patients undergoing cardiac operations, including patients with cardiogenic shock.19

Limitation of the study:

We reported here our institutional experience during the last two years showing us that an early and more aggressive IABP support saves viable myocardium whenever ischemic complications are suspected, also in patients with stable hemodynamics. Moreover, on an intention to- treat basis, we enrolled patients with the most similar risk profile to avoid misleading results.

Conclusion: Preoperative insertion of an IABP was associated with improved early postoperative outcomes in high-risk patients, it was associated with less ICU and hospital stay and postoperative morbidity. Earlier IABP support as part of surgical strategy would appear to be a strategy worth pursuing.

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Short-term outcome of surgical revascularization using on pump beating technique in patients with severe left ventricular dysfunction

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***Objective*: Patients presenting with severe left ventricular (LV) dysfunction who undergoing coronary artery surgery are at increased risk of perioperative morbidity and mortality. This study compares early and short-term outcomes after on-pump beating-heart coronary artery bypass grafting (CABG) versus conventional CABG in patients with ejection fraction (EF) less than 30%.**

***Methods:* 287 patients with ejection fraction less than 30% underwent CABG from July 2005 to July 2009 were analyzed, On-pump beating-heart CABG was done in 137 patients (group 1) and 150 patients were done using conventional technique (group2).**

***Results:* In-hospital mortality was less in the on-pump beating-heart CABG group (4.37% versus 4.66%). The total blood loss was less in group 1, but there was no difference statistically. Perioperative Intra-aortic balloon pump (IABP) was inserted in 23 patients, 16 patients in the conventional CABG group whereas only 7 patients required this in the on-pump beating-heart CABG group. The ventilation time was longer in conventional group it was 11.2±8.3 hours versus.8.2±7.7 in on pump beating group. No significant difference was found in morbidity including stroke and renal failure. The incidence of postoperative arrhythmia including atrial fibrillation was significantly less in on pump beating group as compared to conventional group it occurred in 10 patients versus 21 respectively. The duration of intensive care unit stay and the hospital stay were shorter in the on-pump beating-heart CABG group, it was significantly different. Short-term outcome revealed improvement in ejection fraction and clinical symptoms of the patients in both groups.**

***Conclusions:* On-pump beating-heart CABG can be performed safely in high-risk patients with accepted morbidity and mortality rate. Short-term clinical outcome is encouraging and seems to justify surgical revascularization for this high-risk group of patients.**

Severe LV dysfunction has been reported as an independent predictor of operative mortality in patients undergoing CABG . Although the recovery of impaired myocardial function has been shown to occur after CABG, left ventricular dysfunction remains a negative determinant of postoperative outcome1 . Impaired left ventricular function can also lead to low cardiac output and a high postoperative morbidity and mortality rate2. Despite improvements in medical treatment and surgical techniques, the management of patients with coronary artery disease and left ventricular (LV) dysfunction is still debated. The number of patients with advanced left ventricular dysfunction who undergo coronary artery bypass grafting (CABG) has increased in the past few years.3 Although surgical revascularization may be successful in the short term, little is known about the long-term results of successful CABG in patients with coronary artery disease and left ventricular dysfunction 4. Many authors had reported the superiority in early and mid-term outcome of on-pump beating CABG procedure, compared with the conventional technique, in an unselected or a specific subgroup of patients1,3.The main advantage of the on-pump-beating heart technique is the ability to perform complete revascularization with low morbidity and mortality even in impaired LV function. 5

The purpose of this study was to define the short-term outcome and the survival in patients with left ventricular dysfunction (LVD) who underwent on-pump beating coronary artery bypass (OPB) compared to results of conventional coronary artery bypass grafting (CABG).

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Methods:

Preoperative assessment and data collection

All data were collected at the time of operation and entered into our database system at King Fahad Cardiac Center in King Saud university, Riyadh, Saudi Arabia which is maintained routinely in our center to document all cardiac surgical activity.

287 patients with poor LV function based on a recorded ejection fraction (EF) less than 30% undergoing isolated CABG between July 2005 and July 2009 were collected and analyzed. 137 patients underwent CABG with on pump beating technique (group1) and 150 patients with conventional technique (group2). For each group, the clinical, angiographic characteristics, the operative, early postoperative complications and short-term outcome data were compared. Patients who underwent combined surgery, redo surgery, emergency procedures, left ventricular aneurysm or aortic surgery were excluded from the study. Allocation to on-pump beating and conventional surgery was on the basis of the preference of the surgeons carrying out the operations.

Identification of poor LV function was based on either the preoperative echocardiography or thallium-201 myocardial scintigraphy which were preoperatively performed to measure the left ventricular function and to assess myocardial viability. This viability study was done when indicated in some patients according to their clinical , echocardiography and coronary LV angiography data.

Patient demographics risk factors, operative information and postoperative outcome data were collected prospectively and retrospectively analyzed. Additional information was obtained from patient medical records when necessary. In addition, the logistic Euro SCORE was used for risk stratification6. Outcome measures for this study included hospital mortality, postoperative complications including bleeding, arrhythmias, pulmonary, neurological and renal complications. Pulmonary complications included chest infection, respiratory failure, re-intubation and tracheostomy. Duration of inotropic support, length of mechanical ventilation , length of ICU and hospital stay were recorded. Hospital mortality was defined as death after the procedure before patient's discharge regardless of the duration of hospitalization. Patients who died after discharge from hospital but within 30 days after the procedure were also considered as hospital mortality. Postoperative blood loss was defined as total chest tube drainage. Respiratory failure was defined as prolonged ventilator therapy (>72 hours) or need for re-intubation or tracheostomy. Neurologic complications included delayed recovery or stroke. Renal complications included acute renal failure as defined by the requirement of hemodialysis. Renal failure was defined as creatinine greater than 200 mmol/L or the need for dialysis. Stroke was defined as a new permanent neurologic event occurring perioperatively or postoperatively.

The clinical diagnosis of CHF was made if the patient had the following criteria: history of exertional dyspnea or orthopnea, or both, clinical examination findings of bilateral basal crepitation on auscultation, bilateral pitting edema of the legs, and congested neck veins, with or without hepatomegaly and clinical response to medical therapy. The patients were followed up for 6–9 month (follow up including clinical and echocardiography).

Surgical techniques On-Pump beating Coronary Revascularization:

Anesthetic technique was standardized for all patients. All procedures were performed through median sternotomy. The left internal mammary artery (LIMA) and long saphenous vein were harvested by standard technique. Patients were heparinized with a dose of 1.5mg/kg body weight. Total cardiopulmonary bypass was established with normothermia. Coronary stabilizer and cardiac positioning devices were used to access the coronary arteries under beating heart conditions. The oxygen blower was used to assist in visualization of anastomosis. Hemodynamic monitoring was performed by Swan-Ganz catheter. Continuous monitoring of arterial pressure, central venous pressure, mean pulmonary artery pressure, pulmonary capillary wedge pressure, cardiac index and systemic vascular resistance were done. The right coronary artery (RCA) was usually the first artery to be grafted, followed by grafting of the vessels on the posterior wall and lateral wall. Left anterior descending (LAD) artery was grafted as the last coronary artery as a routine. The target vessel was occluded proximally using a 4-0 polytetrafluoroethylene suture passed twice beneath the artery. All distal anastomosis were performed with running sutures of 7-0 or 8-0 prolene. Proximal anastomoses were performed in standard technique using partial clamping of ascending aorta.

Techniques of conventional CABG:

After systemic heparinization with an activated clotting time level of at least 400 seconds, CPB was instituted between the ascending aorta and the right atrium using a single venous cannula. After the aorta cross-clamped, high potassium blood cardioplegia was administered in an antegrade fashion for myocardial protection combined with systemic hypothermia 28-30°C. Cardioplegia was repeated after every distal anastomosis. Distal anastomoses were completed first, followed by proximal anastomoses using the single aortic cross-clamp technique or partial clamp. Aortic cross-clamp was released and the patients were weaned from CPB after a short reperfusion. After weaning of CPB, protamine was given depending on the heparin level. The intra-aortic balloon pump was inserted in patients with haemodynamically instability.

Postoperative management

At the end of surgery patients were transferred to the intensive care unit (ICU) and managed according to the unit protocol. All vital signs, hemodynamic variables, ventilation data, chest tube drainage and urine output were measured every hour in the intensive care unit. Patients were extubated as soon as they met the following criteria: hemodynamic stability, no bleeding , adequate spontaneous respiratory parameters, normothermia and consciousness with pain control.

Statistical Analysis

Data were analyzed using a statistical software package (Graph

Pad In Stat® version 3.00 for Windows, Graph Pad Software Inc., San Diego, California, USA) and presented as mean (SD), numbers or ratio as needed. Data were analyses using the student t test; Variables that are not normally distributed were compared using the Mann-Whitney test. Non parametric data were analyzed using Chi-square test or the Fiesher exact test as appropriate. Two-tail P values < 0.05 were considered significant.

Results:

We previously studied in our earlier research 7 the early outcome of on pump beating technique (phase 1of study). In this series we extended and completed the second phase of previous study which included the early and short outcome with clinical evaluation of heart failure symptoms and echocardiography follow up.

The overall hospital mortality rate was 4.52 % (13 patients), out of them 4.37% (6 patients) were in on pump beating (OPB) group and 4.66 % (7 patients) were in conventional one (CPB). The cause of death was severe low cardiac output syndrome. Preoperative characteristics of the study groups were shown in Table 1. There were no significant differences between the 2 groups in terms of age, sex distribution. Group 2 had higher incidences of diabetes mellitus, hypertension, congestive heart failure and smoking history, but there was no significant difference.

Characteristic	On-Pump Beating-Heart CABG (n = 137)	Conventional CABG (n = 150)	p Value
Age (years)	63.0 ± 8.4	61.4 ± 7.8	NS
Sex			
Male	75 (54.7%)	82 (54.6%)	NS
Female	62 (45.3%)	68 (45.5%)	NS
Mean LVEF%	28%±1.7	27.8%±2.0	NS
Diabetes mellitus	107 (78.1%)	111(74.0%)	NS
Hypertension	113 (82.48%)	128 (85.3%)	NS
Smoking history	68 (49.6%)	80 (53.3%)	NS
Cerebrovascular disease	8 (5.83%)	9 (6%)	NS
Peripheral vascular disease	13 (9.48%)	15 (10%)	NS
Chronic obstructive pulmonary disease (COPD)	5 (3.64%)	7 (4.6%)	NS
Congestive heart failure	7 (5.11%)	8 (5.33%)	NS
Preoperative mean NYHA class	3.3±.5	3.2± .7	NS

Table 1: Preoperative Clinical Characteristics.
LVEF :left ventricular ejection fraction; NYHA : New York Heart Association
NS: non significance.

Operative data were shown in Table 2. Patients in group1 (On-pump beating group) had shorter duration of the operation and CPB time; the difference in CPB time is related to prolonged reperfusion period after the release of the aortic cross clamp, it was 96.6 ± 43.8 versus 119 ±59.8, which was statistically significant difference. The number of bypass grafts and the rate for complete revascularization were almost the same in both groups, it was 3.3± 0.7 versus 3.3 ± 0.6.

Characteristic	On-Pump Beating-Heart CABG (n = 137)	Conventional CABG (n 150)	p Value
Operation time (min)	229.6 ± 59.9	336.3 ± 79.2	HS <0.0001
Cardiopulmonary bypass time (min)	86.6 ± 23.8	113.1 ± 49.8	HS <0.0001
Number of bypass grafts	3.3± 0.7	3.3 ± 0.6	NS

Table 2: Operative variables of patients on both groups.
HS: high significance.

Postoperative complications:

The postoperative complications were summarized in Table3. Chest tube drainage was less in group 1, but there was no statistically significant difference. Perioperative intra-aortic balloon pump (IABP) usage was significantly higher in group 2 patients. In both groups, we used intra-aortic balloon pump, when there was hemodynamically instability as high pulmonary artery pressure, hypotension or ischemic changes in ECG monitoring.

The incidences of early postoperative complications were significantly higher in patients with conventional CABG, reflected in longer ventilation time, intensive care unit stay, and hospitalization. Postoperative data according to the method of surgery were shown in Table 3. The group of patients underwent on pump bearing surgery (group 1) had a lower total complication rate than those underwent conventional CABG. The incidences of reopening for bleeding or hemodynamic instability, stroke and renal failure were not significantly different in both groups. The incidence of postoperative arrhythmia like atrial fibrillation was significantly less in on pump beating group as compared to CPB group, it happened in 10 patients (7.3%) versus 21 (14%) respectively. The need for inotropic support was significantly greater for longer period in the conventional group. Patients in group 2 needed longer ventilation time, intensive care unit stay and longer intensive care unit hospital stay than those in group 1.

Outcome	On-Pump Beating-Heart CABG (n = 137)	Conventional CABG (n = 150)	p Value
Reopening for bleeding	6 (4.38%)	7(4.6%)	NS
Inotropes (hours) (mean± SD)	32±9.5	49±10.08	HS<0.0001
Ventilation time (hours) (mean± SD)	8.2±7.7	11.2±8.3	HS<0.0001
Stroke	6 (4.38%)	9 (6%)	NS
Renal failure	5 (3.65%)	6 (4%)	NS
Atrial fibrillation	10 (7.3%)	21 (14%)	S <0.011
Chest drainage in 24 hours (ml)	658.1±453.8	760.5±530.3	NS
Intra-aortic balloon pump required	7 (5.11%)	16 (10.66%)	S 0.023
ICU stay (days, (mean± SD)	2.4±1.35	3.8±1.58	HS <0.0001
Postoperative hospital stay (mean± SD)	6.5±1.41	9.4±2.43	HS <0.0001
In-hospital mortality	6 (4.37%)	7 (4.66%)	NS
Mean NYHA class	1.9 ±0.7	2.2 ±0.2	NS

Table 3: Operative Outcomes
CABG = coronary artery bypass graft surgery; ICU = intensive care unit.
S: significance

Clinical and echocardiography follow up:

There was a statistically significant improvement in the EF% in both groups during the short-term follow-up, defined as 6 months after the date of surgery, from 28% ± 1.7% to 40.0% ± 2.0% in group 1 and in group 2 from 27.8% ± 2.0 to 39% ± 2.3%, however there was no statistical different between both groups (table 4).

	On-Pump Beating-Heart CABG (n = 137)	Conventional CABG (n = 150)	p Value
Pre-operative. LVEF	28% ± 1.7%	27.8%± 2.0	NS
Post-operative LVEF	40.0% ± 2.0%	39% ± 2.3%,	NS

Table 4: Postoperative improvement of left ventricular ejection fraction (LVEF)

\Improvement in functional class corresponded with a significant improvement in EF during short-term follow-up. When compared with the preoperative value, there was statistically significant improvement in the mean NYHA class in both groups from 3.3±.5 to 1.9±.7 in group 1 and 3.2± 0.7 to 2.0±0.2 in the other group, but there was no statistically significant difference between both groups with regards to postoperative NYHA class (table 3).

There was 8 patients, (5 patients in group 1 and 3 in group 2) ,complaining of recurrent angina during follow-up , they controlled by adjustment of medical treatment and no interventions or coronary angiography were required. Seven patients in group 2 and two patients in group 1 were hospitalized after discharge due to LV failure. These patients were managed medically, and discharged with symptomatic improvement.

Discussion:

CABG is performed with acceptably low risk in patients with ischemic left ventricular dysfunction, with or without concurrent heart failure8. It has been shown that CABG provides a survival benefit over medical therapy alone in patients with LV dysfunction and coronary artery disease.9 With improvement in anesthesia, myocardial protection, cardiopulmonary bypass and postoperative care, operative mortality in this group was decreased significantly to 2.4- 11 % 10. Nevertheless, the outcomes have often been controversial and depend on patient selection, baseline workup, and critical decision making.11

In a systematic review of CABG trials, Nalysnyk and colleagues 12 identified low EF, history of stroke, myocardial infarction, or heart surgery and the presence of diabetes or hypertension as risk factors leading to increased 30-day mortality. Morrison and colleagues 12 found higher early mortality in patients with severe LV systolic dysfunction, in a review of prospective and retrospective registries including more than 2,000 patients.

As low left ventricular ejection fraction is one of the most factors associated with increased morbidity and mortality after CABG, the point of consideration is which approach is the best for such patients and how to select the patient who is most likely to benefit from surgical revascularization.13 Despite the new myocardial protection techniques, there are some hearts which do not tolerate aortic cross clamping. Even continuous warm blood cardioplegia which keeps the heart in an aerobic environment does not completely prevent postoperative stunning possibly because of the myocardial edema intrinsic to the diastolic state of the arrested heart. 14

The detrimental effects of aortic cross clamp might be more significant in patients with poor left ventricular function, where even small damage to myocardium can have significant clinical consequences, so one of the ways to avoid damaging effects of CPB and cross clamp is to perform CABG on beating heart. With the availability of good stabilizers and paying attention to various techniques for adequate exposure, all the target vessels on the heart can be comfortably grafted on beating heart. 15

In the present study the in-hospital mortality was lower in the on-pump beating-heart CABG group than in the conventional CABG group. It was 4.37% and 4.66%

respectively. This incidence compares favorably with that of Ascione and associates1 who reported that, the overall incidence of in-hospital mortality and of perioperative MI was 4%. Azarfarin and his associates 8 noted the mortality rate of 9.5% in patients with LV dysfunction in their study was higher than expected, probably due to multiple factors. Unlike some previous series, they did not exclude urgent and emergency operations. Mizutani and coworkers 16 reported in their study, 2.6% mortality in on pump beating group while it was 11% in conventional one , they suggested that , this consideration may be related to the elimination of cardioplegic arrest , which is the main difference between two techniques. Shapira and colleagues 17 did not identify low EF per se as a predictor of hospital mortality, but found it was associated with a higher incidence of postoperative complications; they concluded that CABG should be considered a safe and effective treatment for patients with LV dysfunction.

On-pump beating-heart CABG is reported to be an acceptable trade-off between conventional CABG and off-pump CABG. The main features of this technique are the use of CPB, the avoidance of cardioplegic arrest and cross clamp application. Early surgical outcome after matching was better in the on-pump beating-heart CABG group 18.

The IABP was used in 23 patients (8.01%) in our study. It should be used whenever surgeon feel that there is a need for it as timing is very important whether preoperatively or perioperatively allowing the myocardium to recover from the low output state. The IABP augments myocardial performance without increasing workload on the heart and myocardial oxygen requirements. Elefteriades and Edwards 19 used the IABP freely for perioperative support especially in patients with extremely impaired left ventricular function and left main dise

No significant benefit was detected for on-pump beating-heart CABG in relation to morbidity, including the incidence of re-exploration for bleeding, stroke and renal failure, which are all believed to be related to the use of CPB itself. The rate for atrial fibrillation was significantly lower in the on-pump beating-heart CABG group. It is not clear why atrial fibrillation was so frequent in the conventional group. The shorter operation time and the shorter CPB time in the on-pump beating-heart CABG group may be related to prolonged reperfusion period after the release of the aortic cross clamp.

Improvement in ejection fraction is not a universal finding after revascularization as it depends on the presence and extent of stunned and hibernating myocardial and the ability to completely revascularize the hibernating tissue. Soliman Hamad and associates 3 reported, the left ventricular end systolic volume index (LVESVI) proved to be an important predictor of both short- and long-term functional improvement in their series. In patients who had a preoperative LVESVI of 100 ml/m2 or less, they observed a favorable outcome for survival and the recovery of left ventricular function . On the other hand, the EF value was not a statistically significant predictor of long-term outcome in their series. That theory rests on the fact that a low EF did not differentiate between hibernation and infarction as the cause of poor contractile function.

Elefteriades and Edwards 19 suggested that there are two modes of benefit from CABG in such patients, first recruitment of hibernating muscle and second, protection of the heart from future infarction by the constructed bypass grafts. In their opinion, there is no ejection fraction that is too low and no ventricle that is too big to undergo CABG surgery. Revascularization reduces postoperative mortality and morbidity in the patients with low EF but does not protect against the progression of ischemic cardiomyopathy in some of them.

In our study the LVEF in both groups was improved and improvement in functional class corresponded with a significant improvement in EF during short-term follow-up. There was statistically significant improvement in mean NYHA class in both groups.

The time-limited beneficial effects of revascularization in patients with left ventricular dysfunction have also been shown by Luciani and colleagues 20 who noted that 47% of the patients studied were free of the symptoms of heart failure 5 years after CABG. Further homogenous clinical series were needed to further elucidate the optimal patient selection for the treatment of ischemic cardiomyopathy.

Limitations of this study:

The present study has some limitations that deserve mention. One pertains to the restriction of clinical outcomes to postoperative morbidity and hospital mortality. Further studies to investigate long-term outcomes are necessary. Another limitation is that we did not categorize low EF patients on the basis of symptoms (failure predominant or angina predominant) or routinely perform myocardial viability evaluations. Patients with LV dysfunction and anginal symptoms with larger proportions of viable myocardium may benefit more from CABG than those with symptoms of cardiac failure in the absence of angina. A further limitation is that we used EF for the definition of LV dysfunction. Although most similar studies used the same parameters, it may not be reliable because it overlooks other important parameters such as LV dilation and extent of akinetic scars.10

Conclusion

Coronary artery sbypass grafting for patients with severe left ventricular dysfunction (EF of 30% or less) is associated with acceptable immediate and short-term results . On pump beating CABG was found to be safe and excellent approach in such high risk patients who may not tolerate cardioplegic arrest and at same time also do not tolerate to be operated on totally without the cardiopulmonary bypass. Short-term clinical outcome is encouraging and seems to justify surgical revascularization for this high-risk group of patients by on pump beating heart technique.

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Tricuspid Annuloplasty using autologous Pericardial Strip versus De Vega Repair for Functional Tricuspid Regurge

Ashraf A. Esmat M.D*

***Background*: Uncorrected functional tricuspid regurgitation has serious long-term morbidity and mortality. We reviewed our experience with tricuspid annuloplasty using autologous pericardial strip versus De Vaga tricuspid annuloplasty for treatment of functional tricuspid regurgitation.**

***Methods:* From January 2008 to August 2009, 159 patients underwent tricuspid annuloplasty for functional TR. Concomitant procedures included mitral valve replacement in 135 patients and mitral-aortic valve replacement in 24 patients. We performed conventional suture annuloplasty (De Vega) in 81 patients and autologous pericardial strip annuloplasty in 78 patients.**

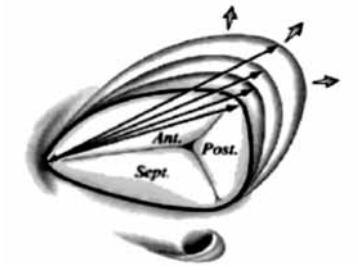
***Results:* At 1.5 years postoperatively, tricuspid regurgitation in patients treated by pericardial strip annuloplasty (AP) was 0-1 in 73.9%, ii in 16.4%, iii in 4%, and iv in 5.7% of patients. In those undergoing suture annuloplasty (C-group), tricuspid regurgitation was 0-I in 64%, ii in 19%, iii in 5.9%, and iv in 10.3%. There was no significant difference between the two groups (P =0 .18). Multivariate analysis demonstrated that preoperative severity of TR and conventional suture annuloplasty were significant predictors of recurrent TR. Overall survival was comparable between two groups (p = 0.742); however, recurrence-free survival was better for the autologous pericardial strip annuloplasty group than for the conventional suture annuloplasty group (86.8% versus 71.9%; p = 0.039).**

***Conclusions:* Mean TR improved as a function of time in the AP-TAP group; however, it got worse in the C-TAP group .Autologous pericardial strip annuloplasty appears to be a simple, easily reproducible, and valid option for surgical treatment of functional TR.**

Cardiovascular

Tricuspid regurgitation (TR), which often accompanies mitral or mitral and aortic valve disease, is mostly functional rather than organic and is associated with pulmonary hypertension or right ventricular dilatation (1). Cardiac surgeons still debate when and how to repair the tricuspid valve. Early investigators advocated a conservative approach, arguing that functional TR, often secondary to pulmonary hypertension and concomitant mitral valve disease, should spontaneously improve after mitral valve repair [2]. Subsequent studies, however, have demonstrated that TR does not necessarily regress after repair of left-sided valve lesions [3, 4]. Uncorrected TR increases both postoperative morbidity and mortality and is associated with poor long-term results with medical management alone [5].

For the tricuspid valve to leak, the tricuspid annulus and hence the right ventricle has to be dilated. Dilatation of the tricuspid annulus is only possibility with regard to its anterior and posterior aspects. These correspond to the free wall of the right ventricle (Fig 1).



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In addition to tricuspid dilatation, three important factors determine whether TR occurs: the preload, the afterload, and the right ventricular function [6].

Treatment of the mitral lesion alone only decreases the afterload. It does not correct tricuspid dilatation nor does it affect preload or right ventricular function. Once the tricuspid annulus is dilated, its size cannot spontaneously return to normal and may, in fact, continue to dilate further. Thus, surgical management of moderate to severe functional TR is now widely recommended to achieve better early and late clinical outcome [6, 7].

Several annuloplasty methods have been described, Suture bicuspidization was originally described by Kay, Maselli-Campagna, and Tsuji (8) in 1965 as a technique to correct TR, other techniques include De Vega's semicircular annuloplasty (9) and the use of prosthetic annuloplasty rings, such as the Carpentier-Edwards semi rigid ring (Edwards LifeSciences, Irvine, Calif)(10) and the Cosgrove-Edwards flexible band (Edwards LifeSciences). (11) A small number of studies comparing ring annuloplasty with suture annuloplasty (primarily the De Vega) have concluded that ring annuloplasty offers a more durable repair and that ring annuloplasty should supplant suture annuloplasty for repair of functional TR. (12) Other investigators have reported good experience with the De Vega annuloplasty and continue to advocate its use. (13)

Therefore, questions have arisen regarding the most physiologic and biocompatible method for TAP. A new method of TAP using autologous pericardial strip and non-absorbable mattress suture technique has been developed in the late 90s. This method was considered to maintain annular structures, to maintain flexibility of right ventricular pumping action, and to prevent re dilatation (14)

In this study, we retrospectively compared our results of TAP using autologous pericardial strip (AP-TAP) with those using De Vaga suture annuloplasty(C-TAP). In addition, we also analyzed the risk factors for recurrence of TR after TAP.

Methods

From January 2008 to August 2009,159 patients (mean age, 52.7 years) underwent annuloplasty for tricuspid valve regurgitation at Kasr el Aini university hospital, Nasser Institute and sheikh Zayed hospital.

Patients with concomitant procedures, such as coronary artery bypass grafting or aortic surgery, or patients who underwent TAP using prosthetic annuloplasty ring were excluded from this analysis. Patients with endocarditis or significant organic disease of the tricuspid valve leaflets or patients with congenital anomalies were also excluded. However, patients with TR with mild fibrosis of the tip of the tricuspid valve were included in this study. However, patients with TR with mild fibrosis of the tip of the tricuspid valve were included in this study. Patients who underwent mitral valve repair were also excluded, because confounding phenomenon of residual mitral regurgitation after surgery could impact on the TR. Therefore, we only included patients who underwent TAP with mitral valve replacement and mitral-aortic valve replacement. Concomitant procedures included mitral valve replacement in 135 patients and mitral-aortic valve replacement in 24 patients. The type of annuloplasty used were the De Vega, performed in 81 patients (C-TAP), and autologous pericardial strip annuloplasty (AP-TAP), performed in 78 patients. We followed anticoagulation protocol after TAP according to that of left-sided heart valve replacement.

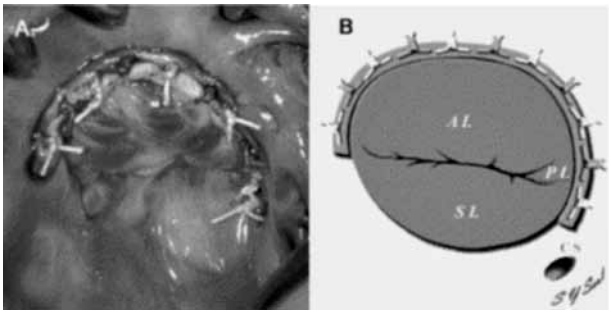
Patients' records included age, sex, presence of previous heart surgery, findings of physical examination (jaundice, neck vein engorgement, hepatomegaly, and pitting edema of the lower limbs), diagnosis, New York Heart Association functional class, and presence of atrial fibrillation on electrocardiogram.

Operative Technique

All operations were done through median sternotomy with the use of cardiopulmonary bypass with moderate systemic hypothermia (28–30°C).

De Vega tricuspid annuloplasty is performed using 2-0 polypropylene with Teflon felt pledgets. This double monofilament suture is then tied down over an obturator, such as the barrel of a 20-mL syringe or 29-mm valve sizer, which satisfactorily reduces the orifice size without placing undue strain on the annuloplasty repair and reduces the tricuspid annular diameter [13].

The autologous pericardial strip annuloplasty is performed by preparing an autologous pericardial strip (6 to 7 cm in length, 3 to 5 mm in width), the pericardial strip was folded over for smooth outer surface and was sutured to the tricuspid annulus with interrupted mattress sutures of 10 to 12 non-absorbable 2-0 Ethibond suture (Ethicon, Inc, Somerville, NJ), starting from the posteroinferior aspect of the septal leaflet to the anterior septal commissure. Two- to three-millimeter-interval sutures in the autologous pericardial strip and 5- to 6-mm-interval sutures in the tricuspid annulus can shorten the tricuspid annulus by 50% to 67% (Fig.2).



When two thirds of the circumference of the tricuspid valve was shortened to 7 cm, a tricuspid annular diameter would be reduced to about 2.7 to 3.2 cm. [14]

To evaluate the TR immediately after TAP in the operating room, saline was injected into the right ventricle of the arrested heart. After the operation, a Trans- esophageal echocardiography (TEE) was performed in all patients and recorded after termination of cardiopulmonary bypass. A favorable result was defined when TR was less than grade II.

Assessment of Tricuspid Annuloplasty

Preoperative and postoperative transthoracic echocardiographic results were used to assess grade of TR and right ventricular systolic pressure. Postoperatively, echocardiography was performed routinely in all patients before discharge. Echocardiography is performed 3 months after the operation then every 6 month after. Interpretation of follow-up echocardiograms was obtained at as many time points as available for each patient. Trans esophageal echocardiographic data were excluded.

Hemodynamic indices of pre-TAP and post-TAP changes included grade of TR, central venous pressure (right atrial pressure), right ventricular systolic pressure, left ventricular ejection fraction, and mean pulmonary artery pressure. Tricuspid regurgitation was graded conventionally as grades I through IV, TR was graded as 1+ for mild, 2+ for moderate, 3+ for moderate to severe, and 4+ for severe, as defined by the American Society of Echocardiography determined by the regurgitant area on echocardiograms before and after TAP.

We compared the results of AP-TAP with those of C-TAP in patients with functional TR. We also assessed the risk factors for recurrence of TR after surgery, as well as the recurrence-free survival in both groups, and the degree of functional improvement after tricuspid valve repair.

Follow Up:

Nine patients were lost in to follow up (94.3%) 150 of 159 patients continue the follow up completely. The mean follow-up was 27.5 ± 7.4 months, with a range from 19 months to 37 months. Follow-up was 94.3% complete.

Statistical Analysis

All data are presented as mean ± standard deviation of the mean. All statistical analyses were performed using the Statistical Package for Social Sciences Software version 12.0 (SPSS Inc, Chicago, IL). Preoperative and operative categorical variables were compared between groups using Fisher's exact test, whereas continuous variables were compared using Student's t test. Tricuspid regurgitation as a function of time, including mean TR and prevalence of TR grade, was evaluated for each annuloplasty technique using repeated-measures mixed models (SAS Proc Mixed; SAS Institute, Inc, Cary, NC) and longitudinal ordinal logistic regression (SAS Proc Glimmix). These longitudinal methods ensured that patients with more repeat echocardiograms or more follow-up visits were not given excessive weight and did not have a disproportionate influence on estimated means and proportions as a function of time. Survival curves were calculated by the Kaplan–Meier method and compared using the log-rank test. Probability values less than 0.05 were considered statistically significant.

Results:

Variable	C-TAP	AP-TAP	P Value
age	39.8 ± 12.4	44.2 ± 12.2	0.002
Female sex	15 (20%)	17 (22.6%)	0.897
NYHA class IV	5 (6.6%)	7 (9.3%)	0.112
III	58 (77.4%)	60 (80%)	
II	12 (16%)	8 (10.7%)	
TR Grade IV	29 (38.6%)	31 (41.3%)	0.071
III	36 (48%)	37 (49.3%)	
II	10 (13.4%)	7 (9.4%)	
I	0	0	

Table 1: Preoperative patient characteristics are provided

There were 75 patients who underwent C-TAP and 75 patients who underwent AP-TAP. There was a statistically significant difference in mean age between the two groups (C-TAP, 39.8 ± 12.4 years versus AP-TAP, 44.2 ± 12.2 years; p = 0.002). There were 15 women among 75 patients in the C-TAP group and 17 women in the AP-TAP group (p = 0.897). Preoperatively, 5 patients (6.6%) were in New York Heart Association functional class IV in the C-TAP group. Meanwhile, 7 patients were class IV in the AP-TAP group (9.3%; p = 0.073). There was a large percentage (90.6%) of TR equal to or greater than grade III in the P-TAP group compared with (86%) in the C-TAP group. However, this was not statistically significant different.

Variables	C-TAP	AP-TAP	P Value
Jaundice	1 (1.3%)	3 (4%)	0.127
LL Edema	6 (8%)	11(14.6%)	0.092
Cong. neck v.	10 (13.3%)	21 (28%)	0.002
hepatomegaly	4 (5.3%)	7 (9.3%)	0.107
AF	65 (86.6%)	68 (90.6%)	0.586

Table 2 shows the physical signs of the patients

variable	C-TAP	AP-TAP	Mean	P-value
LV EF ≤0.40	2 (2.6%)	3 (4%)	0.62 ± 0.37	0.734
CVP(mmhg) ≥ 15	16 (21.3%)	14 (18.6%)	11.8 ± 5.2	0.601
Mean PAP ≥ 50	4 (5.3%)	3 (4%)	30.7 ± 11.7	0.811
RV systolic pressure≥80	5 (6.6%)	4 (5.3%)	48.9 ± 19	0.756

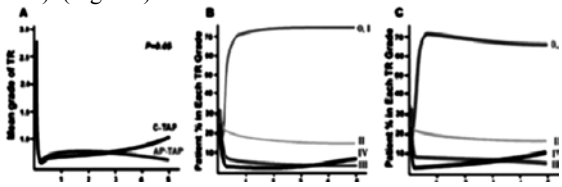
Table 3 : Preoperative hemodynamic data are listed.

There was no statistical difference between the two groups in terms of preoperative left ventricular ejection fraction, central venous pressure, right ventricular systolic pressure, and mean pulmonary artery pressure.

Efficacy of the techniques of Tricuspid Annuloplasty
the occurrence of significant residual TR after TAP, is defined as grade III or higher. All the patients had echocardiograms at the time of discharge from the hospital. In this study, there was significant postoperative residual TR early after De Vega annuloplasty in 5.3% (4 of 75 patients) and in 4% (3 of 75 patients) after AP-TAP (p = 0.843). By multivariate binary logistic regression analysis, higher preoperative TR grade (odds ratio, 2.954; 95% confidence interval, 2.132 to 4.093; p < 0.001) was identified as an independent predictor for development of significant postoperative residual TR after TAP. The method of TAP was not identified as a risk factor for postoperative residual TR.

Changes in Tricuspid Regurgitation as a Function of Time

To assess the overall efficacy and durability of annuloplasty, we evaluated TR grades by three different methods. We determined TR grade in echocardiography at last follow-up, freedom from development of TR equal to or greater than grade III as a function time using Kaplan–Meier analysis, and serial echocardiographic assessment for mean TR and TR prevalence as a function of time using longitudinal regression analysis. The degree of TR grade improved significantly immediately after TAP without significant difference between two groups. At the last echocardiographic follow-up, TR in the AP-TAP group was grade 0 to I in 55 patients (73.3%), grade II in 12 (16%), grade III in 4(5.3%), and grade IV in 4 patients (5.3%). However, in the C-TAP group, TR grade was 0 to I in 52 patients (69.3%), grade II in 10(13.3%), grade III in 5 (6.6%), and grade IV in 8 patients (10.6%). The percentage of patients with TR equal to or greater than grade III was higher in the C-TAP group than in the AP-TAP group, but the distribution of TR grade was similar in the two groups.(fig.3B and 3C) show predicted TR prevalence as a function of time in both groups. Evolution of TR was similar in both groups. Mean TR grade dropped significantly after surgery, was maintained for up to 1 year. From baseline to last follow-up, mean TR grade decreased approximately 60% in both groups. Mean TR improved as a function of time in the AP-TAP group; however, it got worse in the C-TAP group (p = 0.05). (Fig. 3A).



Durability of Tricuspid Annuloplasty

Multivariate binary logistic regression analysis showed that preoperative TR grade (odds ratio, 8.743; 95% confidence interval, 3.232 to 23.652; p < 0.0001) and suture annuloplasty (odds ratio, 6.307; 95% confidence interval, 1.843 to 21.580; p = 0.003) were independent predictors for recurrence of TR during follow-up . According to the Cox proportional hazards model, higher preoperative TR (odds ratio, 6.823; 95% confidence interval, 2.783 to 16.724; p < 0.0001) and the use of suture annuloplasty (odds ratio, 2.718; 95% confidence interval, 1.054 to 7.009; p = 0.039) were risk factors for development of recurrent TR .

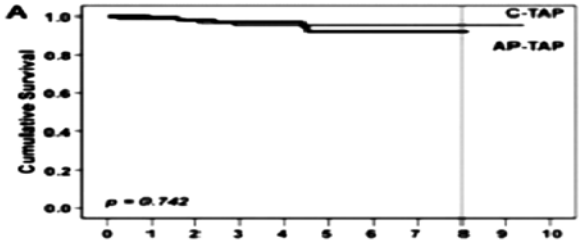
Left Ventricular Ejection Fraction and Functional Status

Left ventricular ejection fraction did not change significantly after surgery (p = 0.40), and there was no difference between the two groups (p = 0.68). Although New York Heart Association functional class improved significantly after TAP in both groups, there was no difference between the two groups (p = 0.79).

Postoperative Early and Late Major Complications
Eighteen patients (12.0%) had postoperative complications, including re exploration for postoperative bleeding in 6, right heart failure in 5, cerebral infarction in 1, paravalvular leakage in 2, pericardial effusion in 4 patients.

Mortality

We had 1 patient died in the C-TAP group (98.6% survival) compared to 2 patients in the AP-TAP group (97.3% survival). The overall survival was comparable between the two groups.(p= 0.742). (fig.4)



Discussion:

Despite 40 years of evolving annuloplasty techniques, there has been no consensus on the management of functional TR. Recent guidelines from the American College of Cardiology (ACC) and American Heart Association (AHA) recommend tricuspid annuloplasty during mitral or aortic valve surgery in patients with severe TR.(15) Although most surgeons agree that a patient with severe, symptomatic TR requires repair, many surgeons favor a conservative approach in patients with only moderate TR. The ACC/AHA guidelines suggest that functional TR without annular dilation or significant pulmonary hypertension does not require repair. There is a growing body of information, however, that the conservative approach is ineffective and that a substantial number of patients will be left with residual TR, which is associated with increased perioperative and late postoperative morbidity and mortality.(16)

Suture annuloplasties, particularly the continuous running type, like the De Vega, have been criticized for being unpredictable and unreliable, perhaps owing to the long suture line or the use of polypropylene suture material, which may break and slide through the tissue as the annulus dilates. (17). De Vega repair was associated with a postoperative residual TR grade II in 10.2% and grade III in 4.1% of patients, and the operative mortality rate was 7.6% ,while a reoperation rate of 1.2% owing to failure of TAP was reported [18]. In a study reporting the operative results of

De Vega TAP, postoperative residual TR higher than grade II was 12%, and the operative mortality rate was 12% [19]. Bernal and colleagues,(13)however, have reported excellent results in 232 patients with the De Vega annuloplasty at 6.8 years postoperatively, with 86% of patients having zero to mild TR. In a recent study by Chull and his colleagues (14), they reported long term results of suture annuloplasty that; TR grade was 0 to I in 64.7%, grade II in 19.1%, grade III in 5.9%, and grade IV in 10.3%. These results were comparable to the results of our study.

In our experience, mean TR, which was decreased significantly after the operation, was unchanged for up to 1 year in both groups, these results are comparable to the study done by Chul and his colleagues (14), but he showed that on long-term follow-up the degree of TR was increased gradually from 3 to 5 years postoperatively in most patients in the suture annuloplasty group. Meanwhile, mean TR improved as a function of time in the AP-TAP group. This result suggests that autologous pericardial strip annuloplasty prevents redilatation of the tricuspid annulus; whereas suture annuloplasty does not. We need longer follow up period to assess our results and compare it with that by Chul and his colleagues.

In conclusion, we have demonstrated that suture annuloplasty (De Vega) and autologous pericardial strip annuloplasty for functional TR were equally effective for TAP in functional TR for up to about 12-18 months postoperatively. Subsequently, however, TR grade appeared to be getting worse in the conventional suture annuloplasty group which is prove in most of the recent studies on tricuspid regurge ,another long-term study is needed to compare our results with these studies. . Follow-up TR grade were superior in the AP-TAP group. Preoperative TR grade and use of suture annuloplasty were independent risk factors for development of recurrent TR during long-term follow-up.

In conclusion, we believe that autologous pericardial strip annuloplasty is a relatively simple, inexpensive and effective technique that can be performed rapidly. Therefore, we suggest that it can be used routinely in patients with functional TR and annular dilatation, at the time of left-sided valve surgery.

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The role of transforming growth factor beta 1 in rheumatic mitral valve disease. Histological and immunohistochemical study

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Waleed Gamal Abou Senna MD**

Introduction: **In chronic rheumatic heart disease the fibrotic valvular deformity occurs through organization of acute inflammation induced by Rheumatic fever Transforming growth factor B1 (TGF-B1) is a 25-KDa protein that a member of the TGF-B1 superfamily. It is a well-studied regulator of extracellular matrix deposition in wound repair. The aim of this work is to detect changes in transforming growth beta 1 in rheumatic mitral valve disease.**

Methods: **Mitral valve leaflets were obtained from patients presenting with mitral valve disease admitted for mitral valve replacement. Paraffin sections of mitral valves were examined histologically and immunohistochemically for TGFB1 and smooth muscle actin.**

Results: **Over expression of TGFB1 immunostaining was detected associated with increased collagen deposition in the rheumatic mitral valves. This was also accompanied with increase in the number of cells showing positivity for smooth muscle actin compared to the control mitral valves.**

Conclusions: **TGFB1 expression is increased in rheumatic valvular heart disease. Thus TGFB1 could be the target of antifibrotic treatment which attenuates the fibrotic process in rheumatic disease.**

Cardiovascular

Rheumatic fever (RF) is the consequences of pharyngeal infection with group A beta hemolytic streptococci in a susceptible host leading to immune disease induced by antigenic similarity of human myocardium with streptococcal antigen1. While most of the manifestations are transient and leave no residual signs, rheumatic myocarditis and fibrotic deformity of the valve, can produce permanent and severe cardiac dysfunction even decades later 2.In chronic rheumatic heart disease the fibrotic valvular deformity occurs through organization of acute inflammation induced by R.F. with subsequent thickening, and retraction of valve leaflets, and secondary damage resulting from turbulent flow induced by valvular dysfunction 3. This leads to fusion of the commissures producing mobile diaphragm .In developing countries rheumatic affection of cardiac valves occurs at an earlier age (below 15 years). It is responsible for 67% of isolated mitral valve disease. It is the most common cause of mitral valve stenosis. It may produce insufficiency, stenosis or both 4. Cardiac surgery is still the most common modality of treatment of rheumatic valvular heart disease. Tumour necrotic factor-ά (TNF-ά), interleukin 6 (IL-6), and several cytokines were proved to be very intense in specimens with valves of patients with advanced valvular heart disease. This suggests that valvular tissue produces pro-inflammatory cytokines that may contribute to the progression of valvular injury 5. The results of some studies support the suggestion that inflammatory processes are involved in the pathogenesis of various valvular diseases 6. Transforming growth factor B1 (TGF-B1) is a 25-KDa protein that a member of the TGF-B1 superfamily. It is expressed in myofibroblasts, vascular smooth muscles, endothelial cells, and macrophages. 7. It is a well-studied regulator of extracellular matrix deposition in wound repair. The aim of this work is to detect changes in transforming growth beta 1 in rheumatic mitral valve disease.

Methods:

Mitral valve leaflets were obtained from thirty patients presenting with symptomatic rheumatic mitral disease. They were admitted at Kasr El Aini Hosp ital for mitral valve replacement with prosthetic valve.

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Codex : o4/06/1106

Diagnostic criteria of the patients:

The age of patients ranged from 25 – 43 years (mean 34 year). All patients had valve replacement using prosthetic valves after preservation of the posterior leaflet. Isolated mitral incompetence was present in six patients, tight mitral stenosis in sixteen and double valve lesion in eight patients. Two patients had associated aortic valve replacement for severe aortic incompetence.

Patients had history of rheumatic fever, predominant mitral stenosis and dense fibrosis seen grossly at time of surgery. Patients signed the hospital's routine written consent for the operative procedure and the subsequent use of the excised mitral valve leaflets for histopathological study. Mitral valve leaflets excised during the valve replacement were fixed in 10 % formol saline and processed to obtain paraffin blocks. Five to six micrometer sections of rheumatic mitral valves were cut. Normal human mitral valves paraffin slides were purchased from Biochain institute INC. USA catalogue number T2234131 to serve as control.

Paraffin sections from normal mitral valves and rheumatic ones were stained by:

1) Hematoxylin and eosin8.
2) Masson trichrome stain to detect collagen9.
3) Immunohistochemical stain10 for:

a. Transforming growth factor beta 1 (TGFB1).

It is a polyclonal rabbit antibody catalogue number LS-B 655/14219 obtained from Lifespan Bioscience. Immunostaining with TGFB1 required pretreatment by boiling in 10Mm citrate buffer (catalogue number AP 9003) pH 6 for antigen retrieval. This was done for 10 minutes and left to cool in room temperature for 20 minutes. The reaction is cytoplasmic.

b. Actin smooth muscle Ab1.

It is a mouse monoclonal antibody catalogue number MS 113 R7. Immunostaining with Actin smooth muscle Ab1 required pretreatment by boiling in 1m EDTA (catalogue number AP 9004) pH 8 for antigen retrieval. This was done for 10 minutes and left to cool in room temperature for 20 minutes. The reaction is cytoplasmic.

Immunostaining was completed by the use of ultravision detection system (catalogue number TP - 015- HD). Counterstaining was done using Mayer's hematoxylin catalogue number (TA- 060- MH). Citrate buffer, ultravision detection system and Mayer's hematoxylin were purchased from lab vision Thermoscientific.

Morphometric study:

The area percent of strong positive TGFB1 immunostaining was measured at magnification X400 in 10 non overlapping fields in every specimen for all patients and controls. The area percent of collagen was measured in Masson trichrome stained sections at magnification X400 in 10 non overlapping fields in every specimen for all patients and controls. Image analysis was done using Leica Qwin 500C image analyzer computer system (England) present in Histology Department, Faculty of Medicine, Cairo University.

Number of cells showing positivity for smooth muscle actin was counted at magnification X400 in 10 non overlapping fields in every specimen for all patients and controls.

Results:

Hematoxylin and Eosin:

Examination of control mitral valves revealed normal architecture of them. Both atrial, and ventricular surface of the valve were lined by endothelium, the stroma was denser towards the surface, and looser in the middle region. Stroma lacked blood vessels (Fig. 1, 2a and 2b) in all control samples. Examination of rheumatic mitral valve revealed marked thickening, abundant interstitial stromal cells (fig 3). Stroma showed multiple blood vessels surrounded by massive inflammatory cellular infiltration in almost all of the specimens (fig. 4 and 5). Both small and large blood vessels were perceived (fig 6). Blood vessels were thin, and thick walled (Fig 7 and 8). Stroma also showed areas of degeneration (Fig. 5).

Masson trichrome stain:

Control mitral valve showed scanty collagen localized mainly in the subendothelial stroma. (Fig.9). Rheumatic mitral valves showed abundant collagen fibers in all specimens of the patients (Fig. 10). Less dense collagen was detected in areas containing numerous blood vessels and numerous stromal cells (Fig 11).

Immunohistochemistry:

Control mitral valves showed moderate and weak positive immunostaining for TGFB1 within the endothelial cells and some of the interstitial stromal cells (fig 12 and13). Reaction was more profound in the subendothelial stroma (fig 12). Rheumatic mitral valves showed strong positive immunostaining for TGFB1 in most of the interstitial stromal cells, some of which were flattened spindle shaped (Fig.14, 15, 16, 17 and 18), others were large rounded ,and slightly vacuolated (Fig.14 and 17). TGFB1 immunostaining was also observed within the lining endothelium of the valves (Fig.15). It could be detected in the endothelial cells of the blood vessels within the valvular stroma (fig 16).

Control mitral valves showed positive immunostainning for smooth muscle actin in cells localized under the vulvular endothelium others within the centre of the valvular stroma (fig 19). Rheumatic mitral valves revealed abundant cells positive for smooth muscle actin within the vulvular stroma subendothelial and at the centre. (fig 20).

Morphometric result:

Mean area percent of collagen was found to be increased in rheumatic mitral stenotic valves (39.2 %) compared to control mitral ones (14.61 %). Mean area

percent of TGFB1 immunostaining was found to be increased in rheumatic mitral valves (21.94 %) compared to control mitral ones (1.92 %). (Histogram 1).

The number of cells positive for smooth muscle actin was 6.5/ high power field in control mitral valves compared to 19/ high power field in rheumatic ones.

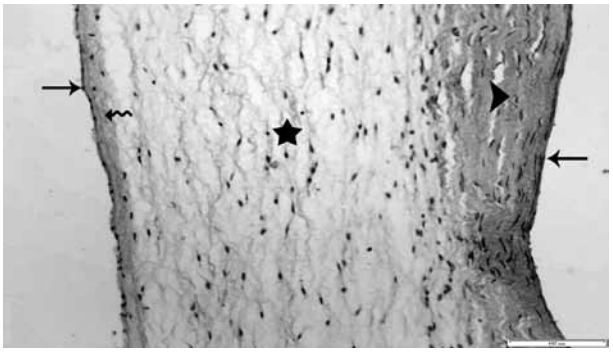
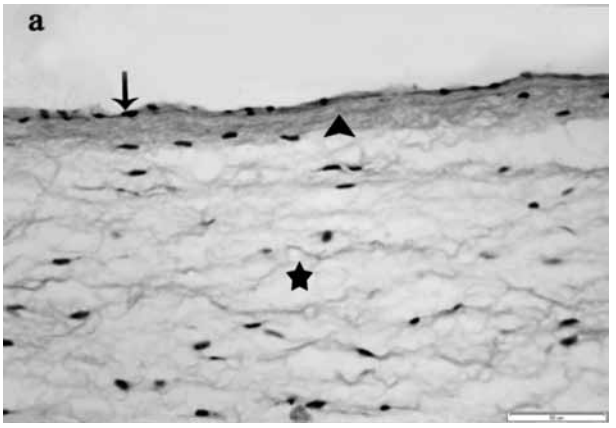


Fig (1): A photomicrograph of a section in a control mitral valve showing the two surfaces of the valve. Both surfaces are lined by endothelial cells (arrow). Stroma is dense, and thin toward the atrial side (wavy arrow) loose in the middle (star), and thick and dense at the ventricular side (arrow head). (H&EX200).



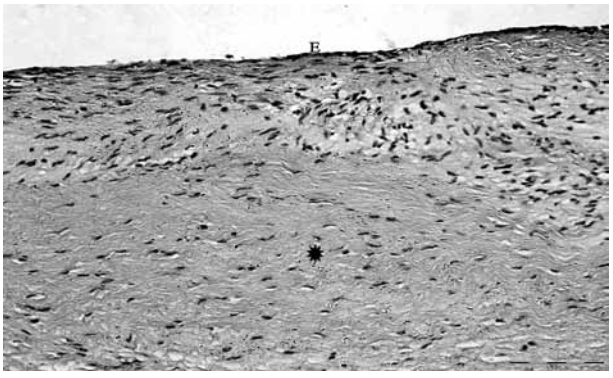


Fig.(3): A Photomicrograph of a section in a rheumatic mitral valve of one of the patients showing thickened dense stroma (asterisk),and the endothelial lining of the valvular surface(E). (H&EX200)

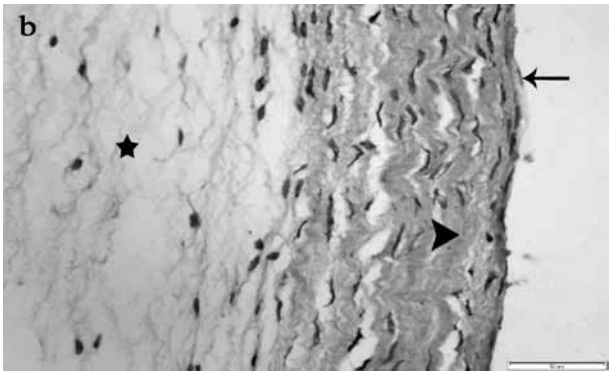


Fig. (2): A photomicrograph of a section in a control mitral valve showing the endothelial lining of atrial(A) , and ventricular (B) surfaces of the valve (arrow), subendothelial stroma and looser stroma in the centre of the valve (star). (H&EX400)

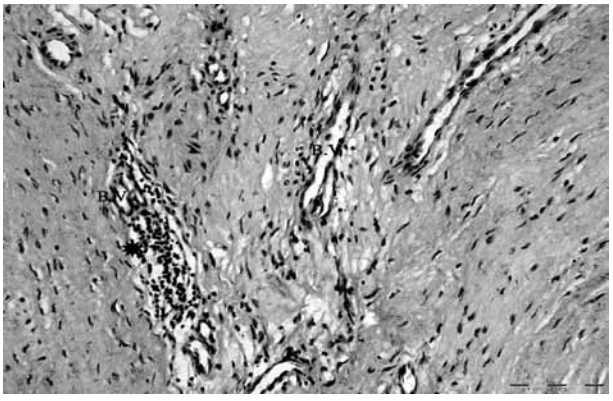


Fig.(4): A Photomicrograph of a section in a rheumatic mitral valve of one of the patients showing the valvular stroma with multiple vessels (B.V.)& inflammatory cellular infiltration (asterisk) especially around blood vessels. (H&EX200)

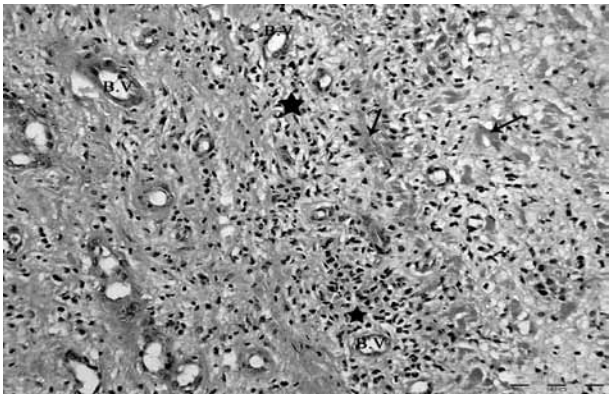


Fig. (5): A Photomicrograph of a section in the rheumatic mitral valve with multiple blood vessels (B.V.), and inflammatory cellular infiltration (star). Note acidophlic degenerated areas (arrow). (H&EX200)

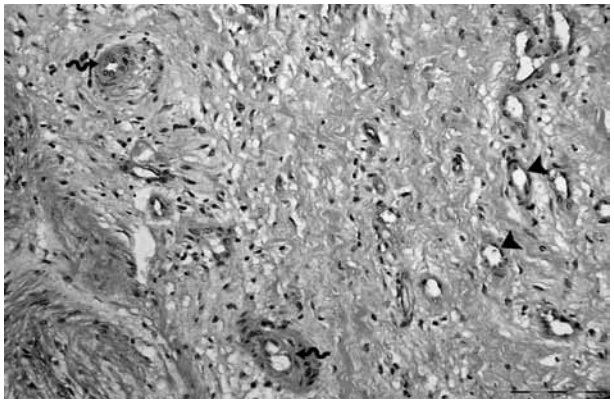


Fig. (6): A Photomicrograph of a section in a rheumatic mitral valve of one of the patients showing the dense stroma with multiple blood vessels some of which are thin walled (arrow head), others have thick wall (wavy arrow). (H&E X200)

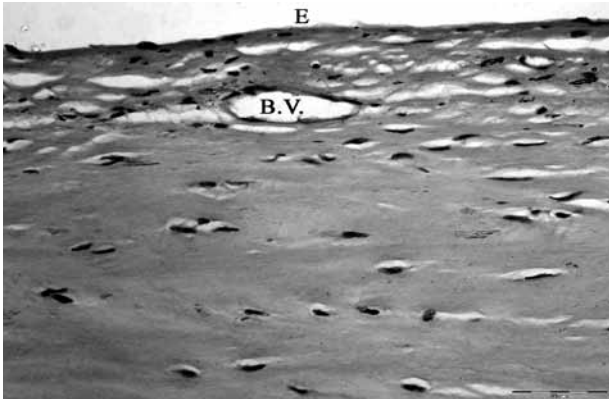


Fig. (7): A Photomicrograph of a section in a rheumatic mitral valve showing the endothelial lining of the valve (E) and thin walled vessels (B.V.) in the valvular stroma. (H&E X400)

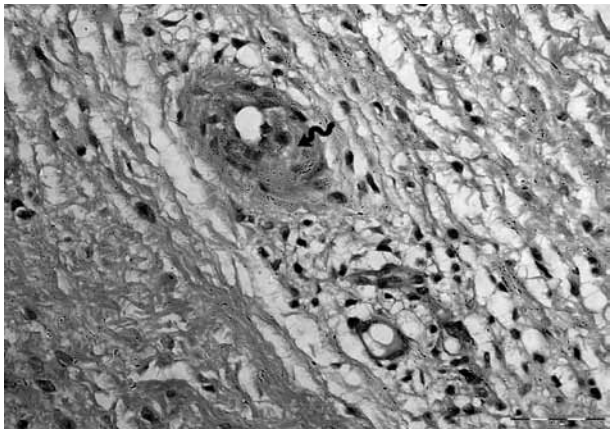


Fig. (8): A Photomicrograph of a section in a rheumatic mitral valve showing thick walled blood vessels (wavy arrow) within the valvular stroma. (H&EX400)

Fig. (9): A Photomicrograph of a section in a control mitral valve showing the scanty collagen fibers under the endothelial lining of atrial side of the valve (thick arrow) and more condensed collagen on the ventricular side (thin arrow). (Masson Trichome X200)

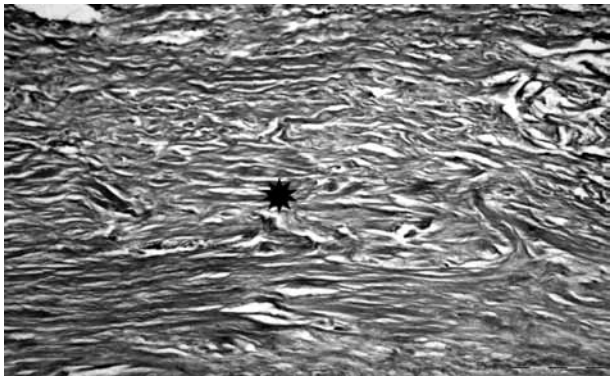


Fig. (10): A Photomicrograph of a section in a rheumatic mitral valve showing massive and abundant collagen within stroma (asterisk). (Masson Trichome X200)

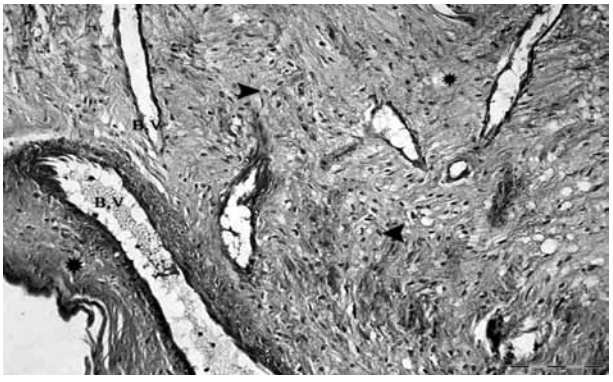


Fig. (11): A Photomicrograph of a section in rheumatic mitral valve showing abundant collagen (asterisk), multiple blood vessels (B.V.) & numerous stromal cells (arrow head).
(Masson Trichome X200)

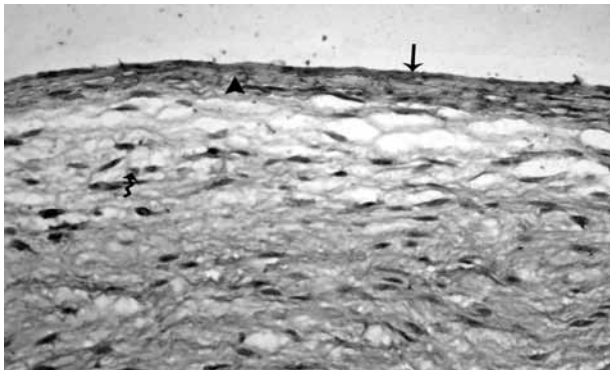


Fig. (12): A Photomicrograph of a section in the control mital valve showing weak and moderate immunoreactivity for TGFB1 in the endothelial cells lining the valve (arrow) abundant in the subendothelial stroma (arrow head). Note weak positive stromal cells within the looser stroma (wavy arrow). (TGFB1 immunostaining with Mayer's hematoxylin counter stain X400)

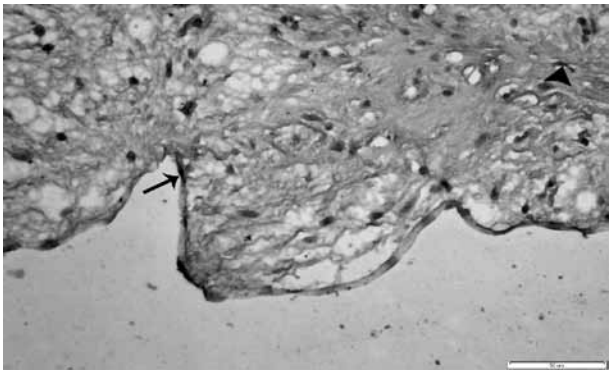


Fig. (13): A Photomicrograph of a section in the control mital valve showing weak immunoreactivity for TGFB1 in the endothelial cells lining the valve (arrow) and some stromal cells within the loose stroma (arrow head). (TGFB1 immunostaining with Mayer's hematoxylin counter stain X400)

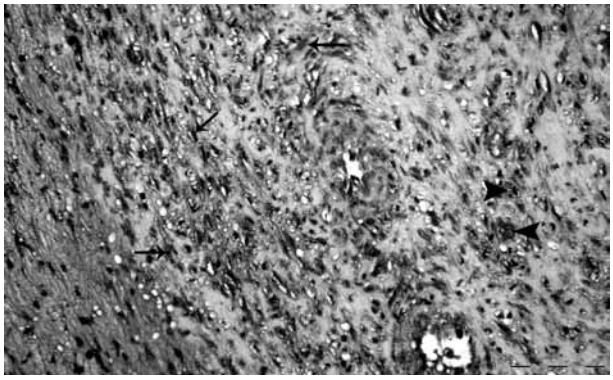


Fig. (14): A Photomicrograph of a section in a rheumatic mitral valve of one of the patients showing positive immunoreaction for TGFB1 within the abundant stromal cells (arrows). Some of the cells appear vaculated (arrow head). (TGFB1 immunostaining with Mayer's hematoxylin counter stain X200)

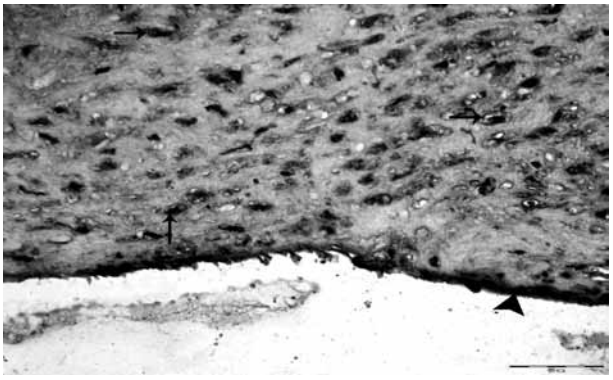


Fig. (15): A Photomicrograph of section in a rheumatic mitral valve showing positive immunoreactivity for TGFB1 within the endothelial lining of the valve (arrow head) & the cytoplasm of the cells of the valvular stroma (arrows). (TGFB1, immunostaining with Mayer's hematoxylin counter stain X400)

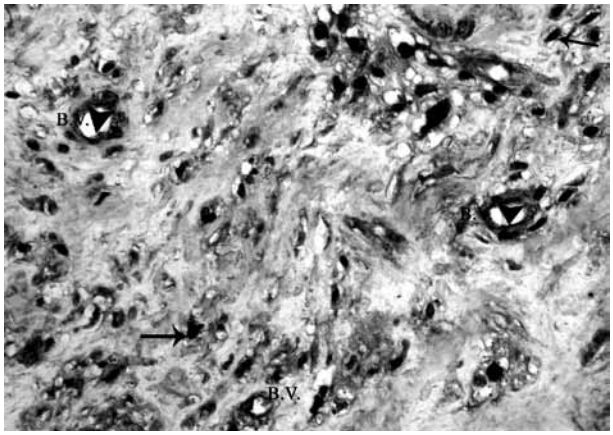


Fig.(16) : A Photomicrograph of a section in a rheumatic mitral valve showing strong positive TGFB1 immunoreactions in the endothelium (arrow head) of blood vessels (B.V.) and the stromal cells (arrows) around them. (TGFB1,immunostaining with Mayer's hematoxylin counter stain X400)

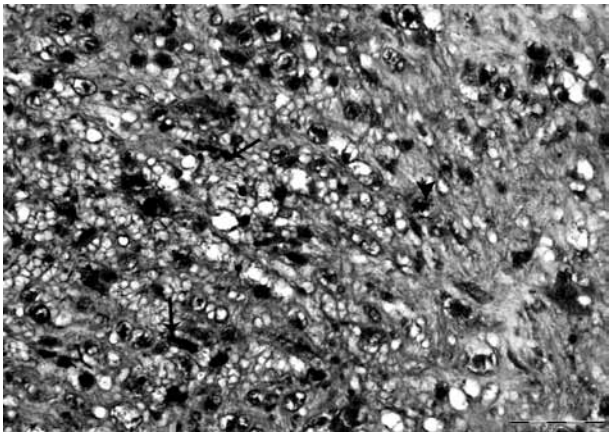


Fig. (17) : A Photomicrograph of a section in a rheumatic mitral valve of one of the patients showing positive TGFB1 in spindle shaped cells (arrows) ,and others that are rounded & have a vaculated cytoplasm (arrow head). (TGFB1immunostaining with Mayer's hematoxylin counter stain X400)

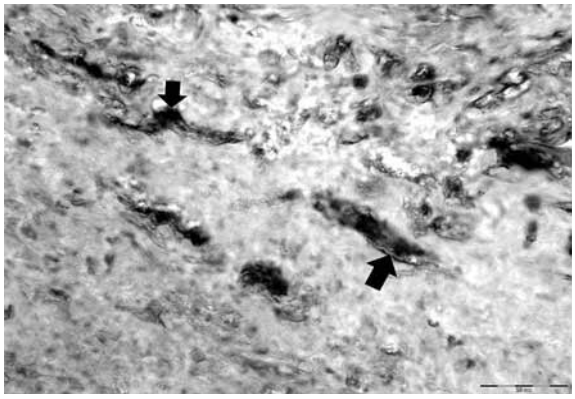


Fig. (18): A Photomicrograph of a section in a rheumatic mitral valve of one of the patients showing positive TGFB1 in the spindle shaped cells with tapering ends (arrows). (TGFB1 immunostaining with Mayer's hematoxylin counter stain X1000)

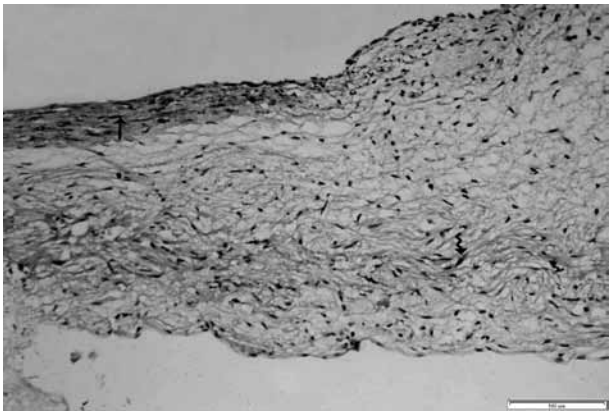
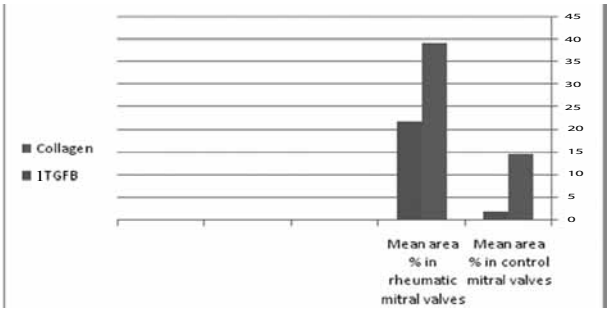


Fig. (19): A Photomicrograph of a section in a control mitral valve showing positive smooth muscle actin in spindle shaped cells with tapering ends (arrows) under the valvular endothelium and in the center of the vulvular stroma (wavy arrow). (Smooth muscle actin immunostaining with Mayer's hematoxylin counter stain X200)

Fig. (20): A Photomicrograph of a section in a rheumatic mitral valve of one of the patients showing positive smooth muscle actin in multiple cells with within the vulvular stroma (arrows). (Smooth muscle actin immunostaining with Mayer's hematoxylin counter stain X200)



Histogram (1):
Chart showing the mean area percent of collagen and positive TGFB1 immunostaining in control and rheumatic mitral valves.

Discussion:

Cardiac valves are connective tissue structures the function of which is necessary for proper hemodynamics. Valvular interstitial cells (VICs) are the most prevalent component of heart valve leaflets, and are responsible for maintaining the structural integrity of the valve. In addition to their role in healthy valves recent histochemical and molecular data have indicated that VICs are actually the precursors of valve myofibroblasts that are observed in diseased heart valves. Little is known about the elements that activate the valve myofibroblast phenotype 11. Myofibroblasts are hyperactivated fibroblasts with properties of fibroblasts, and muscle cells that facilitate tissue remodeling, and wound healing12.

In the present study the rheumatic valves were of distorted architecture with severe thickening and fibrosis compared to normal ones. Massive inflammatory cellular infiltration especially around blood vessels was also detected. Multiple blood vessels were evident. Persistence of inflammatory cellular infiltration several decades following the initial rheumatic attack was similarly reported by earlier studies 3. Inflammatory cells predominantly CD4+T cells together with CD8+T, B cells, and macrophages were also detected by the recent work of Guilherme and his colleagues 2 .They added that such cells released interferon IFNά, and tumour necrotic factor TNFά. They also supposed that even during chronic phase the presenting mononuclear cellular infiltration continues to produce inflammatory cytokines which could amplify the local inflammation triggered by the initial autoimmune reaction of the heart. Previous studies revealed that lymphocytes obtained from chronic rheumatic heart disease patients exhibited T helper (Th2) cytokine response. This immune response was reported to promote fibrotic process by activating fibroblast proliferation, myofibroblast differentiation, extracellular matrix deposition, and transforming growth factor- B1 production. TGF-B1 plays a critical role in matrix remodeling, and collagen synthesis 12. Multiple blood vessels both thin and thick walled ones were observed compared to almost absent ones in the control specimens. This was similar to what was previously reported by Kim, and his colleagues 12.

TGFB1 immunostainig was observed in the endothelial lining of the valves, and that of the multiple blood vessels. Also it was detected within the flattened cells within the valvular stroma. It was also detected in the rounded vaculated cells most probably macrophages. This was compared to control ones where it was present in the endothelium, and subendothelial stroma. The demonstrated over expression of TGFB1 in rheumatic valves was concomitant with findings of Kim, and his colleagues12, since they reported similar over expression of TGFB1 in rheumatic valves. These flattened cells with tapering processes were most probably fibroblast, and myofibroblasts. Such cells are responsible for production of collagen. The later were producing almost double fold of the first one 13. This makes it reasonable to assume that it is probable that TGFB1 might have a role in activating fibroblasts, and myofibroblasts, and resulting into production of collagen. Such assumption could be supported by the current work observation of that rheumatic mitral valves showing abundant collagen (fibrosis) had similarly high expression of TGFB1. Thus it can be deduced that TGFB1 has a role in valvular fibrosis in cases of chronic rheumatic heart disease. Earlier work correlated valvular TGFB1 over expression with greater collagen deposition, extracellular matrix disorganization, and calcification of the valves in the population of the study of Jian, and his colleagues 14.

Earlier studies that approached this relation indicated that increased mechanical load alone could initiate the contractile phenotype of VICs. This coupled with even small increase in local TGFB1 concentrations, could contribute to the initiation of valve matrix disarray, and degeneration in mechanically or biologically compressed valves. The increased TGFB1 signaling might accumulate quickly into large pathological changes in the valve architecture, and ultimately result in valve disease 11.

TGFB1 concentration was reported to be elevated at the site of valve lesions, similar to wounds in the tissues 15. Also, inflammatory cells that infiltrate valve cusps during rheumatic fever and endocarditis are considered as sources of TGFB1 11.

The current work reported over expression of TGFB1 in rheumatic mitral valves was associated with about three fold increase in the number of cells expressing smooth muscle actin, these would be the myofibroblasts. Earlier studies reported the ability of TGF-B1 to differentiate mesnchymal cells into myofibroblast phenotype 11.

The local concentration of TGFB1 within the cardiac valves might be important because TGFB1 appeared to directly stimulate extracellular matrix protein expression from valvular interstitial cells even before their differentiation to myofibroblasts 16.Such relation was also proposed by others 17. They demonstrated in their in vitro work a regulatory role of TGFB1 in wound healing. They reported it's over expression in their experimental model of wound. They stated that TGFB1 activated VIC proliferation, and expression of ά SMA protein (myofibroblast nature) then regulated wound closure, and repair.

In several studies inflammatory cytokines were used as therapeutic targets 5. Finally from the present work finding and supported by several earlier studies TGFB1 could be also considered as a potential target for therapy in rheumatic valve disease. In clinical trials a number of studies have indicated that angiotensin converting enzyme inhibitors (ACE), and angiotensin II receptor antagonists may decrease production of TGFB1 18, 19.Also, administration of losartan reduced serum levels of TGFB1. Some studies have used animal models to examine the effects of TGFB1 antagonism. Kuwahara et al. were able to induce increased TGFB1 expression within the rat heart resulting in progressive myocardial fibrosis, and eventual diastolic dysfunction. On the other hand administration of TGF-B1 monoclonal antibodies to rats prevented fibrosis, and diastolic dysfunction 20. Therapy that decreases TGFB1 expression would arrest the progression of fibrosis which is a major event in valve pathology in rheumatic valve disease. This could help patients with mild disease in which surgery is not yet indicated particularly in young age (especially when bearing in mind that inflammatory cells persisted in the valve tissue decades after the initial attack of rheumatic fever). Thus, this proposed treatment modality would help to avoid future surgical management in such cases, and hence its related complications (e.g. anticoagulant related bleeding, thromboembolism, and patient-prosthesis mismatch in case of prosthetic valve replacement). In addition, this type of treatment could be given to patients with mild mitral valve disease who are prepared for aortic valve replacement to avoid redo valve surgery for the mitral valve in the future, since it is well known that the probabilities of thromboembolism, and anticoagulant related bleeding are much higher in cases of double valve replacement compared to single valve replacement 21.

Conclusions:

TGFB1 expression is increased in rheumatic valvular heart disease. Higher expression of TGFB1 is associated with changes in the extracellular matrix, differentiation of valvular fibroblasts to myofibroblasts, and valvular fibrosis. Thus TGFB1 could be the target of antifibrotic treatment which attenuates the fibrotic process in rheumatic disease.

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The Impact of Perioperative White Blood Cell Count on the Early Outcome after Coronary Artery Bypass Grafting.

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Background: Atherosclerosis has been thought as an inflammatory process. Markers of inflammation are considered predictors of cerebrovascular events. It has been shown that there is a link between preoperative blood cell count and reperfusion injury after cardiac surgery. Another phenomenon which is thought to be induced by inflammation is postoperative atrial fibrillation after cardiac surgery. The aim of this work is to assess the relationship between perioperative white blood cell count and adverse outcome after coronary bypass grafting.

Methods: Thirty seven patients had coronary artery bypass grafting (CABG) procedure in the duration between 1/2008 and 12/2010 at Mouwasat Hospital. All the operations were done using cardiopulmonary bypass. The age of the patients was between 35 and 67 years (mean 49.27 years). The white blood cell (WBC) count was measured immediately before, immediately after, and on the 6th postoperative day. Cardiac enzymes release was measured immediately after surgery. All morbidity events and any mortality were recorded.

Results: WBC count in the high normal range was present in 18 cases, atrial fibrillation (AF) in one case, one case needed intra-aortic balloon pump (IABP) and stroke occurred in one case. Increased cardiac enzyme release was in 33 cases.

Conclusions: White blood cell can be a predictor of worse outcome after CABG procedure as it is one of the markers of inflammation which has been suggested to be the underlying mechanism of atherosclerosis and postoperative atrial fibrillation after CABG. It can also affect the outcome through formation of microemboli in the cerebral circulation.

Atherosclerosis is increasingly viewed as an inflammatory disease. Markers of inflammation both generalized and specific can be used to predict the risk of cardiovascular events 1. The baseline white blood cell count (WBC) - a generalized marker of inflammation - has been correlated positively with the development of coronary artery disease and the risk of future acute myocardial infarction. Studies have shown that the risk of acute myocardial infarction is two to four times as great in patients with WBC in the high normal range compared with patients in the low normal range 2. After acute myocardial infarction, an increased WBC count on admission has been shown to be predictive of the development of congestive heart failure and death 3. Although cardiac surgery induces systemic inflammatory response, the relationship between preoperative inflammatory markers (WBC count), and clinical outcome after coronary artery bypass grafting (CABG) is not clear 4. The white blood cell count is a simple and available laboratory test. Several studies have suggested a link between white cell subpopulation, neutrophils and reperfusion injury 5. Mechanisms for this reperfusion injury include proteolyic, oxidative injury, enhanced platelet activation, micro vascular plugging, complement activation and enhanced accumulation within the infracted myocardium 6. Roth and his colleagues showed results which indicate that serial leukocyte filters connected to the blood cardioplegia line could decrease myocardial cell injury and may therefore help to improve outcome of patients with severely depressed ejection fraction undergoing coronary artery bypass grafting 7 .The aim of this work is to assess the relationship between perioperative white blood cell count and adverse outcome after coronary bypass grafting.

Department of cardiothoracic surgery Faculty of medicine Cairo University.
Codex : o4/07/1106

Materials and Methods:

This retrospective study included thirty seven patients who had CABG procedure in the duration between 1/2008 and 12/2010 at Mouwasat Hospital. All operations were done using cardiopulmonary bypass. The age of the patients was between 35 and 67 years (mean 49.27 years). Eighteen patients (18/37) had left main disease. In thirteen patients the degree of left main disease was 80 %or above. The WBC count was measured for every patient before surgery, immediately after surgery and on the sixth postoperative day. Cardiac enzyme assay was done immediately following surgery. In hospital mortality was defined as death within the same hospital adm ission regardless of the cause. Postoperative stroke was defined as a new focal neurological deficit or comatose states or both occurring postoperatively that persisted longer than 24 hours after its onset. The following events were recorded during the postoperative period (during the in hospital stay):

1- Neurological disorders.
2-Atril fibrillation.
3-Use of intra-aortic balloon pump.
4-Re- exploration for bleeding.

Results:

No mortality was recorded in our study. Eighteen patients (18/37) showed WBC count in the high normal range. Among them one case that developed atrial fibrillation and one case needed intra aortic balloon support immediately postoperatively. One case developed stroke and still in the ward on mechanical ventilator with hemiplegia and blindness. Acute renal failure developed in one case. Thirteen patients were re-explored for bleeding (13/37). As regards cardiac enzymes, high values were found in thirty three (33/37) patients. WBC count was above normal immediately after surgery in thirty six patients (36/37) and on the sixth postoperative day in sixteen patients (16/37).

Discussion:

In our study there has been no early mortality. However, in the study of Lawrence and his colleagues the mortality rate was 61% higher in patients with high normal WBC count in comparison with patients with low normal WBC count. This could be explained by higher incidence of peripheral vascular disease in those patients. We found that higher preoperative white blood cell count is associated with higher release of cardiac enzymes. This could explain the link between white blood cell and myocardial injury. The underlying mechanisms include accumulation of neutrophils in the ischemic and reperfused myocardium, formation of blood aggregates that alter the properties of blood in the microvasculature and the release of activated substances including oxygen free radicals, proteases and proinflammatory cytokines 5. This elevation of cardiac enzymes was also reported by Newall, and his colleagues which was associated with reduction in 1-year survival 8.

It is well known that atherosclerosis is increasingly viewed as an inflammatory process. Markers of inflammation as white blood cell count could be used as a predictor of peripheral vascular disease and cerebrovascular events 9. In our study the preoperative white blood cell count is found to be correlated with more severe left main disease and more frequent use of intra-aortic balloon pump. Similarly Lawrence and his colleagues reported a correlation between WBC count and the need of intraoperative or postoperative intra-aortic balloon pump 2. This may be explained by the higher rates of myocardial infarction and re-exploration and the subsequent need of homodynamic support among these patients.

Postoperative atrial fibrillation (AF) is the most common postoperative arrhythmic complication. The aetiology of AF after open heart surgery is incompletely understood. Currently the role of inflammation and oxidative stress on electrical remodeling is under investigation. The results of our study which are supported by other studies provide additional evidence of the association between the high normal white blood cell count and postoperative atrial fibrillation 10, 11.

The presence of association between high normal white blood cell count and stroke in our results is similar to other studies 12. The inflammatory induced astherosclerotic process may be the underlying mechanism of stroke development. Some workers showed a correlation between the thickness of aortic arch (which may be the source of microemboli) and the WBC count 13. In the study of Whitaker and his colleagues it was found a correlation between the intraoperative microemboli count, neutrophil count and outcome 10 minutes after bypass. The high WBC and the neutrophil count 10 minutes after bypass correlated with bad postoperative neuropsychological outcome 12.

Limitatations of the study:

The study included a relatively small number of patients in comparison with other studies. The large number of cases enables the worker to reach more accurate conclusions. The study did not include more specific markers of inflammation, such as C- reactive protein, interleukin-6 and TNF- alpha which may strengthen the association of the increased risk of adverse outcome with the inflammatory status.

Clinical Implications:

Our data supported by other studies can help to draw the attention to WBC count as an important preoperative risk factor before CABG procedure. The most important impact of their study on clinical practice is to enhance clinical risk stratification by including WBC count in the current preoperative risk assessment tools for patients undergoing coronary artery bypass grafting (The Euro Score). From the data , it appeared suitable to add three and a half points to three Euro Score value if the preoperative WBC count is between 10 and 12 , and to add four and a half points if the count is greater than 12 [9].

Conclusions:

White blood cell can be a predictor of worse outcome after CABG procedure as it is one of the markers of inflammation which has been suggested to be the underlying mechanism of atherosclerosis and postoperative atrial fibrillation after CABG. Formation of white blood cell microemboli may promote stroke development after CABG. Also, reperfusion injury after cardiopulmonary bypass can be induced by accumulation of white blood cells in the ischemic and reperfused myocardium.

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An Attempt to Approach the Dilemma of Ischemic Mitral Regurge

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Background: In this study we compared the surgical management of ischemic mitral regurgitation (IMR) by revascularization alone and by revascularization combined with mitral valve repair.
Methods: We studied 98 patients who underwent revascularization alone (n = 50) or revascularization combined with mitral valve repair (n = 48) for IMR from Dec. 2007 to March 2010. Preoperative and operative characteristics, postoperative mitral regurgitation severity, and operative mortality were examined for each surgical group.
Results: No differences were noted between the two groups in age, sex, history of diabetes or hypertension, and number of bypass grafts. The combined surgical group had a lower preoperative left ventricular ejection fraction (0.42 ± 0.07 versus 0.51 ± 0.08), greater severity of IMR, higher frequency of prior myocardial infarction, and longer cross-clamp and pump times (p < 0.001). The combined surgical group had a greater reduction in IMR ratio (78% versus 14%), (p = 0.008). Early mortality (30 days) showed higher mortality in combined group (3) 6.2% versus(1) 2%, both groups had similar mortality in 6 month follow up .
Conclusions: In patients with IMR, combined mitral valve repair and revascularization resulted in less postoperative mitral regurgitation compared with revascularization alone. Attempts to reduce pump time for combined procedures by using pericardial ribbon can be achieved and with fair repair outcome.

Ischemic mitral regurgitation (IMR) is a common (approximately 20%) complication after establishment of myocardial infarction (MI), which follows more frequently an inferior MI (38%) rather than an antero-septal one (10%) [1].. The management of ischemic mitral regurgitation remains controversial. Therapeutic options have included mitral valve replacement and coronary artery revascularization, mitral valve repair and coronary artery revascularization, and revascularization alone. Previous studies have reported that the patients with mitral valve replacement and coronary artery revascularization have high early and late mortality and low long-term survival [1-3]. Because the morbidity and operative mortality associated with combined revascularization and mitral valve replacement are high and long-term survival is poor [1-3], some authors have advocated revascularization alone [4-5], whereas others have recommended revascularization combined with mitral valve repair [1,3,6,8]. Uncorrected mitral regurgitation leads to reduced long-term survival after revascularization [1,3,9]; however, mitral valve surgery may add to the operative risk when combined with revascularization [1.3.8.9.10]. The optimal strategy for treatment of ischemic mitral regurgitation is not known.

Our study was on our experience in 98 patients who underwent revascularization alone or combined with mitral valve repair for ischemic mitral regurgitation. We compared the effect of each surgical procedure on the severity of mitral regurgitation, on operative mortality, and on midterm outcome. We also examined the influence of the repair method

Methods

From Dec. 2007 till march 2010, ischemic patients with moderate to severe mitral regurge undergoing revascularization alone or combined with mitral valve repair were reviewed for inclusion in the study if they had coronary artery disease and at least 2+ mitral regurgitation. Based on echocardiographic and surgical findings, patients were excluded from the study if their mitral valve disease was

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primarily rheumatic, myxomatous, infectious, or congenital. Also ,we excluded patients with mitral regurgitation due to papillary muscle rupture, torn or elongated chordae tendineae, or ballooning or scalloping of the mitral leaflets, and patients who had 0 or 1+ preoperative mitral regurgitation.

Echocardiography:

Preoperative transthoracic echo with diagnosis and grading of severity was done for all patients. For cases with severe mitral regurge, dobutamine stress echo was done to predict improvement of regurge with revascularization only or the need for additional repair .Intra operative TEE was done by certified anesthesiologist before and after cardiopulmonary bypass to confirm diagnosis and monitor efficiency of repair and the need for reintervention . Postoperative transthoracic echo was done to follow up function and efficiency of repair .We used echo machine (Vivid 3, GE, Wisconsin USA) in all cases.

Mitral valve was examined intra operatively in mid-esophageal four chamber view, mid-esophageal commissural view , mid-esophageal two chamber view , mid-esophageal long axis view , transgastric basal short axis view and transgastric long axis view.

Mitral regurgitation (M.R) was graded semi quantitatively on a scale of 0 to 4+ using a visual estimation of the regurgitation jet area in relation to the left atrial area, measuring regurgitant orifice area , measuring regurigtant volume and tracing pulsed wave Doppler on pulmonary veins modified from Nanda's criteria [12]. A successful valve repair was defined as a two-grade or greater reduction in mitral regurgitation when compared with the preoperative or pre pump study. Doppler echocardiography was performed at a mean (±SD) of 3 ± 15 days (range 0 to 6 months) before the operation and 4 ± 25 days (range 0 to 5 months) after the operation

Surgical Procedure

The etiology of valve disease was determined from direct visual inspection of the mitral valve leaflets, annulus, chordae tendineae, and papillary muscles. If the valve was not repaired, the etiology was determined from the echocardiographic findings. An ischemic etiology was concluded if the mitral leaflets and chordae appeared normal, but there were findings of papillary muscle infarction or thinning, papillary muscle ischemia, or mitral annular dilation associated with left ventricular dilation and healed infarction [7-8].

Ischemic mitral regurgitation was repaired by one of two annuloplasty techniques at the discretion of the operating surgeon. No specific criteria were used in selecting a particular annuloplasty technique for an individual patient. Ring annuloplasty was performed as described by Carpentier and colleagues [14], and included 20 Carpentier-Edwards, 28 had pericardial ribbon which consists of 4cm length ribbon of native patient pericardium treated with 6% Gluteraldhide for 10 min. then rolled and tied by 2/0 silk (fig.1 ,2, 3) , Alfieri leaflet repair procedure was required in 2 patients of pericardial ribbon group

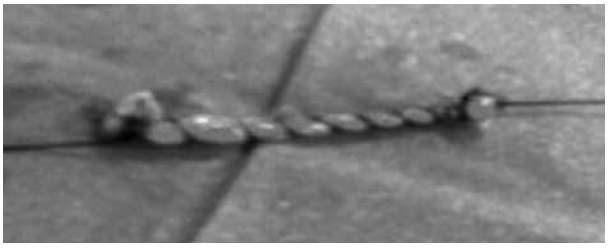

Figure 1, : Pericardial ribbon,

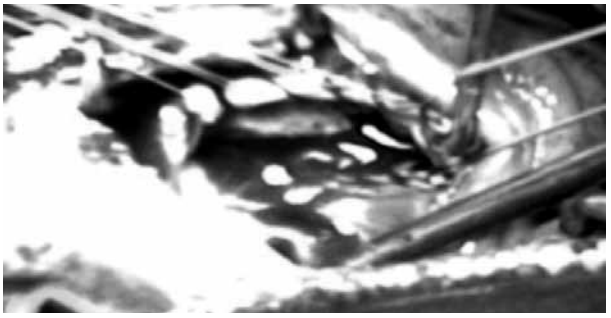

Figure 2 , pericardial ribbon in posterior annuloplasty

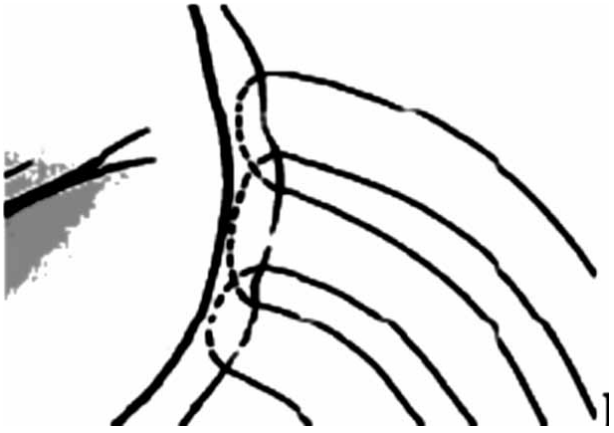

Figure 3 : Suturing technique for posterior annuloplasty] Calafiore AM, Di Mauro M, Gallina S, Canosa C, Iacò AL. Optimal length of pericardial strip for posterior mitral overreductive annuloplasty. Ann Thorac Surg 2003;75:1982–1984.

Postoper ative Follow-Up

After the operation, we followed up with a outpatient clinic visits. Follow-up was continued every 6 months, unless death occurred.

Statistical Methods

For comparing the surgical groups with regard to preoperative characteristics and measures of operative success we used two-sample t tests (for continuous or ordinal data) and 2 analysis or Fisher's exact test for categorical data. Analysis of variance (with the Bonferroni correction) was used for the change in the mitral regurgitation grade. The significance level was set at $p = 0.05$. Actuarial survival was calculated by the

life-table method. All mortalities (including operative deaths) were included. For analysis of survival data, a Wilcoxon test was used to test for equality among the surgical groups. A multivariate stepwise Cox model was used to determine predictors of early (30 days) and late (>30 days) survival.

Results:

Patients

The clinical characteristics of the two surgical groups (revascularization alone and revascularization combined with mitral valve repair) are shown in(Table 2). Both groups were middle age, with mean ages of 51 and 52 years, respectively (p = 0.86). Gender distribution was not significantly different between the two groups (p = 0.41). The frequencies of diabetes, hypertension, renal insufficiency, and renal failure requiring hemodialysis did not differ. The mean left ventricular ejection fraction was lower in the combined revascularization and mitral valve repair group than in the revascularization-alone group (p = 0.009),

		RV (ml)	ERO (cm2)	MR jet (% LA)	PV Doppler waves
I	Mild	<30	I <0.2	<15	Normal
II		30-44	0.2-0.29	15-30	Systolic blunting
III		45-59	0.3-0.39	35-50	Systolic blunting
IV	Severe	≥60	>0.4	>50	Systolic reversal

Table 1. Assessment of the mitral regurgitation severity

	CABG (n=50)	CABG+MV Repair(n=48)	P value
Age (years) (mean±SD)	51±5.17	52±7.68	0.48
Female	15(30.0)	12(25)	0.41
Hypertension	10(20.0)	7(29)	0.54
Diabetes mellitus	17(35.0)	22(46)	0.09
Ejection fraction	51±8	42±7	0.009
Recent UA	5(10.0)	6(12.5)	0.35
CHF	2(4.0)	6(12.5)	0.045
Renal insufficiency (Creatinine>1.5 mg/dl)	6(12.0)	10(21)	0.43
M.R. Pre operative grade (mean ±SD)	2.1±0.3	2.9±0.9	0.045
NYHA class (mean±SD)	2.7±0.9	3.1±0.8	0.52

Table 2. Patients' characteristics*

Surgical Procedure

Revascularization alone was performed in 50 patients, and revascularization combined with mitral valve repair by annuloplasty was performed in 48 patients (Table 3). No significant difference was noted between the two groups for the number of coronary artery bypass grafts (p = 0.38). . Pump time and cross-clamp time were significantly prolonged in combined group (p < 0.001).

	CABG (n=50)	CABG+MV Repair(n=48)	P value
No. of grafts (mean±SD)	3.4±1.5	3.1±0.9	0.38
Total pump time (min)	43±12	74±25	<0.001
ICU stay (mean/days)	2	3	0.31
IABP	2(4)	3(6.25)	0.19
Need 0f temporary pace maker	0	4(8.3)	--
Renal dialysis	1(2.0)	0(0.0)	--
Total hospital stay (days) (mean±SD)	10.5±3	12.8±5.3	0.055
M.R grade before hospital discharge (mean±SD)	1.8±0.1	1±0.3	0.008
Reduction ratio in M.R	14%	78%	<0.001
Midterm Follow up echocardiogram (days) (mean±SD)	195±78	174±85	0.23
M.R grade at midterm follow up (mean±SD)	2.4±0.3	1.4± 0.3	0.005
NYHA class	1.5± 0.9	1.1±0.6	0.17
Early mortality	1(2%)	3(6.2%)	0.042
midterm mortality	0	0	--

Table 3 . post operative data

Doppler Echocardiography

The preoperative mitral regurgitation grade was significantly greater in the combined group than in the revascularization-alone group (p =0.045, Table 2). Despite this difference, the postoperative mitral regurgitation grade in the combined group (1 ± 0.3, mean ± SD) was significantly lower when compared with the revascularization-alone group (1.8 ± 0.1, p = 0.008). As a result, the preoperative to postoperative change in mitral regurgitation grade was greater in the combined group . Defined as a two-grade or greater reduction in mitral regurgitation, a successful outcome occurred significantly more often in the combined group than in the revascularization-alone group, as (78% versus 14%, p < 0.001). When comparing

different types of valve repair (table 4), the success rate after repair was insignificantly lower with a pericardial ring (83% success rate) than with the Carpentier-Edwards ring (89% success rate; p = 0.08). Other comparisons among different ring repair techniques did not reach statistical significance except for total pump time which is lower in pericardial ribbon group (p = 0.05)

	Carpentier-Edwards ring (n=20)	Pericardial ribbon (n=28)
No, of grafts (mean±SD)	2.8±1.1	3.2±0.7
Total pump time (min)	78±24	62±19
ICU stay (mean/days)	3	3
IABP	1(5)	2(7.1)
Need 0f temporary pace maker	2(10)	2(7.1)
Renal dialysis	0(0.0)	0(0.0)
Total hospital stay (days) (mean±SD)	11.5±4.3	12.1±5.1
M.R grade before hospital discharge (mean±SD)	0.9±0.1	1±0.3
Reduction ratio in M.R	89%	84%

Table 4 : post operative differences among the different repair groups

Follow-up Doppler echocardiography was performed in 44 patients in the revascularization-alone group at a mean (± SD) of 195±78 days after the initial postoperative Doppler study, and in 40 patients in the combined group at 174 ± 85 days. For these patients with postoperative Doppler studies, in the revascularization-alone group the mean grade of mitral regurgitation was 2.4 ± 0.3 on the follow-up study compared with a grade of 1.8 ±0.1 on the initial postoperative study. By comparison, in the combined group the mean grade of mitral regurgitation was 1.4 ± 0.3 on the follow-up study compared with a grade of 1 ± 0.3 on the initial postoperative study. Thus, the mitral regurgitation grade significantly worsened from the first to the second postoperative study in the combined group (p = 0.005), in comparison with the revascularization-alone group. (Table 1&2)

Postoperative Survival

Early mortality (30 days) was lower in the group with revascularization alone than in the combined valve repair and revascularization group (2% [1 of 50 patients] compared with 6.2% [3 of 48 patients], respectively; p = 0.042.

No significant difference was noted for survival up to 6 months after the operation between the revascularization-alone group and the mitral valve repair plus revascularization group.

Causes of early death (30 days) for the revascularization-alone group (n = 1) was non cardiac . Causes of early death for the combined valve repair and revascularization group (n = 3) were cardiac in 2 (66.6%) and non cardiac in 1 (33.3%) .

Functional Class

The New York Heart Association (NYHA) functional class was assessed before and at a mean of 6 months after the operation in survivors. , the preoperative NYHA class was 2.7 ± 0.9 (mean ± SD) and decreased at 6 months to 1.5 ± 0.8 in the revascularization group , compared with 3.1 ± 0.8 before the operation and decreasing at 6 months to 1.1 ± 0.6 in the combined mitral valve repair and revascularization group . Despite strong evidence of overall improvement, no difference was noted between the two surgical groups in the magnitude of improvement

Discussion:

In comparison with mitral valve replacement, mitral valve repair has been associated with a lower rate of complications, especially thromboembolism and warfarin-related hemorrhage, and a higher survival rate [3]. A previous study has reported that 40% of patients continued to have significant residual mitral regurgitation and only 9% had resolution of mitral regurgitation with revascularization alone for ischemic mitral regurgitation [6]. Similarly, in the present study, revascularization alone did not result in a significant change in mitral regurgitation grade, and only 6 (12%) of 50 patients achieved a two-grade or greater reduction in mitral regurgitation, In other words, reduction or elimination of mitral regurgitation can be expected in only about 10% of patients after revascularization alone. In these patients, improvement in mitral regurgitation probably occurs as a result of restoration of blood flow to an area of hibernating myocardium; that is, ischemic but viable myocardium that does not function properly at rest, but does function with adequate blood flow. Notwithstanding these observations, reported mortality rates have been low after revascularization alone [4-5]. The optimal treatment strategy, therefore, is not known.

Previous studies have shown that mitral valve repair (especially mitral annuloplasty) can decrease or eliminate mitral regurgitation in most cases [7,8,9,10,15]. In the present study, the repair patients had a significantly greater reduction in mitral regurgitation than patients who underwent revascularization alone. The responsible mechanisms may include a more favorable subvalvular three-dimensional dynamic geometry [16], a reduction in annulus diameter [7], and an increased leaflet coaptation area [7]. Although mitral annuloplasty is an important aspect of mitral valve repair, the preferred technique remains controversial. The flexible pericardial and Dacron rings may be superior to the rigid Carpentier-Edwards ring for mitral valve annuloplasty in the view of more favorable mitral annulus dynamics and preservation of left ventricular function during stress conditions [16]. Based on the present report, however, success (reduction of mitral regurgitation by two grades or more) was achieved in 89% of patients with the Carpentier-Edwards ring, and 84% with the pericardial ribbon ring . The pericardial

ribbon ring had a insignificantly lower success rate than the Carpentier-Edwards (classic) ring, but the other comparisons did not reach statistical significance. A larger study is needed to detect any difference among ring annuloplasty techniques for the successful reduction of ischemic mitral regurgitation.

Most series have reported operative mortalities ranging from 9.5% to 15% when mitral valve repair is added to revascularization, [10-11] in comparison with 3% to 4% for revascularization alone [5-7]. In the present series, early mortality (30 days) after the combined procedure was higher than after revascularization alone 6.2%, versus 2%, A somewhat higher early mortality after the combined procedure may be attributable to the longer pump time , which may be poorly tolerated in patients with reduced ventricular function and an already high "ischemic burden" due to the coronary artery disease.

We have previously shown that the grade of mitral regurgitation remains unchanged in the early postoperative period (in the absence of a new ischemic event) if the afterload conditions are carefully monitored and controlled [7,8,12]. Thus, the early postoperative (or intraoperative) echocardiographic evaluation provides an accurate assessment of the adequacy of repair [7,8,12,13].

Conclusion:

In patients with IMR, combined mitral valve repair and revascularization resulted in less postoperative mitral regurgitation compared with revascularization alone. Attempts to reduce pump time by using pericardial ribbon , shorter pump time can be achieved and with fair repair outcome.

Study limitations

The population was limited for the surgeon based procedures, and the midterm follow up needs longer and to be on annual bases , both these limitations would be corrected in our next follow up paper .Uneven groups as we had to put all patients whom M.R improved in dobutamine stress studies in revascularization group. Disarrangement in patient O.R scheduling led to lose some of patient's data that excluded from study and would increase the population number

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Surgical Ventricular Restoration for Beginners

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Background : **The effects and efficacy of surgical ventricular restoration (SVR) are well-established in chronic post infarction ischemic cardiomyopathy, to restore or remodel the left ventricle to its normal, elliptical shape and size in patients with akinetic segments of the heart**

Aim of work : **To evaluate our experience in the surgical ventricular restoration (SVR) techniques of the left ventricle for patients post myocardial infarction**

Methods: **Forty eight patients between October 2008 to May 2010 Patients divided into two groups, group A included patients underwent CABG plus minus mitral valve surgery, but in group B patients underwent CABG with SVR and plus minus mitral valve surgery.**

Results: **The hospital mortality rate was 4.5 % (one patient in SVR group). All patients underwent CABG . Mitral repair was done in 28 patients, 13 of them were in group A and others were in group B, Group A had shorter duration of the operation and CPB time; it was 237 ± 39 versus 329 ±98.1 minutes. Cross-clamping time was 76.7±21.2 versus 115.1±59.9 minutes . The number of grafts was 3.5± 0.7 versus 3.4 ± 0.4, IABP in group A were 2 but it was in 6 patients in group B. Early postoperative complications were significantly higher in group B , reflected in intensive care unit stay, and hospitalization. Six patients had postoperative bleeding requiring blood transfusion . Atrial fibrillation was less in on group A as compared to group B, (13.6%) versus 5 (19.2%) respectively. Renal impairment, 8 patients had high creatinine level in group A, vs 3 patients in group B. Follow up; it revealed much improvement in EF, LVESVI, LVEDV and LVEDD. There was significant improvement in the EF% in both groups during the short-term follow-up, it was 35 ± 14.7% in group A and 39.8 ± 4.3% in group B, with statistical difference between both groups. Improvement in functional class corresponded with a significant improvement in the mean NYHA class in both groups it was 2.12±0.5 in group A and 1.5±0.4 in group B. No patient had grade 3 or 4+ mitral regurgitation.**

Conclusion: **SVR using volume control and elliptical patch ventriculoplasty offers to the patient's better satisfaction & fair improvement in their quality of life as rgard the short term.**

Surgical ventricular restoration (SVR) is a procedure designed to restore or remodel the left ventricle to its normal, elliptical shape and size in patients with akinetic segments of the heart, secondary to post infarction left ventricular aneurysm.1 Complications after anterior myocardial infarction (MI), including angina, heart failure (HF), and ventricular arrhythmias, may occur within 30 days from the acute event; patients with complicated anterior MI are at high risk for death and for major adverse events, despite the aggressive therapeutic approach to acute MI.2

Congestive heart failure and depressed left ventricular function are associated with poor survival rates. Survival may be improved and symptoms ameliorated by medical or surgical approaches.3 surgical approaches to congestive heart failure include transplantation, ventricular assisting device implantation, standard coronary artery and valve surgery, more recently, ventricular restorative surgeries.4

The effects and efficacy of surgical ventricular restoration (SVR) are well-established in chronic post infarction ischemic cardiomyopathy, but few data exist on the efficacy of SVR in the setting of acute/sub acute complicated anterior MI with dilated ventricle.5 The SVR procedure is usually performed after coronary artery bypass grafting (CABG) and may proceed or be followed by mitral valve repair or replacement and other procedures such as endocardectomy and cryoablation for treatment of ventricular tachycardia.6

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The concept of reconstructing the ventricle to a prescribed size based on the patient's body size was introduced by Dor 7and popularized by Menicanti8 with modification by using special balloon aiming to restore the volume and the conical shape of the left ventricle, the best methodology to determine the appropriate size of the reconstructed ventricle has yet to be determined. Some surgeons base it on the enlarged end diastolic dimensions and others by indexed body surface area.

Surgical restoration replaces the infarct scar with a smaller surgical scar, and tries to modify ventricular geometry in such a way as to recreate a nearly normally shaped ventricle. The structural anatomy of the myocardium cannot rebuilt, and so it is necessary to give the LV as normal shape and volume as possible to get its physiological status.9

Aim of the work:

The aim of this study is to evaluate our experience in the surgical ventricular restoration (SVR) techniques of the left ventricle for patients post myocardial infarction (MI) ischemic cardiomyopathic patients, as regard: patient's satisfaction, dyspnea score (NYHA class), left ventricular end-systolic volume index (LVESVI) reduction.

Methods:

Study Design:

This study was prospectively collected and retrospective analyzed based on the database of our experience in different governmental centers we worked at, for patients undergoing SVR. All the patients admitted to the study gave their informed consent for the scientific analysis of their clinical data in an anonymous form.

Patients:

Forty eight patients (35 men, mean age 53.9±9.6 years) with previous anterior myocardial infarction and secondary LV dilatation referred to our center for SVR between October 2008 to May 2010 received a complete echocardiographic examination, ventriculography or MRI which was mandatory to assess the left ventricular contraction pattern in post MI cardiomyopathic patients. Patients divided into two groups, group A included patients underwent CABG plus minus mitral valve surgery, but in group B patients underwent CABG with SVR and plus minus mitral valve surgery. All patients will be included in this study fulfilling the following inclusion criteria: end-systolic volume index of > 60mL/m², end-diastolic volume index of > 120mL/m², Ejection fraction (EF) of ≤ 40 ≥25% ,Large area of akinesis / dyskinesis, NYHA ≥ II , good coronary target vessels with or without mitral regurge (MR), good right ventricular function with pulmonary artery systolic pressure (PASP) < 50 mmHg and retained basilar heart function with contractile anterior basal and inferior basal portions who have much better prognosis after exclusion of the aneurysmal or akinetic portion of the ventricle. Our exclusion criteria in this study were right ventricular dysfunction or failure, akinetic antero-basal or infero-basal portions, associated ischemic VSD and other co-morbid factors as advanced renal impairment, liver diseases, signific pulmonary disease (COPD). All of the clinical definitions will be taken from the 1998 data collection from of the Society of thoracic Surgeons National Cardiac Surgery Database.

All patients will be subjected to the preoperative characteristics including full history, all routine laboratory investigations and risk factors for assessment of morbidity like diabetes, hypertension, hypercholesterolemia, smoking, pre-operative arrhythmia, drugs on admission, presence of preoperative support as pacemaker, inotropes, Intra-aortic balloon pump and or intravenous infusion of nitrates.

Operative data were collected including number of grafts, total operative time, total bypass time. All patients in this study underwent one of the standard surgical ventricular restorative techniques after coronary artery revascularization with or without mitral valve surgery. We used the LVESVI reduction as more accurate figure than left ventricular end diastolic dimension (LVEDD), because in SVR, the main concern is to keep elliptical shaped ventricle so the reduction will be more on the transverse diameter more than the longitudinal diameter.

All postoperative data were analyzed including: amount of blood loss, arrhythmias, myocardial infarction, ICU and hospital stay. Hospital mortality was defined as death after the procedure before patient's discharge regardless of the duration of hospitalization. Follow up Echocardiography at 3 and 6 month was done.

Surgical Procedure:

Because of the cost of the Menicanti sizing balloon, restoration of the L.V. was done by a commercial handmade balloon using: rubber gloves size 7.5 ,corrugated rubber drain Nelaton catheter size 16 mitral valve sizer 33 and no. O silk sutures (figure 1&2). The The procedure was conducted under total cardiac arrest

Figure (1) Balloon components

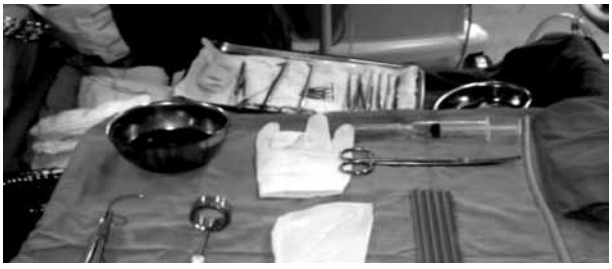

Figure (2) Handmade balloon

Results:

The overall hospital mortality rate was 4.5 % (one patient in SVR group). The cause of death was severe low cardiac output syndrome. Preoperative variables for all patients were shown in table 1. There was had higher incidences of diabetes mellitus, hypertension and smoking history in group A without statistical difference between both groups which displayed in Table 2.

Patient Data	Group A 22 pts	Group B(SVR) 26 pts	P value
CABG + Mitral Repair	13 pts.59%	15 pts.57.7%	NS=0.17
CABG + Mitral Replacement	2 pts.9.1%	3 pts.11.5%	NS=0.11

Table 1: Preoperative characteristics for all patients.

Variable	The mean SD	
Age	53.95±9.6 years	
BSA	1.96±o.16	
LVEDD	7.00±0.27	
LVEDV	215.83±18.97	
EF	32.73±4.35	
PAP	33.97±7.54	
NYHA class	2.91±0.74	
MR (33 patients)	Grade I	9 pts.
	Grade II	10pts.
	Grade III	11pts.
	Grade IV	3 pts.

Table 2: preoperative characteristics in both groups.

All patients underwent CABG with revascularization of the left anterior descending artery. Operative data were shown in Table 3. CABG with mitral repair was done in 28 patients, 13 of them were in group A and others were in group B, but mitral replacement was performed in 5 patients, 3 of them in group B and 2 patients were in group A. Patients in group A had shorter duration of the operation and CPB time; the difference in time is related to SVR technique, it was 237 ± 39 versus 329 ±98.1 minutes. The average cross-clamping time was 76.7±21.2 versus 115.1±59.9 minutes which was statistically significant difference. The number of bypass grafts and the rate for complete revascularization were almost the same in both groups; it was 3.5± 0.7 versus 3.4 ± 0.4. Two patients needed intra-operative or post-operative intra-aortic balloon pump in group A, but it was in 6 patients in group B. We used intra-aortic balloon pump, when there was hemodynamically instability as high pulmonary artery pressure, hypotension or ischemic changes in ECG monitoring.

Patient characteristics	Group A (CABG) 22 patients	Group B (CABG+ SVR) 26 patients	P value
Age (years)	54±2.1	53±2.6	NS=0.43
Male : female ratio	18:4	All males	NS=0.15
NYHA	3.1±0.8	2.9±0.1	NS=0.73
LVESVI(ml/m2)	123±6.1	121±5.2	NS=0.63
EF %	32.7±4.3	31.5±2.8	NS=0.58
COPD	(4.5%)1 pt.	(3.8%) 1 pt.	NS=0.81
Hypertension	18 pts.81.8%	21 pts.80.7%	NS=0.33
Smoking history	16 pts.72.7%	18 pts.69.2%	NS=0.17
Diabetes mellitus	19 pts.86.3%	22 pts.84.6%	NS=0.37
Operation time (min)	237.6 ± 39	329.8 ± 98.1	HS=0.005
Cardiopulmonary bypass time (min)	76.6 ± 21.2	115.1 ± 59.9	S=0.025
Number of bypass grafts	3.5± 0.7	3.4 ± 0.4	NS=0.35

Table 3: Operative data.

The postoperative data were summarized in Table 4. The incidences of early postoperative complications were significantly higher in patients with group B patient with SVR, reflected in intensive care unit stay, and hospitalization. The group of patients underwent CABG had a lower total complication rate than those underwent conventional CABG plus SVR. Six patients had postoperative bleeding requiring blood transfusion; none of them needed re-exploration. The incidence of postoperative arrhythmia like atrial fibrillation was less in on group A as compared to group B, it happened in 3 patients (13.6%) versus 5 (19.2%) respectively. As regards renal impairment, there was highly statistical difference between both groups, 8 patients had high creatinine level in group A, while it was happened in 3 patients in group B.

Patient Data	Group A	Group B	P value
Hospital stay (days)	11.2 ±4.1	12.3±2.6	NS=0.45
ICU stay (days)	3.4±1.9	5.3±2.8	HS=0.009
Renal impairment post surgery (creatinine >2.0)	8 pts.(36.3%)	3 pts.(11.5%)	HS<0.001
IABP support	2 pts.(9%)	6 pts.(34.6%)	HS<0.001
AF	3pts.(13.6%)	5 pt.(19.2%)	S=0.021

Table 4: Postoperative data.

Follow up:

A complete follow-up was obtained in most of patients. After surgery, echocardiography was done for all patients who underwent follow up; it revealed much improvement in EF, LVESVI, LVEDV and LVEDD as shown in table 5. There was a statistically significant improvement in the EF% in both groups

during the short-term follow-up, defined as 3 and 6 month after the date of surgery, it was 35 ± 14.7% in group A and 39.8 ± 4.3% in group B, with statistical different between both groups. Improvement in functional class corresponded with a significant improvement in EF during short-term follow-up in comparison with the preoperative value, there was statistically significant improvement in the mean NYHA class in both groups it was 2.12±0.5 in group A and 1.5±0.4 in group B. No patient had grade 3 or 4+ mitral regurgitation.

Discussion:

Surgical ventricular restoration (SVR) is a relatively new and continuously improving technique for restoring left ventricle (LV) shape, size, and function in patients with ischemic cardiomyopathy and its end result of heart failure. So far, it has been well established that SVR improves LV ventricular volumes and theoretical increasing the ejection fraction (EF). Moreover, the beneficial effects of SVR include an improvement in LV mechanical synchrony, resulting in a more efficient myocardial pump function and subsequent less progression of mitral regurge11.

Many other techniques and approaches were developed over the years to treat post infarction ventricular aneurysms12. Dor and colleagues7 introduced the technique of endovetricular circular patch plasty. His approach was unique in that it approached akinetic areas and dyskinetic aneurysms equally.

Our results were coincided with study of Di Donato and colleagues 13 who evaluated the effectiveness of SVR and unrepaired mild ischemic mitral regurgitation on left ventricular geometry, cardiac and functional status and survival. These investigators analyzed 55 patients with previous anterior infarction and mild chronic functional mitral regurgitation. Left ventricular volumes, ejection fraction, and geometric parameters were measured before and after surgery. The authors concluded that SVR improved mitral functioning by improving geometry abnormalities. Survival is optimal and greater than would be expected in patients with post-infarction dilated ventricles and depressed left ventricular function.

In contrast of study of Mark and coworkers 14 who compared CABG plus SVR with CABG alone in 1,000 patients with ischemic heart failure, an anterior wall scar, and a LVEF less than or equal to 0.35. The authors concluded that addition of SVR to CABG in patients with ischemic heart failure did not improve quality of life, but significantly increased health care costs.

Ribeiro and colleagues15 randomized 74 patients with viable anterior wall myocardium following anterior myocardial infarction to coronary artery bypass (CABG) alone or CABG plus surgical ventricular restoration (SVR). The two-year survival was not significantly different between the groups. The CABG+SVR group had significantly improved freedom from heart failure compared with the CABG only group. While SVR provided significant improvement in left ventricular volumes compared to CABG alone, the number of patients was small and the follow-up short term. The authors further stated that it is not clear whether SVR can revert or stop the remodeling processes after myocardial infarction.

Sartipy and colleagues16 reported on 101 patients who underwent SVR using the Dor procedure at a single center for class III or IV congestive heart failure, angina and ventricular tachyarrhythmia during the period of 1994 to 2004. The authors reported early mortality (within 30 days of operation) was 7.9%; left ventricular ejection fraction increased from 27% ± 9.9% to 33% ± 9.3% postoperatively.

Study Limitations

This study has a few potential limitations. The number of patients was small. The follow up was limited while our belief that SVR techniques would affect more positively on long term results However, this is the first time, to the best of our knowledge, that detailed changes in patients satisfaction and quality of life which were reported in patients who underwent SVR.

Item	Group A		Group B		P value
	3month	6month	3month	6month	
Patient satisfaction	35%	55%	28%	75%	S=0.027
=NYHA	2.89 ±0.6	2.12±0.5	2.9±0.76	1.5±0.4	HS <0.001
EF	32.7±4.3	35±4.7	31±3.4	39.8±4.3	HS<0.001
LVESVI (ml/m2)	123±6.5	116±9.8	108±12	80±20	HS<0.001
LVEDV	215.83±18.97	151.73±54.6	143.57±47.84	123±0.12	HS<0.001
LVEDD	6.78±0.24	6.23±0.12	6.42±0.26	5.54±0.56	HS < 0.001
Mortality	0	0	1 pt.	0	N.S=0.34

Table 5: Immediate and late follow up (3 month) in both groups:

Conclusion:

SVR using volume control and elliptical patch ventriculoplasty offers to the patient's better satisfaction & fair improvement in their quality of life as rgard the short term. It add no much risk increase if compared to those in same category and whom underwent CABG only or plus Mitral repair.SVR should not be a routine to all patients undergoing CABG with low E.F but, meticulous selection for patients for such procedure is the keystone for its success and to get good results. Initial results are encouraging to continue and we believe it might be of much benefit as regard long term follow up.

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Myocardial revascularization with prosthetic valve replacement. Incidence and surgical challenge

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Background: **Coronary artery disease is common with valve disease at the age of 40 years or above. The presence of both lesions may make the operation more complex than valvular surgery alone. In this study the incidence of coronary artery disease with valve lesion was detected with a focus on risk factors of atherosclerosis. A comparative study between both combined surgery with revascularization and valve surgery alone was spot lighted in this study.**

Methods: **All patients with a valve disease committed for valve surgery was referred to coronary angiography before surgery, data were recorded regarding the diseased vessels, operative data and NYHA class pre and 3 month postoperatively in both groups.**

Results: **50 patient were studied, 17 (34%) had ≥ 50% luminal coronary artery stenosis the other 33 (66%) had normal coronaries or insignificant lesions. Male gender represents 43(86%) and female gender 7 (14%). In group I (combined CABG and valve surgery) average preoperative NYHA class was 3 and for group II (valve surgery only) NYHA class was 3 as well. No mortality in group I but 2 patients died in group II (5.8%). Total anastomosis number was 28 (1.6/patient). Single vessel disease represents 7 cases (41%), double vessels 9 cases (52.9%) and triple vessels 1 case (5.8%). The common valve pathology was rheumatic 44(88%). Improvement in NYHA class was statistically equal in both cases groups.**

Conclusion: **coronary angiography would be done for patients 40 years old or above before valve surgery. A complex operation of combined revascularization and valve surgery could be achieved with a good risk and good improvement as in valve surgery alone.**

Valve surgery is common, but more patients are now presenting with increasingly complex pathology. Also advanced age and high risk profile patients are no more contraindication for cardiac surgery even are frequently seen in the operating theater. Some of these patients referred to surgery are those with coronary artery disease and valve pathology who require proper surgical intervention. Valve pathology may be the presenting symptoms of the patient but advanced age may be accompanied by coronary artery disease. American College of Cardiology ACC)/American Heart Association (AHA) recommends that coronary angiography should be performed before valve surgery in men aged > 35 years, women aged > 35 years with coronary risk factors and postmenopausal women1. This study tried to get an answer about the incidence of coronary artery disease in patients 40 years or above referred to surgery for valve operations and to find out if the combined procedure of valve surgery with revascularization carrying the same risk as the valve surgery alone.

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Methods:

In a period of 2 years between 2009 and 2011, 50 patients at Ain Shams University Hospital and associated private hospital were referred to valve surgery, all patients selected for this study were 40 years or above. Data were collected including age, gender, history of diabetes1 (defined as fasting glucose >126 mg/dl or on treatment), hyperlipidaemia (fasting cholesterol >200 mg/dl or on treatment), hypertension (systolic >140 mm Hg or diastolic >100 mm Hg or on treatment and smoking. All patients had coronary angiography before surgery regardless the symptoms of angina and ECG findings. The coronary angiography was revised and a stenosis was defined as > 50 % luminal narrowing. The surgery was done by a single surgeon either combined valve

and revascularization (group I) or as a valve surgery only (group II) either for mitral, aortic or double valve disease according to Echo and angiographic findings. The number of distal anastomosis denoting the number of the grafts, a reversed segment of saphenous vein was used in all grafts. The pathology of the valve disease was also recorded, degenerative, rheumatic or infective endocarditis. Valve pathology was defined as2 : 1- Rheumatic on echocardiographic bases and surgical findings (diffuse thickening leading to leaflet rigidity, commissural fusion, thickened and shortened chordate tendinae, calcific deposit on leaflet. 2- Degenerative : as pure mitral insufficiency with histologic evidence of myxoid change. 3- endocarditis : culture positive endocarditis or valve vegetation. The pathology of the valve was recorded prospectively and at the end of the operation. Intraoperative information about valves replaced, number of grafts performed, aortic cross clamp time and bypass time are also recorded. Follow up was carried for 3 month after the operation to compare the NYHA class before and after surgery. Patients with ischemic mitral regurgitation, prosthetic valve thrombosis requiring an emergency operation with no time for coronary angiography, redo surgery for a second valve replacement, infective endocarditis with vegetation on aortic valve were excluded from this cohort of patients. The only case of infective endocarditis which was included in this study was referred to coronary angiography as the patient developed acute myocardial infarction as a first presentation upon admission due to an embolus from vegetation on aortic valve. All data collected and registered into statistical Microsoft Excel sheet, version 2007. Categorical variables were reported in percentages, student t-test was used to for paired and unpaired data was used to compare the probability variables in different groups.

Operative technique:

All patients were operated using standard techniques of cardiopulmonary bypass (CPB) using membrane oxygenator (Terumo-Capiox E; Terumo Corp., Tokyo, Japan) or (Justra, Justra Marketing Pte., Ltd.). Direct aortic canulation, Right side was drained using bicaval canulae in double, mitral valve or in combined surgery. Double lumen canula was used in aortic valve surgery alone or combined with revascularization. Bicaval taping and snaring was required for 6 cases in which repair of tricuspid valve was required, in addition to closure of ASD secondum with a pericardial patch in one of those cases. CPB instituted and patient kept warm to identify the coronary vessels going to be grafted mean while a reversed segment of a saphenous vein graft is well prepared and distal anastomosis to coronary vessels started on bypass beating heart using 7/0 polypropylene suture 9 or 8 mm needle . Medtronic Octopus tissue stabilizer (Medtronic, Inc, Minneapolis, Minn) was used to have a steady field when required. Intracoronary shunt (DLP, **Medtronic**, Inc, Minneapolis, Minn) was used according to the coronary artery diameter (1.5-2.5 mm) to keep the heart perused, a squirt of warm saline was used when necessary to ensure clear proper field of anastomotic site. Total clamp of the aorta was done after completing the distal anastomosis. The heart was arrested using crystalloid cold cardioplegia using 14-16 gauge diameter canula or directly in coronary ostia in case of aortic incompetence. An ischemic area of the myocardium can get benefit of giving cardioplegic solution in an already made anastomosis through a saphenous vein segment. Cooling was down to 32C°.

Mitral valve approached through interatrial groove and replaced followed by closure of left atrium leaving a left atrial suction vent in case of replacement of aortic valve. Mechanical valve prostheses were used for replacement St. Jude (St. Jude Medical, St. Paul , MN , USA) or Carbo Medics (Carbo Medics Inc. , Austin , Tex) and Sorin Bicarbon (Sorin Biomedica , Saluggia , Italy) . Pledged supported U–Shaped sutures were used. The aortic valve is replaced in 2nd order, the aorta is then closed, the heart was de-aired and aortic clamp was removed. Proximal anastomosis to the aorta was done using a suitable side partial aortic clamp while re-warming blood is completed. Hemodynamically stable patient were weaned from mechanical ventilation as soon as they recovered from anesthesia. Those patients with combined coronary bypass grafts received acetyl salicylic acid 100 mg per day in addition to sodium warfarin. All patients continued to use the same regimen of oral anticoagulation after discharge from the hospital. Follow up was carried out for patients 3 month after the operation.

Results

A total of 50 cases were studied 17 (34%) of them had combined surgery (group 1) with total 28 grafts (1.6/pt) the remaining 33 (66%) had valve surgery only including mitral, aortic or double valve replacement (group 2) (table 1) and (tabel 6).

	Number of patients	%
Group I Valve disease and IHD	17	34%
Group II Valve disease only	33	66%

Table 1 : Distribution of patients between the two groups (Total 50 Patients)
IHD: Ischemic heart decease

The characteristics of the studied cohort there were 43 mails (86%) and 7 females (14%). The mean age for group I were 51±6.9 years ranging from 40 to 67 years versus 47± 6.8 years for group II (P-value 0.12). Table 2 shows the base line characteristics for the total number of the patients. The angiographic data obtained revealed a single vessel disease in 7 patients (41.1%) double vessel disease in 9 patients (52.9%) and triple vessel disease in 1 patient (5.8%) (table 3).

characteristic n = 50	Mean ± SD	
Age		
Group I	51+6.9	
Group II	47+6.8	
	number	(%)
Male	43	86
Female	7	14

Hypertension	23	46
Dyslipidaemia	14	28
Diabetes	14	28
Smoking	35	70
Etiology of valve disease		
Rheumatic	44	88%
Degenerative	5	10%
Infective endocarditis	1	2%

Table 2 : Characteristic data of the patients

	n	%
< 50% stenosis	33	66%
≥ 50% stenosis	17	34%
Distribution of ≥ 50% n=17		
SVD	7	41.1
DVD	9	52.9
TVD	1	5.8

Table 3 : Angiographic data SVD Single vessel disease. DVD double vessel disease. TVD triple vessel disease.

The mean aortic clamp time in group I in single valve replacement 55±10.03 min. compared to 48±11.6 min. in group II (P-value 0.34) and for double valve in group 1 85±8.5 compared to 90±6.05 in group II (P-value 0.14). The CPB time was for single valve in combined group (group I) 137±16.3 compared to 80±17.8 min. in group II (P-value 0.00007) and 177±12.5 for double valve in combined group (group I) compared to 122±11.5 min. in group II (P-value 0.003) (table 4) the number of grafts performed was ranged from 1-3, non of the patients received IMA as a conduit, saphenous vein graft was used in all instead.

	Group I (Valve+CABG)		Group II (Valves only)	
	Aortic clamp time (min)	Bypass time	Aortic clamp time (min)	Bypass time
	single valve			
mean± SD	55±10.03	137±16.3	48±11.6	80±17.8
Min	35	109	34	59
Max	67	174	84	129
	Double valve			
mean± SD	85±8.5	177±12.5	90±6.05	122±11.5
Min	72	157	85	105
Max	88	180	102	140

Table 4: Comparison between Group I&II aortic clamp time and bypass time

NYHA class was recorded before and 3 months after surgery for both groups (table 5) with average NYHA class 3 preoperative and 2.2 in post operative period for group I (P-value 0.0003) . In group II preoperative NYHA class was an average of 2.9 and post operative of 2.07 (P-value 0.0003). Comparing both groups in pre operative NYHA class no differences was found between group I, and II (P-value 0.67) also non significant P-value was found for NYHA class post operatively for both groups (P-value 0.08) no mortality was found in group I but 2 cases died in group II in early postoperative period.

Discussion

The study of this cohort patient revealed the incidence of significant coronary artery disease requiring CABG with valve surgery at the age of 40 years or above. In this study the incidence was 34%, this goes with the international publications where the range varied between 20-40% in the same group of patients1. In other series some3 reported a lower incidence in Chinese population as low as 2 patients with coronary artery disease out of 119 Chinese patients with mitral stenosis; others4 reported the highest incidence of ischemic heart disease with aortic stenosis 37% among patients with valve and coronary artery disease. In another study aortic regurgitation accompanying CAD represents 20% among the variety of valve lesions studied. Aortic valve disease represents 23% of the total valves with CAD in our study. In past at necropsy study13% was found to had a coronary artery disease out of 77 patient died after prosthetic valve replacement this was common in all ages but was more common after the age of 40 years5.

The American College of Cardiology (ACC)/American Heart Association (AHA) recommend that coronary angiography should be performed before valve surgery in men aged ≥ 35 years, women aged ≥35 with coronary risk factors and post menopausal women1 as mention before.

The prevalence of risk factors for atherosclerosis in our study were smoking 70%, hypertension 46%, dyslipidemia 28% and diabetes 28%.

The majority of the patients were with single vessel disease 41.1%, double vessel disease 52.9% and only 1 case with triple vessel disease also, others studied the same age group they found that single vessel disease represents 45% and multiple vessel disease 54%6.

Angina occurs commonly in valvular heart disease but does not necessarily signify the presence of CAD, this is particularly true in patients with aortic valve disease it also applies in those with mitral valve disease. In addition, there are some patients without angina who still have significant coronary obstruction. In patients being considered for valve surgery it is generally accepted that the presence of angina is an indication for coronary arteriography as part of the preoperative investigations6. In another study out of 42 patients with typical chest pain going to have valve surgery 19 of them had CAD and out of 20 patients with atypical chest pain 3 had CAD, this was done for 88 consecutive patients with AS requiring AVR 8 .

Group I (Valve+ CABG)								
Operation	MVR	AVR	DVR	total	MVR	AVR	DVR	total
	10	4	3	17	17	9	7	33
No of grafts	19	5	4	28				

Table 5 : Distribution og grafts in group I and valves used in both groups

	NYHA class			
	Group I (valve+CABG)		Group II (Valves Only)	
	Preoperative	postoperative	Preoperative	postoperative
Class I	0	8	0	20
Class II	3	9	11	10
Class III	11	0	14	1
Class IV	3	0	8	0

Table 5 : Distribution of cases according to NYHA in the 2 groups

A variable pathology was recorded in valve disease, rheumatic was found to be most common pathology in our group 88%, degenerative 10% infective endocarditis in 2 %. ; others found that the rheumatic valves was most common among this group as high as 70%1 and infective endocarditis as low as 4.9% this law incidence of recorded IHD with infective endocarditis patients may be attributed to the law trend to do coronary angiography in the presence of vegetation on aortic valve. Recently the risk of missing a diagnosis of IHD in patients undergoing valve surgery due to infective endocarditis could be avoided by using multislice CT angiography9 .The diagnoses of IHD with valve disease patients make management is more complex, the combined procedures are markers for increased operative mortality and decreased survival10 this is clear as patients with combined procedure are generally older have more functional disabilities, are more like to suffer from angina, have higher rate of myocardial infarction5.In this study no recorded mortality in combined group of surgery (group I) this possibly due to relatively lower mean age group than other reporters 11,12,13,14 but none of our patient was over 70 years; Also mitral incompetence due to previous MI carries a high risk in combined surgery than does other valve pathology15. Ischemic mitral incompetence was an exclusion criterion in our study also in combined group of surgery no residual mitral regurgitation as the patients were managed by prosthetic valve replacement. Residual mitral regurgitation greatly affect the outcome of the operation in case of mitral repair 16, more over the 0% mortality in our combined group (group II) maybe due to exclusion of emergency cases from our study as well. Emergency valve surgery with CABG carries a high operative risk 15, 16

One of the factors yield the surgeon a good results regarding the mortality is the complete revascularization in all patients. The complete revascularization was found to be an important factor for successful operation rather than the number of the grafts performed17 only 2 coronary arteries of non significant lesions were left alone in 2 patients with other revascularized vessels in group I.

The revascularization was done using saphenous vein in all patients. Others18, 19 used saphenous vein graft predominantly in AVR-CABG operations. In a study of 50 patients none of them received IMA in combined surgery of CABG and valve replacement20.

This group of patients had the distal anastomosis while beating on pump this makes the bypass time longer in group I than in group II, but the aortic clamp was not statistically different in both groups, this in particular will help in patient with poor left ventricular function where short ischemic time is recomended21. Partial clamp of the aorta was used to achieve the proximal anastomosis .Others used radial artery, IMA end to side anastomosis as T-shaped graft to avoid partial clamp of the aorta and reduce the risk of embolization22. Despite of that karthik23 reported that the left internal mammary artery doesn't adversely affect the short-term and medium-term outcomes in patients undergoing concomitant coronary and valve operations. Survival at 7 years was similar with or without the use of IMA.

The significant improvement was noticed in both groups considering the NYHA class preoperative and postoperative in both groups. Also no significant difference in both groups post operatively. The other differences as hospital stay, ICU stay, and ventilation hours were not recorded as it depends on the hospital circumstances and variability factors in anesthesia. Others reported that class III, IV associated with decreased late survival rate 19, 24.25. The follow up in our group was short for 3 month. The recorded 2 mortality was in group II, one was a female patient with mitral stenosis and high pulmonary artery pressure, the other patient was male with double stenosis pathology lesion, both died early in ICU post operative.

Co nclusion: From previously mentioned data we can conclude that the valve lesions in patients at the age of 40 years

or above may be accompanied by coronary artery stenosis as well. Coronary angiography is recommended for this group of patients. This combined pathology could be managed surgically with as good results as valve lesion alone.

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Perioperative cardiac troponin I to assess the effect of warm reperfusion dose at the end of the proximal anastomosis of coronary artery bypass graft on the myocardium.

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Background: **Cardiac troponin I (cTnI) is a highly sensitive and specific marker for postoperative detection of differences in myocardial injuries after coronary interventions. This study was done to compare between cold blood cardioplegia and cold blood cardioplegia followed by a hot shot during cardiopulmonary bypass in coronary artery bypass grafting (CABG) patients using cardiac troponin I (cTnI) as the criteria for evaluating the adequacy of myocardial protection.**

Methods: **From May 2007 to February 2010, 86 patients underwent conventional on pump CABG at El Hussein hospital, Al Azhar University. In our prospective study, patients was divided into 2 groups, group A (n=40) in which we used cold blood cardioplegia without reperfusion dose, while group B (n=46) we used cold blood cardioplegia with reperfusion warm dose at the end of proximal anastomosis. Blood samples were taken from all patients before operation, 6, 24, 48 hours and 6th day postoperative for determination of serum cardiac troponin-I level.**

Results: **The level of cTnI in both groups increased 6, 24 and 48 hours postoperative compared with preoperative level, and this indicates that in both groups the myocardium was injured. The value reached peak in 24 hour and returned to basal levels on the 6th postoperative day. Compared with group A, the serum concentration of cTnI in group B was significantly lower at 6, 24, 48 hours and 6 days**

Conclusion: **The level of cTnI in conventional CABG patients was significantly reduced with the use of cold blood cardiolplegia followed by hot shot in comparison with the use of simple cold blood cardioplegia without hot shot. The results suggests that the use of additional hot shot after myocardial preservation by cold blood cardioplegia in patients undergo conventional CABG reduces the leakage of cTnI.**

The ideal method for protection of the myocardium during ischemic time has been debated since the very early beginning of CABG. The significance of release of cardiac injury markers after coronary interventions has long been debated. Especially after coronary artery bypass grafting (CABG), cardiac biomarker release is multifactorial (1). First, after the operation, the elevation of serum concentrations of cardiac enzymes is caused partly by enzyme release from tissues other than the heart, and cannulation of the heart may lead to biomarker release not caused by ischemia (2). Second, at least two types of ischemic phenomena; global ischemia during aortic cross clamping and regional ischemia due to graft or native vessel occlusion may cause cardiac marker release after the operation, and it is conceivable that they are associated with prognosis to differing extents. Many studies evaluated the myocardial protection with different types and methods of cardioplegia induction by giving simple cold blood cardioplegia during cardiopulmonary bypass and using cardiac troponin (I or T) as the criteria for evaluating the adequacy of myocardial protection (3,4,5).

Troponin is the inhibitory or contractile regulating protein complex of striated muscle. It is located periodically along the thin filament of the muscle and consists of three distinct proteins: troponin I, troponin C, and troponin T. Likewise, the troponin I subunit exists in three separate isoforms; two in fast-twitch and slow-twitch skeletal muscle fibers, and one in cardiac muscle. The cardiac isoform (cTnI) is about 40% dissimilar, has a molecular weight of 22,500 daltons, and has 31 additional amino acid residues that are not present on the skeletal isoforms. Antibodies made against this cardiac isoform are immunologically different from antibodies made against the other two skeletal isoforms, and the unique isoform and tissue specificity of cardiac troponin I is the basis for its use as an aid in the diagnosis of acute myocardial infarction (6) .Myocardial infarction is diagnosed when blood levels of sensitive and specific biomarkers, such

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as cardiac troponin, the MB isoenzyme of creatine kinase (CK-MB), and myoglobin, are increased in a clinical setting of acute ischemia. The most recently described and preferred biomarker for myocardial damage is cardiac troponin (I or T). The cardiac troponins exhibit myocardial tissue specificity and high sensitivity. The level of cTnI remains elevated for a much longer period of time (6-10 days), thus providing for a longer window of detection of cardiac injury. Normal levels of cTn I in the blood are very low. After the onset of an AMI, cTnI levels increase substantially and are measurable in serum within 4 to 6 hours, with peak concentrations reached in approximately 12 to 24 hours after infarction (7).Cardiac troponin-I (cTnI) has been introduced in clinical work to test myocardial injury, showing higher specificity and sensitivity than other routinely used biochemical markers of cardiac damage and also it has been used to assess the effectiveness of different methods of myocardial protection. The advent of highly sensitive and myocardial tissue specific serologic biomarkers, such as cardiac troponins (I and T), have recently lead to a redefinition of myocardial infarction initiated by the European Society of Cardiology and the American College of Cardiology/ American Heart Association (8).

Methods:

From May 2007 to February 2010, 86 patients underwent conventional on pump CABG at El Hussein hospital, Al Azhar University. In our prospective study, patients was divided into 2 groups, group A (n=40) in which we used cold blood cardioplegia without reperfusion dose, while group B (n=46) we used cold blood cardioplegia with reperfusion warm dose at the end of proximal anastomosis.

All the patients were multi-vessel coronary artery disease receiving first do CABG without valve disease with an ejection fraction above 0.5 and no recent myocardial infarction (>2 months). The left internal mammary artery was used in all patients. The distal and proximal anastomoses were done using single aortic cross clamping technique. Our surgical approach was always a median sternotomy. Heparin was given (300 U/Kg), and cardiopulmonary bypass (CPB) was established with ascending aorta and two-stage venous cannulation using moderate hypothermia (28-32°C), a centrifugal pump, and uncoated tubing system with membrane oxygenator. Myocardial protection was achieved using antegrade cold blood cardioplegia. Intraoperative heparin monitoring was by standard activated clotting time (ACT). Additional heparin boluses (5000 U) were given if the ACT values were less than 400 seconds. Protamine sulfate was administered to reverse heparin. Cardiopulmonary bypass was used at a flow rate of 3.5 – 5.0 l/min. Mean arterial pressure was maintained 60 - 85 mmHg by adjusting blood flow rate. Infusion of cold blood cardioplegia was done in both groups immediately after cross clamping. The cold blood cardioplegia solution formed of potassium chloride (20 mEq/L) , lidocaine (100 mg/L) and sodium bicarbonate (20 mEq/L). The route of delivery was exclusively antegrade in the two groups. The temperature of cardioplegia ranged from 4 to 6 °C. The first dose of cardioplegia infused over 4 minutes with the same infusion rate (150-200 ml/min) for all patients of both groups and repeated every 20 minutes with half dose with the same rate of perfusion.At the completion of all proximal anastomosis, all patients in group B receive a hot shot for 3 to 5 minutes followed by a continuous infusion of non cardioplegic warm normal blood into the aortic root while the cross-clamp is still in place at a flow of 300 to 350 ml/min and with pressure 80 mm Hg. The aortic clamp is released within 5 minutes after adequate contractility is observed.The warm blood cardioplegia solution is the same solution used in cold blood cardioplegia solution, but the dose of KCl is reduced to 10 mEq/L. Blood samples were taken from all patients before operation, 6,24,48 hours and 6th day postoperative for determination of serum cardiac troponin-I level. Cardiac troponin-I concentrations were measured by sandwich Enzyme-Linked Immunosorbent Assay (ELISA) (9).Serum samples are pippetted into wells. Unbound Troponin I and other components of the sample are removed by washing, then biotin-conjugated monoclonal antibody specific to troponin I is added. In order to quantitatively determine the amount of troponin I present in the sample, Avidin conjugated to Horseradish Peroxidase (HRP) is then added to each microplate well. Next, a tetramethyl- benzydine -substrate solution is added to each well. Finally, a sulfuric acid solution is added and the resulting yellow colored product is measured at 450nm.

Results:

Statistical analysis was completed with SPSS statistical version 9.0. T-test was used for analysis of two quantitative variables. Statistical significance was accepted at a $P<0.05$. All data are expressed as mean±standard deviation (S.D.)

Variables	Group A (40)	Group B (46)	P-value
Age (years)	55±7.2	52±6.8	>0.05
Sex(M\F)	29\11	31\15	>0.05
Ejection fraction (EF%)	52±7	55±8	>0.05
Cardiopulmonary bypass(CPB) time (min)	90±14	93±12	>0.05
Aortic cross clamp time(ACCT) (min)	68±11	70±9	>0.05
Graft number	2.8±0.5	3.0±0.6	>0.05
Intra-aortic balloon pump insertion after CPB weaning (cases)	5	4	>0.05

Table 1: Preoperative and operative characteristics of the two groups of patients

Preoperative and operative data are shown in Table 1. The preoperative status was nearly identical in the two groups according to age, sex ratio and ejection fraction (EF %). In the operative data there was no significant difference between the two groups in cardiopulmonary bypass time, clamp time, graft number and intra-aortic balloon pump insertion after CPB weaning

Variables	Group A (40)	Group B (46)	P-value
Ventillation time (hours)	22±8	14±5	<0.05
Resternotomy for bleeding(cases)	5	6	>0.05
Mediastinal drainage 24 hours(ml)	850±105	810±110	>0.05
Renal failure (cases)	4	5	>0.05
Intensive care unit stay (days)	4±1	2±1	<0.05
Ejection fraction (EF%)	50±6	57±8	<0.05
Hospital stay (days)	14±7	10±5	<0.05

Table 2: Postoperative data of the two groups of patients

In the postoperative data there was no significant difference between the two groups in resternotomy for bleeding, mediastinal drainage 24 hours and renal failure. Ventillation time, intensive care unit stay and hospital stay were significantly lower but ejection fraction was significantly higher in group B compared to group A.

Variables	Group A (40)	Group B (46)	P-value
cTnI preoperative	0.5±0.31	0.46±0.27	>0.05
cTnI 6 hours	3.78±1.9	2.46±1.7	<0.05
cTnI 24 hours	7.35±3.25	5.12±3.73	<0.05
cTnI 48 hours	3.46±1.42	1.96±0.97	<0.05
cTnI 6 days	0.58±0.37	0.43±0.21	<0.05
Ejection fraction (EF%)	50±6	57±8	<0.05
Hospital stay (days)	14±7	10±5	<0.05

Table 3: Concentration of cTnI(ng/ml) during the period of study of CABG patients

The level of cTnI in both groups increased postoperative 6, 24 and 48 hours compared with preoperative level, and this indicates that in both groups the myocardium was injured. The value reached peak in 24 hours and returned to basal levels on the 6th postoperative day. Compared with group A, the plasma concentration of cTnI in group B was significantly lower at 6, 24, 48 hours and 6 days.

Discussion:

There is an importance of technical modifications and efforts for protection of the myocardium during ischemic time of CABG patient. Newer markers of myocardial cell necrosis, most notably cardiac troponins, fundamentally improved the clinical diagnostic criteria for assessment of myocardial state. Cardiac troponin-I is a specific and sensitive marker of myocardial injury. CTnI was found exclusively in cardiac muscle and clearly was different from skeletal isoforms, so making it a specific marker for myocardial damage. This specificity is particularly beneficial for patients undergoing cardiac surgery because the value of measurements of serum creatinine kinase and lactate dehydrogenase is limited by enzyme release from non cardiac tissues (6 ,10).

In the present study, the level of cTnI in both groups increased postoperative 6, 24 and 48 hours compared with preoperative level, and this indicates that in both groups the myocardium was injured. The value reached peak in 24 hours and returned to basal levels on the 6th postoperative day. Compared with group A, the plasma concentration of cTnI in group B was significantly lower at 6, 24, 48 hours and 6 days

Our data showed a significant higher grade of myocardial protection exerted by warm reperfusion in comparison to simple blood cardioplegia induction without reperfusion dose. This finding supports the hypothesis of a high protective effect of reperfusion. Warm reperfusion accelerated myocardial metabolic recovery, preserved high-energy phosphates, improved the metabolic response to postoperative hemodynamic stresses, and reduced left ventricular pressures

In accordance to these results Teoh, et al (11) compared cold blood cardioplegia to cold blood cardioplegia followed by a 'hot shot' They showed that with the hot shot, myocardial metabolic recovery was improved, high-energy phosphates were better preserved, metabolic response to stress was normal, and diastolic function was preserved. Reperfusion damage is thought to be caused in part by oxygen free radicals produced during the early phases of reoxygenation. The hot shot improves cold blood cardioplegia protection by washing out the products of anaerobic metabolism.

Consistent with these results In Caputo's study (12), patients undergoing primary elective coronary revascularisation were randomized to one of two different techniques of myocardial protection. The data suggest that warm blood hyperkalemic reperfusion hot shot prevents myocardial metabolic derangement seen during coronary artery surgery.

Therefore, it is acceptable that hypothermia has been routinely used as it reduces oxygen demand by decreasing the basal metabolic rate. However, hypothermia may have side effects like 'cold contracture' of microcirculation in coronary arteries to cause additional ischemia and reperfusion injury. Rapid cooling during cardioplegia increasing left ventricular pressure, Ca2+ and coronary resistance, and is energy consuming , inhibiting the sodium pump to cause edema, and shifting the oxygen–hemoglobin dissociation curve leftward .So warm induction reduces damage by avoiding cool contracture (3).

In addition, Li et al (4) found that cold blood cardioplegia with warm induction was clearly better than simple cold blood cardioplegia induction.

Also De Paulis et al (13) investigates the effect of temperature of blood cardioplegia and systemic perfusion on the release of troponin I and other biochemical markers and they found that both strategies of myocardial protection and systemic perfusion guarantee subclinical minor myocardial damage, The strategy of tepid whole blood cardioplegia and mild systemic hypothermia seems to preserve myocardium better than whole blood cold cardioplegia.

Conclusion:

The level of cTnI in conventional CABG patients was significantly reduced with the use of cold blood cardiolplegia followed by hot shot in comparison with the use of simple cold blood cardioplegia without hot shot. The results suggests that the use of additional hot shot after myocardial preservation by cold blood cardioplegia in patients undergo conventional CABG reduces the leakage of cTnI.

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Towards better interpretation of transit time flow measurement: analysis of 2640 grafts

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Objective: **Despite its high negative predictive value, the positive predictive value of transit time flow measurement was found to be low. This necessitates good judgment by the surgeon, who should take in consideration the confounding factors influencing the measurement. This is particularly important when taking the decision to revise a graft with unsatisfactory transit time flow values. The objective of this work is to study these factors.**

Methods: **The study included 1171 patients with isolated on-pump CABG. The total number of bypass grafts was 2640 (2.25 ± 0.8 grafts per patient). Tukey-Kramer HSD test was used to compare the measurements in different coronary artery territories. Multiple regression models for the mean flow and pulsatile index were calculated.**

Results: **The mean flow in all grafts was 42.5 ± 25.8 and the pulsatile index was 1.93 ± 1.18. Tukey-Kramer HSD test and the multiple regression model revealed significantly higher mean flow in the grafts to the right coronary artery and significantly lower mean flow in the grafts to the diagonal artery. Both test revealed significantly lower pulsatile index in the grafts to the right coronary artery. According to the multiple regression model, other factors influencing the mean flow were bypass material, gender, total number of grafts, ejection fraction, operating surgeon and preoperative adrenaline. Apart of minimal influence of gender, none of these factors influenced the pulsatile index according to its multiple regression model. Comparing the flow values in patients with postoperative myocardial infarction with those without, no statistically significant differences were found.**

Conclusions: **Factors influencing the flow measurement should be taken in consideration during interpretation of the measured values. Proper interpretation and the correct decision to revise the graft are essential to minimise the avoidable postoperative cardiac events while avoiding revising properly performed grafts.**

Cardiovascular

Transit time flow measurement (TTFM) has established itself as a suitable method for routine intraoperative functional graft evaluation. Its predictive value for postoperative graft patency has been demonstrated [1-3]. Nevertheless, assessment of graft patency with TTFM alone may prompt unnecessary graft revision [4]. Despite its high negative predictive value, the positive predictive value of TTFM was found to be low. Therefore, even if a surgeon sees an abnormal TTFM value, there is a strong chance (1 – positive predictive value) that there is no anastomotic problem in the graft [3].

Accordingly, the decision to revise a graft with unsatisfactory TTFM values, should be always left to the surgeon's judgment. Visual assessment of the anastomosis, size of the coronary artery and its importance play the major role in taking such a decision. However, patient-related and operation-related factors can influence the values of TTFM. Accordingly, these factors should be taken in consideration when the surgeon is confronted with unsatisfactory TTFM.

Confounding factors influencing the TTFM have not been adequately studied. Based on the long experience with routine TTFM, these factors are studied by analyzing more than two and half thousands of grafts performed in a homogenous group of patients representing the daily practice in most cardiac surgical facilities.

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Methods:

Transit time flow measurement of bypass grafts has been performed routinely in all case of CABG since the end of 1998. All the measurements from January 1999 till

December 2008 were analyzed. Patients with sequential grafts, T-grafts and OPCAB were excluded from the analysis.

After applying these exclusion criteria 1171 patients with isolated CABG were included in the study. The total number of bypass grafts was 2640 (2.25 ± 0.8 grafts per patient). The low number of grafts per patient is caused by the exclusion of patients with sequential grafts, a common technique at our institute in multivessel cases.

All patients have signed an informed consent for the operation and for quality control measures including flow measurements.

Operative procedures:

Cardiopulmonary bypass was performed under systemic normothermia and cardiac arrest was achieved with cold hyperkalemic blood. Internal mammary artery grafts were harvested skeletonised. Papaverine was sprayed over the mammary artery at the end of the harvesting.

Both distal and proximal anastomoses were performed during a single period of aortic occlusion.

Grafting was performed on all vessels measuring more than 1.5 mm in diameter with 70% or greater stenosis.

Transit time flow measurement:

The theoretical basis of TTFM has already been reported [5]. The flow measurement was taken in all bypass grafts before reversal of heparin. The same device was used in all cases; Transonic Flow Measurement HT311 (Transonic Systems Inc, Ithaca, NY), with probes measuring between 2 and 4 mm in size to fit perfectly around the graft.

Measurements were taken under stable systolic blood pressure above 100 mmHg.

The decision to repeat the graft depending on unsatisfactory values was left to the surgeon's judgment. Generally speaking, grafts with pulsatile indices higher than 5 were repeated. Higher values were tolerated in small and, taking the angiography in consideration, less important target coronary arteries. Forty seven grafts were revised in 45 patients. The values after repeating the grafts were taken in the analysis.

The mean flow in milliliters per minute and the pulsatile index expressed as an absolute number were recorded.

Statistical analysis:

The mean flows and the pulsatile indices were expressed as mean ± SD. A univariable analysis using Tukey-Kramer HSD test was performed to compare the measurements in different coronary artery territories. Student t-test was performed to compare the measurements according to the gender and to compare the patients who had postoperative myocardial infarction with those who had not.

To study all factors influencing the flow in the bypass grafts multiple regression models for the mean flow were calculated. Initially 23 variables were studied. Further models were obtained by excluding the factors with P value more than 0.25 in a stepwise way. The final model was obtained when no further decrease in the Akaike Information Criterion was observed (AIC= deviance of the model + 2 x number of included parameters).

Factors influencing the pulsatile index were analyzed similarly. In order to demonstrate the importance of the pulsatile index as an indicator for anastomotic quality, after obtaining the last model, a final model was calculated by re-inclusion of those factors which were found to influence the mean flow and were excluded during the stepwise calculations of the pulsatile index model. This last step did not change the statistical significance of the factors included in the model obtained using the AIC.

All statistics were obtained by the version 5 of the JMP® software (SAS Institute Inc.).

Results:

The number of grafts to every coronary artery is shown in table 1. The mean flow in all grafts was 42.5 ± 25.8 and the pulsatile index was 1.93 ± 1.18. The mean flow and pulsatile index in every coronary artery are shown in tables 2 and 3 respectively. The distribution of the measured data is shown in table 4.

	LIMA	RIMA	Radial	Vein	All
LAD	1061	0	0	69	1130
Diagonal	97	0	58	242	397
OM	0	21	103	406	530
RCA	0	29	49	505	583
All	1158	50	210	1222	2640

Table 1: Number of grafts according to the target coronary arteries and bypass materials:
LIMA= Left Internal Mammary Artery, RIMA= Right Internal Mammary Artery, LAD= Left Anterior Descending, OM= Obtuse Marginal, RCA= Right Coronary Artery

Among the patients included in the study there were 308 females (26.3 %). The mean flow and pulsatile index in female patients were 40.3 ± 23 ml/minute and 1.76 ± 0.72 respectively. The mean flow and pulsatile index in male patients were 43.2 ± 26.7 ml/minute and 2 ± 1.3 respectively. The differences in mean flow and pulsatile index were statistically significant ($P < 0.01$ for both).

Comparing the four coronary arteries (left anterior descending, diagonal, obtuse marginal and right coronary artery) in all patients using Tukey-Kramer HSD test reveals significant differences in mean flow between all pairs except between the left anterior descending and the obtuse marginal coronary arteries (table 5). The same test reveals significantly lower pulatile index in the right coronary artery grafts in comparison to grafts to other coronary arteries. There are no significant differences in pulsatile index between grafts to left anterior descending, diagonal and obtuse marginal coronary arteries (table 6).

Level	- Level	Difference	Lower CL	Upper CL
RCA	Diagonal	9.99	5.63	14.35
LAD	Diagonal	6.23	2.32	10.13
OM	Diagonal	5.86	1.35	10.37
RCA	OM	4.13	0.11	8.16
RCA	LAD	3.77	0.43	7.11
LAD	OM	0.37	-3.17	3.9

Table 5: Comparisons of mean flow (ml/minute) for all pairs using Tukey-Kramer HSD:

Level	- Level	Difference	Lower CL	Upper CL
Diagonal	RCA	0.32	0.12	0.52
OM	RCA	0.32	0.14	0.51
LAD	RCA	0.3	0.15	0.46
Diagonal	LAD	0.02	-0.16	0.2
OM	LAD	0.02	-0.15	0.18
Diagonal	OM	0	-0.21	0.21

Table 6: Comparisons of pulsatile index for all pairs using Tukey-Kramer HSD:

	LIMA	RIMA	Radial	Vein	All
LAD	41.8±24.7	-	-	49.1±25.8	42.6±24.9
Diagonal	26.8±15.1	-	44.4±27.8	40.1±22.1	36.4±22.3
OM	-	34.9±26.5	39.3±25.1	43.6±24.9	42.2±25.1
RCA	-	39.8±22.4	47.8±31.1	46.4±29.2	46.4±29.2
All	40.3±24.5	37±24.8	42.1±27.7	44.7±26.5	42.5±25.8

Table 2: Mean flow (ml/minute) according to the target coronary arteries and bypass materials:

	LIMA	RIMA	Radial	Vein	All
LAD	2.02±1.16	-	-	1.76±0.68	1.99±1.13
Diagonal	2.44±1.36	-	2.03±0.85	1.81±0.74	2.01±0.1
OM	-	2.18±1.3	2.16±1.48	1.96±1.2	2.01±1.26
RCA	-	2.01±1.9	1.61±0.94	1.68±1.31	1.69±1.3
All	2.05±1.19	2.13±1.54	1.99±1.22	1.8±1.14	1.93±1.18

Table 3: Pulsatile index according to the target coronary arteries and bypass materials:

	LAD (MF / PI)	Diagonal (MF / PI)	OM(MF / PI)	RCA (MF / PI)	All (MF / PI)
2.5% Quantile	11.3 / 0.8	9 / 0.89	10.2 / 0.77	10.6 / 0.6	10.4 / 0.71
25% Quartile	25 / 1.44	20.6 / 1.4	24.1 / 1.33	24.8 / 1.01	24.1 / 1.32
Median	36.8 / 1.77	36.6 / 1.76	2.16±1.48	40.7 / 1.38	36.7 / 1.71
75% Quartile	53.4 / 2.22	55.5 / 2.28	1.61±0.94	58.6 / 1.91	54 / 2.2
97.5% Quantile	109.5 / 4.47	103.4 / 5.74	1.99±1.22	122.5 / 4.92	112 / 4.89

Table 4: Distribution of mean flow (ml/minute) and pulsatile index according to the target coronary arteries

The multiple regression model for the mean flow (table 7) reveals independently higher flow in the right coronary artery and independently lower flow in the diagonal coronary artery. The multiple regression model for the pulsatile index (table 8) reveals independently lower pulsatile index in the right coronary artery.

Forty seven grafts in 45 patients were revised (1.8 % of all grafts). Data about the measurements before revision of the grafts were missing for 9 grafts. In the other 38 grafts, the mean flow and pulsatile index improved after revision from 4.6 ± 1.6 ml/minute to 32.7 ± 17.7 ml/minute and from 7.16 ± 1.46 to 2.84 ± 1.12 respectively (P< 0.01 for both). In only 2 grafts the improvements in both mean flow and pulsatile index were less than 50%.

Term	Estimate	SE	t Ratio	P value
Intercept	75.24	4.46	16.86	<0.001
Diagonal	-3.93	1.05	-3.76	<0.001
RCA	5.31	1.33	4.01	<0.001
LIMA	-4.94	1.7	-2.91	0.004
Radial	3.43	1.66	2.07	0.039
No. of grafts	-2.4	0.63	-3.83	<0.001
Female	-5.73	1.17	-4.89	<0.001
Age	-0.07	0.05	-1.35	0.173
EF	-0.18	0.03	-5.5	<0.001
PI	-6.22	0.42	-14.93	<0.001
Preop. Adrenaline	5.76	2.28	2.53	0.012
Surgeon (B)	4.62	1.31	3.54	<0.001
Surgeon (C)	-3.27	1.04	-3.15	0.002

Table 7: Factors influencing the bypass flow in bypass grafts:

Term	Estimate	SE	t Ratio	P value
Intercept	2.68	0.22	12.34	<0.001
Diagonal	-0.02	0.05	-0.32	0.752
RCA	-0.1	0.03	-2.9	0.004
LIMA	0.08	0.08	0.94	0.347
Radial	-0.02	0.08	-0.33	0.738
No. of grafts	0.02	0.03	0.57	0.567
Female	-0.24	0.06	-4.33	<0.001
Age	0	0	-0.42	0.676
EF	0	0	-0.02	0.987
MF	-0.01	0	-14.93	<0.001
Preop. Adrenaline	-0.01	0.11	-0.08	0.935
Surgeon (B)	-0.07	0.06	-1.08	0.278
Surgeon (C)	0.13	0.05	2.54	0.011

Table 8: Factors influencing the pulsatile index in bypass grafts:

During the first postoperative week, 14 patients (1.2 %) developed myocardial infarction (defined by the elevation of creatine phosphokinase-MB fraction more than 50 U/L with the appearance of new Q waves in the ECG). The mean flow in the bypass grafts of these patients was 37.2 ± 21.8 ml/minute and the pulsatile index was 1.82 ± 0.87. Comparing these values with those of patients without postoperative myocardial infarction revealed no statistically significant differences (P= 0.157 and P= 0.463 respectively).

Discussion:

TTFM has been used for more than a decade to assess the quality of the anastomosis in CABG. Nowadays, it is the method most commonly used for intraoperative graft evaluation. However, because of its low positive predictive value [3] surgeons should take unsatisfactory TTFMs with caution. In an experimental model, Nordgaard et al [6] were able to demonstrate low mean flow and high pulsatile index in the absence of stenotic anastomosis. To take the decision to repeat an anastomosis, surgeons should be aware of the factors influencing TTFM. The current study could demonstrate these factors based on the analysis of measurements of 2640 grafts.

Patients with T-grafts and those with sequential anastomoses were excluded from the study. Inclusion of these grafts would have complicated the statistical analysis. It is reasonable to believe that the findings of the current study apply equally to these grafts. Gwozdziewicz et al [7] could demonstrate that the blood flow through an individual bypass is comparable with that through the distal segment of a sequential bypass.

In order to investigate a homogenous group of patients OPCAB patients were excluded from the analysis. During the last years, we have been increasingly performing OPCAB with aorta-no-touch technique, necessitating T-grafts and sequential anastomoses. The literature about TTFM in OPCAB in comparison with on-pump CABG reveals controversial results. Onorati et al [8] and Kjaergard et al [9] found similar flowmetric results in both groups. Schmitz et al [10] reported markedly lower flows in OPCAB than in on-pump cases. Balacumaraswami et al [11] found similar flow in both groups in arterial grafts but lower flow in saphenous vein grafts in OPCAB cases. The comparative study with the highest number of OPCAB grafts was done by our group [12]. In a case matched study, we found similar flow in both groups in LAD and lower flow in the other coronary arteries. We believe that the learning curve plays an important role in the anastomotic quality and subsequently the flow measurement in OPCAB.

The results of the current study show significantly lower flow in grafts to the diagonal coronary artery in comparison with those to other coronaries. This finding was also reported in other studies [13-15]. A likely explanation for the lower flow is the smaller diameter of the diagonal coronary artery. The coronary artery with significantly higher flow and lower pulsatile index was the right coronary artery. These findings are consistent with a previous study from our group [14]. Similarly, Hirotani et al [1] found significantly higher flow in right internal mammary artery when bypassed to the right coronary artery than when it was bypassed to either the diagonal or the

circumflex region. Tokuda et al [3] investigated optimal cutoff values for mean flow and pulsatile index to predict early graft failure. The cutoff value for mean flow was higher in grafts to the right coronary artery (20 ml/min. vs. 15 ml/min. for the left coronary arteries). Meanwhile, the cutoff value for the pulsatile index was lower in grafts to the right coronary artery (4.7 vs. 5.1 for the left coronary arteries). Surprisingly, Nordgaard et al [13] found higher pulsatile index in grafts to the right coronary artery. Actually, the finding of the current study that the pulsatile index in grafts to the right coronary artery is lower that those to the left coronary system, is consistent with the physiological facts. In contrast to the phasic nature of blood flow in the left coronary artery, blood flow in the right coronary artery is relatively constant during the cardiac cycle. The constancy of blood flow is related to the lower intramural pressures and near absence of extravascular compressive forces in the right ventricle compared with the left ventricle [16]. Inverse relation between the muscle mass and the extravascular compression forces can explain the finding of the current study regarding the inverse relation between ejection fraction and the mean flow. This finding was also reported by Nordgaard et al [13].

The results of the current study show negative influence of the usage of left internal mammary artery on the mean flow. A similar finding was noticed in other studies [11,13]. Reports about lower flow in the mammary grafts may not be understood as a disadvantage of the internal mammary artery. Some degree of spasm caused by manipulation during the measurement cannot be excluded. In contrary to the above mentioned studies, Hirotani et al [1] reported higher flow in internal mammary than in vein grafts. Royse et al [17] reported that total arterial revascularization using a composite graft provided a 2-3 fold increase of reserve blood flow to the coronary vascular bed. Over the last few years, total arterial revascularisation, using exclusively bilateral internal mammary arteries in a T-graft configuration, has become our standard coronary bypass operation. The results are very encouraging and we reported our experience in a subgroup of our patients [18].

One of the interesting finding in the results of the current study is the influence of the operating surgeon on the mean flow but not on the pulsatile index. A possible explanation is the way of manipulating the grafts with the subsequent spasm.

The negative influence of total number of grafts can be explained by the fact that more grafts are done in patients with more diseased coronary vessels. Those patients have commonly more collaterals, and subsequently more competitive flow reducing the flow in their bypass grafts.

Preoperative adrenaline was associated with higher mean flow. Adrenaline was given preoperatively mainly in patients with acute ischemia. When the preoperative ischemia is added to the cross clamp time, those patients have total ischemic time significantly longer than the other patients. The flow was measured during the early period of postischemic reperfusion. Kalweit et al [19] demonstrated early decrease followed by late increase in coronary resistance during postischemic reperfusion. This early decrease in coronary resistance can explain the finding that preoperative adrenaline positively influence the mean blood flow.

There was significantly lower mean flow in female patients. The smaller diameter of coronary arteries in females can explain this finding, which was reported in other studies [9,13,14].

As shown in the results, many factors influenced the mean flow. In contrary, apart of minimal influence of gender, none of these factors influenced the pulsatile index. This confirms its importance and superiority over mean flow as a marker of anastomotic quality.

Studies addressing the he relation between transit time flow measurement and in-hospital outcome are few. Bauer et al [20] reported that the implication of TTFM lead to significant reduction of the incidence of postoperative ventricular fibrillation. Herman et al [21] demonstrated that patients with abnormal flow in at least one graft have worse hospital outcome. Nineteen percent of their patients had abnormal flow in at least one graft. They defined abnormal flow as pulsatile index higher than 5. In the current study, there were no significant differences in flow measurements in patients with postoperative myocardial infarction in comparison with those who had no infarction. By revising 1.8 % of the grafts, less than 2.5 % of our patients had, according to the definition adopted by Herman et al [21], abnormal flow. The percent of the revised grafts is a little lower than reported in the literature (2.2 % [15] and 3.2 % [22]). Unlike both studies, off-pump cases were not included in the analysis. Needless to say, only 14 patients with postoperative infarction are too few to reach a conclusion. Nevertheless, other result would have been surprising. The cases of postoperative infarction would not have been avoided through better interpretation of TTFM.

In conclusion, factors influencing TTFM should be taken in consideration in interpretation of the measurements. Proper interpretation and the correct decision to revise the graft are essential to minimise the avoidable postoperative cardiac events while avoiding revising properly performed grafts.

Limitations:

Including a large number of grafts in the analysis was only possible in a retrospective study, which has important limitations. It was not possible to obtain accurate data about important factors and include them in the analysis. Most important of these factors are size of the target coronary artery, size of the bypass graft and the presence of collaterals. Although these factors have not been adequately studied, the surgeon should be aware that these factors logically influence the flow in bypass grafts.

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Emergency left ventricular thrombectomy Report of 5 cases

Bakir M Bakir, MD.

Emergency left ventricular thrombectomy was carried out on 5 patients. Three after acute myocardial infarction and two patients without obvious cardiac disease. In four patients, surgery was done after peripheral embolization has occurred. Four patients had an uneventful recovery and one patient died because of mesenteric vascular occlusion. These cases indicate that left ventricular thrombectomy is an option for management of patients with mobile , pedunculated thrombi especially for those with previous embolization.

Left ventricular thrombus has been reported in the setting of acute myocardial infarction, L.V. aneurysm, cardiomyopathy and myocarditis (1).Other rare causes include protein C deficiency (2), hyper-eosinophilic syndrome , antiphospholipid syndrome (3), Sipples syndrome (4) . Reports of LV thrombi without any obvious cardiac disease have also been reported in the literature (5). The likelihood of developing a thrombus after an acute myocardial infarction (M.I.) varies with infarct location and size being most often seen in large anterior ST elevation myocardial infarctions (STEMI).

The greatest incidence is being encountered in the reperfusion era, as evidenced by the GISSI-3 database of 8326 most of them were treated with thrombolytic therapy. L.V. thrombus was present in 5.1% of patients overall: 11.5% of those with an anterior wall infarction and 2.3% of those with infarctions at other areas (6). Transthoracic echocardiography has been the standard procedure for the diagnosis of L.V. thrombi after acute myocardial infarction. However, recent studies suggest that cardiac magnetic resonance imaging may be more sensitive (7). L.V. thrombi can be of 3 types: perimural, protruding, mobile or pedunculated. Mobile thrombi are rare compared to mural thrombi; but have a significantly higher risk of emobilization (8).

We report here 5 patients who underwent emergency left ventricular thrombectomy at King Fahad Cardiac Center, King Saud University: 3 patients after acute anterior myocardial infarction and two patients without any known cardiac pathology.

Case Reports:

1- The first patient was a 45-year old male patient who presented 10 days after acute anterior myocardial infarction with right lower limb ischemia, emergency femoral embolectomy was done and the patient was anticoagulated. However, he suffered another embolus in the left lower limb. Echocardiography revealed moderate L.V. dysfunction (E.F. 35%) in addition to 2 mobile thrombi floating in the left ventricle, the largest measuring 3x3.4 cm (fig 1). Coronary angiography revealed total occlusion of the LAD at its origin. He underwent emergency surgery to prevent further episodes of emobilization. LV thrombectomy in addition to CABG in the shape of LIMA to LAD were done 12 days after the anterior myocardial infarction.

2- The second patient was a 63 years old female patient who presented with severe chest pain, rise in myocardial enzymes, S-T segment changes in the anterior chest leads suggesting anterior myocardial infarction. The patient received thrombolytic therapy her coronary angiography revealed severe 3-vessel disease with a tight osteal LAD lesion. Echocardiography revealed mobile apical LV thrombi. The patient suffered no embolic manifestations, however, because of recurrent chest pain with E.C.G. changes, I.A.B.P. was inserted and the patient was taken to surgery 5 days after the acute M.I. and CABG x 3 was done in addition to removal of the L.V. thrombus.

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3- The third patient was a 58 years old male with 10 days history of anterior M.I. referred from another hospital. Echocardiography done 3 days after the M.I. revealed an E.F of 40% and there was no evidence of mural thrombi. The patient was transferred to our Center for further management. Coronary angiography was done revealing severe 3-vessel disease. 5 days later he started to have recurrent chest pain and E.C.G. changes and at the same time started to have severe abdominal pains. Echocardiography was repeated and revealed apical mural thrombi. Mesenteric vascular occlusion was suspected but due to the extremely critical condition of the patient, an I.A.B.P. was inserted and patient transferred immediately to the operating room where C.A.B.G.X 3 was done in addition to removal of L.V. thrombi. The patient had a C.T. abdomen done on the next day which revealed occlusion of the superior mesenteric artery with evidence of intestinal gangrene. Emergency Laparotomy was done which revealed gangrene of the whole bowel not amenable to surgical resection. This patient died 3 weeks later.

4- The fourth patient was a female 42 years old presented with ischemia of the right lower limb with occlusion at the level of the popliteal artery, emergency embolectomy was done. Transthoracic echocardiography revealed a large L.V. echogenic mass, freely mobile attached to the apex by a stalk measuring 3.5x2cm . Coronary angiography was done that surprisingly didn't reveal any coronary artery disease. The patient was transferred to the operating room for emergency thrombectomy. Based on the absence of any structural heart disease or hypercoaguable state, the mass was provisionally diagnosed as left ventricular myxoma. The final histopathology revealed the mass to be a thrombus.

5- The last patient was a 37 years old male patient admitted to the emergency room with sudden onset of bilateral lower limb pains with poor pulses in both legs. There was a history of amphetamine abuse for 15 years. Urgent C.T. revealed occlusion at the distal aorta with a thrombus. Bilateral femoral embolectomy was done. The patient had another episode of embolism in the right lower limb within 48 hours. Echocardiography showed a freely mobile mass in the left ventricular apex with hypokinetic anterior wall. Coronary angiography revealed a 70% lesion in the LAD. The patient was taken to the operating room for coronary bypass grafting and removal of a 1.5x 1.5 cm thrombus from the L.V. apex in addition to right popliteal artery embolectomy.

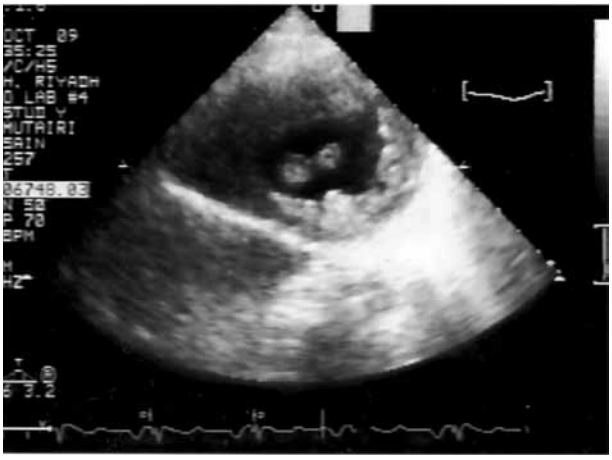

Fig (1): Short-axis view in mid cavity showing 2 mobile pedunculated echo-dense masses in the left ventricle, one of them measuring 3x3.4cm.

Surgical procedure:

All patients underwent median sternotomy, cannulation of ascending aorta, 2-stage venous cannulae for venous return was used for normothermic cardiopulmonary bypass with aortic cross clamp. The left ventricle was entered through the infarct area (if present), usually 2cm lateral and parallel to the LAD. The patients were anticoagulated for 6 months. No further episodes of embolization were encountered during the follow-up period.

Discussion:

Left ventricular mural thrombus is a well known complication of anterior STEMI. Thrombi are important clinically because they can lead to serious problems. L.V. thrombi are the major source of embolic stroke after M.I. (9). Most thrombi develop within the first 2 weeks (median 5-6 days) after an M.I.(10). The incidence of early embolism is most likely when the thrombus is mobile or protruding in the L.V. (11). Echocardiography has been used to identify thrombi that are liable to embolize. The actual size of the thrombus is likely to be more than the size measured by echocardiography as only the central core is echogenic and that is where the measurement is made (4).

Therapeutic modalities are controversial. Although anticoagulation is the main stay in managing such thrombi (12). Surgical removal has its role and is indicated especially in those who had prior embolizations or when the thrombus is large, pedunculated or multiple in numbers and in the setting of an acute myocardial infarction necessitating emergency surgery. Several techniques for extraction of left ventricular thrombi have been described. These include, left ventriculotomy (13) transatrial approach (14) and transaortic extraction using a thoracoscope (15,16). Left ventriculotomy although has its hazards in closing a recently infracted friable muscle but we believe that it is important to be performed to inspect the cavity thoroughly with good exposure and complete removal of the mural thrombi.

L.V. thrombus in the absence of obvious cardiac disease or hypercoaguable state is a rare. Yadava and associates (5) suggested that patchy fibrosis and myofibrillar hypertrophy resulting from diffuse small coronary vessel disease and pathologic coronary spasm causing transient myocardial ischemia may predispose LV thrombus formation in these patients.

With regards to patient number 5, there are no previous reports of an association between amphetamine and L.V. thrombus. However, few reports have been published about L.V. thrombus associated with cocaine induced anterior M.I. which is associated with platelet activation, and thrombus formation (17).

This report supports the evidence that surgical removal of left ventricular thrombi is a feasible therapeutic option especially in protruding mobile thrombi with history of emobilization and in patients in whom early bypass surgery is indicated because of their critical condition.

Final caveats, one must be careful not to manipulate the heart until the aortic cross clamp is applied. Careful and painstaking removal of the thrombus should always be done. Particular attention should be paid to the part of the thrombus trapped within the LV trabeculations.

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Does prior percutaneous coronary angioplasty and/or stenting adversely affect early outcome after coronary artery bypass Surgery?

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Objectives: **Percutaneous intervention for coronary revascularization is associated with an increased risk of repeat revascularization. In this study we examine the effect of previous percutaneous intervention on early outcome in patients undergoing coronary artery bypass surgery.**

Methods: **Between may 2007and may 2010, 24 case underwent first-time isolated coronary artery bypass grafting with previous percutaneous coronary intervention (group 1) were evaluated for in-hospital mortality and major adverse cardiac events and compared with matched cases treated during the same time period without previous percutaneous coronary intervention (group 2).**

Results: **At baseline, group 1 had higher incidences of previous myocardial infarction. Other preoperative variables were similar in both groups. There was no difference in in-hospital mortality (0.0% in both groups) or major adverse cardiac events between patients with or without prior PCI.**

Conclusions: **In this small cohort, previous PCI was not associated with increased short-term mortality after CABG. Good outcomes can be obtained in the group of patients undergoing CABG who have had previous PCI. Larger study and long-term follow up is necessary to validate this finding.**

In the current era of stent usage, before patients with multivessel disease are finally referred to coronary artery bypass grafting, percutaneous coronary intervention is more frequently performed as the initial revascularization strategy .In spite of the fact that many randomized control trials (1-4) and recent real-world registries(5-6) comparing coronary artery bypass grafting (CABG) surgery with percutaneous coronary intervention (PCI) still support CABG as the superior revascularization strategy in terms of survival and reintervention rate in multivessel disease and particularly in patients with diabetes mellitus and triple-vessel disease (7-9), However, in the current era of stent usage, the number of patients with multivessel or triple-vessel disease in whom PCI is initially performed and who might not get the option of receiving bypass surgery as their first-choice revascularization treatment is rapidly increasing without any equivalent scientific evidence. Subsequent CABG surgery with previous PCI, however, might not achieve the same excellent results, as thoroughly demonstrated in the literature. The objective of this study was to assess our own experience regarding the association between prior PCI and patients' early outcome after subsequent revascularization by CABG.

Patient population:

This cohort of patients was studied over two year's period. Twenty four patients with previous PCI who underwent first time isolated CABG (group 1) were evaluated for in-hospital mortality and major adverse cardiac events and compared with matched cases treated during same period without previous PCI (group 2). Institutional review board of our hospital approved this study, and waived the individual consent because this study was retrospective.

Perioperative management

Patients who were receiving dual-antiplatelet therapy with aspirin and clopidogrel before surgical intervention were perioperatively managed as follows: (1) maintenance of aspirin therapy until surgical intervention and routine administration of 81 mg/d starting from the first day postoperative, (2) discontinuation of clopidogrel for a 2- to 5-day window in accordance with the current American College of Cardiology/American

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Heart Association guidelines by withdrawing clopidogrel 72 hours before surgical intervention at the earliest and restarting it within 24 hours after CABG. Patients with recent stents received reloading dose of clopidogrel 300 mg through nasogastric tube on the night of surgery provided that there was no excessive bleeding from chest tubes. If there was excessive bleeding, reloading dose was given next morning.

Operative protocol

Surgical revascularization was performed by using standard techniques in all patients, on pump single clamp technique with antegrade/retrograde cold blood cardioplegia. No off pump cases were included in this study. Heparin was administered to achieve an activated coagulation time of greater than 400 seconds and protamine to reverse heparin according to standard practice.

Statistical analysis

Descriptive statistics are summarized for categoric variables as frequencies (percentages) and compared between groups by using the Pearson 2 exact test. Continuous variables, expressed as means ± standard deviation.

Results

Preoperative characteristics of the patients are shown in Table 1. Patients did not differ according to most of their demographics, risk factors, and comorbidities.

In group 1, more patients had antiplatelet therapy before surgical intervention with clopidogrel and or agraststst. Subanalysis of group 1 regarding PCI procedures showed that, Only 2 patients were operated urgently after they underwent angioplasty of culprit lesion without stenting. Residual significant stenosis was present after angioplasty. There were 10 patients (40%) with isolated in-stent restenoses, 8 patients (34%) with isolated de novo coronary artery stenoses, and 4 patients (16%) with combined in-stent restenoses and de novo coronary artery stenoses. According to the type of stent used, 20 patients (83%) had bare-metal stents, 2 patients (8 %) had BMS. No patients had combined bare-metal stents and drug-eluting stents.

Intraoperative results, such as cardiopulmonary bypass and aortic cross clamp times, number of bypass grafts and distal anastomoses, and mean bypass graft flows, did not differ between the groups. There was no in hospital mortality in either group (Table1).

Postoperative complications did not differ significantly between the two groups, slight higher difference in ICU stay, reexploration for bleeding and wound infection was not statistically significant (Table2).

Demographics	Group 1,with previous PCI (n = 24)	Group 2,without previous PCI (n = 24)	P value
Age (y)	66 ± 9	67 ± 9	NS
Sex, male	23 (96%)	21 (87%)	NS
Risk factors and comorbidities			
Diabetes mellitus	21 (87%)	20(83%)	NS
Hypertension	20 (83%)	18 (75%)	NS
Hyperlipidemia	18 (75%)	17 (71%)	NS
History of stroke	2 (8%)	1 (4%)	NS
COPD	3(13%)	1(4%)	NS
Peripheral vascular disease	13 (54%)	9 (38%)	NS
Renal disease*	4 (17%)	3 (13%)	NS
Angina CCS III-IV	8 (34%)	7(29%)	NS
MI < 4 wk prior	15(63%)	16 (67%)	NS
LVEF (%)	40 ± 12	40 ± 15	NS

Table (1):Preoperative patient characteristic *Serum creatinine level of greater than 2.0 mg/dL.

	Group 1,with previous PCI (n = 24)	Group 2,without previous PCI (n = 24)	P value
Intraoperative data			
CPB time (min)	115 ± 36	110 ± 37	NS
ACC time (min)	85 ± 26	82 ± 23	NS
Mean number of grafts	3.2 ± 1	3.4 ± 1	NS
Postoperative data			
IABP support	3 (13%)	2 (8%)	NS
ICU stay (d)	3 (1-5)	2(1-4)	NS
Hospital stay (d)	9 (7-14)	8 (7-12)	NS
AF	8 (34%)	6(25%)	NS
Renal failure (dialysis)IV	0 (0.0%)	1(4%)	NS
Stroke	0 (0)	0 (0.0%)	NS

Re-exploration for bleeding	1 (4%)	0 (0.0%)	NS
CPR Wound infection	0 (0.0%) 1 (4%)	1 (4%) 0 (0.0%)	NS NS

Table (2):Intraoperative and postoperative characteristics
Data are presented as means ± standard deviation, number (percentage).

PCI,Percutaneous coronary intervention; CPB, cardiopulmonary bypass; ACC, aortic crossclamp; IABP, intra-aortic balloon pump; ICU, intensive care unit; CPR, cardiopulmonary resuscitation. AF;Atrial Fibrillation

Discussion

Percutaneous coronary intervention (PCI) has traditionally been used as first-line therapy for limited coronary artery disease while coronary artery bypass grafting (CABG) has been the mainstay of therapy for patients with more advanced multivessel and left main disease. With the more frequent use of PCI in patients with advanced and complex disease, there is an increasing number of patients who present for CABG who have had previous PCI.

become recognized recently. At first, evidence emerged in the former times of angioplasty, showing that patients with initial percutaneous transluminal coronary angioplasty and subsequently undergoing CABG had a poorer long-term survival. (10) There was also recent evidence that PCI itself adversely affects outcome in repeated PCI (11) and also in several clinical studies of noncardiac surgical patients, in whom the risk for major adverse events after surgical intervention significantly increased with previous PCI. (12-14)

Many studies have previously reported a worse outcome in prior PCI patients undergoing CABG. Hassan et al, (13) compared outcome after CABG in 919 patients with and 5113 without prior PCI. Although the prior PCI group had less severe coronary artery disease and less co-morbidity, multivariate analyses identified prior PCI as an independent predictor of hospital mortality (HR 1.93; P = 0.003). In two groups of 919 propensity-matched patients, the in-hospital mortality was 3.6% in the prior vs. 1.7% in the non-prior PCI group (P = 0.01). Thielmann and colleagues (14) investigated outcome in 2626 consecutive patients undergoing first time CABG without prior PCI in comparison with 360 after a single and 289 patients with multiple prior PCI. Using risk-adjusted multivariate logistic regression analysis they reported that multiple prior PCIs were associated with increased in-hospital mortality [HR = 2.24 (95% CI 1.52–3.21); P <0.001] and the risk of major adverse cardiovascular events [HR = 2.28; (95% CI 1.38–3.59); P <0.001]. In a subsequent propensity-matched group based on 13 pre-operative risk factors, logistic regression analysis again confirmed multiple prior PCIs to be associated with increased in-hospital mortality (HR = 3.01; P <0.01) and major adverse cardiovascular events (HR = 2.31; P <0.01).

Chocron et al.(15) in a post hoc analysis of the IMAGINE (Ischemia Management with Accupril post-bypass Graft via Inhibition of the coNverting Enzyme) study found that in patients with left ventricular ejection fraction >40% having a history of PCI before surgery there was a worse outcome post-CABG than in those with no prior PCI.

Taggart in his comment (16) mentioned that potential criticism of the studies by Chocron, Hassan, and Thielmann is that PCI may have been suboptimal as there was a relatively low use of DES in comparison with BMS. However, as several meta-analyses have consistently demonstrated that while DES reduce the risk of restenosis in low-risk coronary lesions they do not reduce the risk of mortality or subsequent myocardial infarction (17). it is counter-intuitive to believe that they will improve results post-CABG. There is a further concern with DES: the FDA has warned that their use is associated with increased risks of both early and late stent thrombosis, as well as death and myocardial infarction'. (18) DES impair endothelialization, leaving a potentially prothrombotic substrate within the vessel, (19) and leave a further conundrum for the surgeon in terms of control of antiplatelet medication and whether to perform bypass grafts to a coronary vessel with a DES without critical restenosis in patients who have multivessel disease. These clinical concerns are compounded by cost implications; not only are DES significantly more expensive than BMS, but new recommendations that patients remain on clopidogrel for at least a year, and possibly indefinitely, add significantly to overall costs. Contrary to previously published series, Yap et al. (20) retrospectively reviewed outcomes after CABG in 13,184 patients of whom 11% had a previous PCI over a 7-year period in 6 hospitals and in an additional 8 hospitals during the last year of study. They found that prior PCI was not a risk factor for unadjusted or adjusted short- or mid-term mortality at a mean of 3.3 years after CABG. Micheal Mack (21) criticized this article. He reported that how does one reconcile this conflicting information with that from the previously published studies as well as the experience of most surgeons, and how should this guide us in clinical practice? . Although that the study of Yap et al is a meticulous study, there are a number of limitations of information contained in the database and of the study that preclude generalization of the results to other clinical practice settings.

First, the study is a retrospective analysis of clinical practice in 2 states in Australia, which may not necessarily correlate with practice patterns in other geographic areas. With a previous PCI having been performed in only 11% of patients undergoing CABG, which is much less than one sees elsewhere, one would expect that complex stenting in more advanced disease was not often performed. Furthermore, we are given no information as to the number of patients who had multiple previous PCI procedures or the proportion of patients who received drug-eluting versus bare-metal stents, all of which may affect outcomes. We also do not have information on the number of patients who may have not have survived after PCI and therefore never received a CABG. Therefore, despite the findings of this study, one should still be cautious about the assumption that a PCI procedure is "free" of cost regarding no added risk of undergoing subsequent CABG. All

the shortcomings of a retrospective, observational study in a relatively small population are present. At this level of study, it is impossible to get sufficiently "granular" on patient-specific issues that may affect outcomes. For example, we have no information on whether multiple repeat PCI procedures were performed and how frequently long stenting was used, both of which are likely to compromise the short- and long-term outcomes of a subsequent surgical operation. Common sense dictates that, as with most things in life, moderation is the key and nothing replaces good clinical judgment on an individual patient level. Potential underlying pathomechanisms for MACEs after PCI have been identified and summarized, such as several independent predictors and risk factors of early and long-term stent thrombosis, including the use of more than one stent, use of long stents, use of stents placed at a bifurcation, a history of stent thrombosis, incomplete revascularization, diabetes mellitus, renal failure, low ejection fraction, and premature antiplatelet therapy discontinuation, especially after implantation of drug-eluting stents (22). Conversely, postoperative blood loss and bleeding complications caused by continuation of antiplatelet therapy might lead to increased transfusion and platelet requirements, which in turn might cause acute stent thrombosis

Furthermore, numerous additional perioperative pathomechanisms among patients with previous PCI undergoing CABG might exist, which have been studied less thoroughly and are as yet largely unknown. There is a growing body of evidence that coronary stents are causing arterial wall injury, leading to dysfunctional and denuded coronary endothelium with chronic inflammatory response and platelet and neutrophil adhesion, which in turn are causing adverse cardiovascular events (23-24). In addition, if the diameter of the stented vessel is less than 2.5 to 3.0 mm, the risk of thrombosis is much higher, and the bypass graft has to be inserted more distally, which in turn adversely affects coronary run-off and the patency rate of the inserted graft. (25-26) This was supported by the comment of Micheal Mack and David tagart (16,21) where they reported that There are a number of hypotheses as to why previous PCI may adversely affect outcomes with CABG. Patients may present with more advanced disease due to the beneficial effect of PCI in delaying surgery until later in life when the disease has progressed. However, it may also be that patients present in a more unstable clinical state. Another reason can be compromise of left ventricular function and loss of collateral circulation due to occlusion of side branches especially when "long stenting" is performed. Distal microembolization in the downstream vessel from stents is another possible cause of left ventricular dysfunction. Endothelial dysfunction induced by stenting is a known occurrence, and it is possible that it could have an adverse effect on adjacent graft patency. Furthermore, the necessity to bypass the coronary artery more distally where it is smaller with more diffuse disease especially in patients with multiple stents rather than in the optimal target vessel landing zone for a bypass more proximally can also be a cause of worse outcomes after CABG. Periprocedural management and outcomes can be adversely affected by the now universal dual antiplatelet regimens in patients with stents who present for CABG. Excessive post-operative bleeding in patients operated on with platelet inhibition and, conversely, stent thrombosis with post-operative myocardial infarction in patients in whom the antiplatelet regimen has been stopped before CABG are causes of early adverse outcomes.

Limitations

In spite of the fact that our study confirmed the results of Yap et al, however, we have some limitations in our study. The most important is the small number of cases included. Also, the present study was nonrandomized and retrospective in design and the generalizability of our experience at a single tertiary care medical center might not extend to all CABG-performing clinical centers, as other many study clearly indicates that the increasing practice of initial PCI before surgical intervention significantly increases the risk of subsequent CABG in a well-defined risk-adjusted and propensity score-matched groups of patients. Further clinical research and multicenter outcome studies are needed to investigate and confirm the short-term and long-term effects of PCI procedures with coronary stenting before CABG surgery

Conclusion

In this small cohort, previous PCI was not associated with increased short-term mortality after CABG. Good outcomes can be obtained in the group of patients undergoing CABG who have had previous PCI. Larger study and long-term follow up is necessary to validate this finding.

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Management of Great Saphenous Vein Wound Infection in Patients Undergoing CABG Surgery

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Background: **Great saphenous vein (GSV) wound infection in patients undergoing CABG surgery is a morbidity that increases hospital stay and cost. We present our experience in treating those patients.**

Methods: **From January 2007 to January 2010, a retrospective study of 1264 patients (after exclusion of the mortalities and sternal wound infections) that underwent isolated CABG procedures at the chest diseases hospital in Kuwait. Patients were divided into group one(control),(n=1180) and group two(with GSV wound infections), (n=84). The infected wounds were classified according to criteria of the Center for Disease Control (CDC) into mild, moderate and severe.**

Results: **The incidence of GSV wound infection was 6.64%,(n= 84). Organisms isolated were E. coli , pseudomonas aeruginosa, MSSE and MRSA .Mild, moderate, and severe saphenous vein wound infections were (n=42,3.32.%), (n=22, 2.74%), (n=20, 1.58%) respectively. The VAC therapy was used in all severe infections and in which, VAC was the definitive treatment in 40% (n=8) [four of them were sent home with portable VAC], while was followed by living skin equivalent in two patients (10%) , operative secondary closure in 45% (n=9), and local rotational flap in only one patient (5%) . Hospital stay increased significantly from 9.15± 6.57 days for the control group I to 30.6 ± 4.67 days for group II (p <0.005).**

Conclusions: **Great saphenous vein wound infections following CABG surgery prolongs hospital stay and cost. Female sex, diabetes mellitus and obesity were the important risk factors identified. Use of newer treatment modalities (as VAC and LSE) may be useful as a nonoperative treatment of these patients. Treatment cost could be decreased if patients could be sent home with a portable VAC until the proper timing of a second procedure.**

The complications of great saphenous vein harvesting are infrequent, but sometimes serious with the resulting delayed hospital discharge, need for more interventions such as daily dressing, antibiotics, VAC therapy, and surgical procedures as debridement, secondary closure, skin grafting or local rotational flaps and may need as aggressive as limb amputation especially in the presence of peripheral vascular disease (PVD) [1] .All these add to patient discomfort and hospital cost. Efforts to prevent this complication should include minimal dissection, careful hemostasis and closure in layers. The reported overall incidence of wound related complications from great saphenous vein harvesting range from 1 % to 44%. [2-5].

Methods:

This study is a retrospective review of 1264 patients who underwent isolated CABG procedures between January 2007 and January 2010. All patients included had at least one great saphenous vein graft (GSV) with or without internal mammary artery graft (IMA). All mortalities and patients with sternal wound infections were excluded. The patients were then divided into group I, as a control, without GSV wound infection (n=1180) and group II, with GSV wound infection (n=84).

The demographic data for all patients, (table 1), were collected from patient files and statistics registry in the hospital with permission from the Ethics Committee of chest diseases hospital in Kuwait. The risk factors for leg wound infection were compared between the two groups. Risk factors in this study included age, gender, obesity, smoking, diabetes mellitus, hypertension, Chronic

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renal failure, aortic cross clamp time, CPB time, PVD, number of GSV grafts and postoperative IABP.

All patients were advised to take a bath with 4% chlorhexidine, retained at least 5 minutes before wash, on the night and on the day of surgery. Hair shaving was avoided and instead hair clipping was done in the evening prior to surgery. The operative site was prepared using 10% povidone -iodine scrub (Betadine) solution as a first layer then Betadine gel as a second layer. Preoperative second generation cephalosporin antibiotic (Cefuroxime, 1.5gm) was given within one hour before skin incision. A second dose of antibiotic was given after termination of cardiopulmonary bypass (CPB) and thereafter every 12hours. Antibiotic was stopped for all patients 48 hours postoperatively.

The GSV harvesting was done using the conventional surgical technique by direct visualization through longitudinal skin incision with or without skin bridging technique. The wound was closed in layers with staples for skin. At the end of operation, the wound was washed with Betadine, and then sealed with dressing and crepe bandage. The crepe bandage was daily changed while the dressing was kept intact for three days. At any time, if there was oozing, the dressing was removed and wound was checked for infection. No local antibiotic was applied to the wound site.

All wounds were followed up daily for any early signs of infection as swellings, bleeding, redness and oozing or discharge. Swabs for culture and sensitivity from the discharge were sent once infection was suspected and then, further management was carried on according to the Centers for Disease Control and Prevention (CDC)'s modified classification of wound infection [6] as follows:

- Mild infection: minimal wound discharge, which settled with oral antibiotics and did not delay patient's recovery from surgery.
- Moderate infection: minimal to moderate purulent discharge which required antibiotics, dressing and delayed recovery from surgery.
- Severe infection: frank pus discharge from the wound requiring antibiotics and surgical intervention.

For mild infections, antibiotics were started only after culture and sensitivity results were available. For moderate and severe infections swabs were collected and antibiotic treatment was started until modified by results of culture and sensitivity. The non operative management included also VAC and Living Skin Equivalent (LSE) while the surgical interventions included debridement, delayed wound closure and local rotational flap.

Statistical analysis

Numerical variables were expressed as mean ± SD, and categorized variables were summarized by percentages. Continuous variables were compared using the student's t- test or nonparametric Mann-Whitney U test whenever the data did not appear to have normal distributions, and categorical variables were compared using the chi-square or Fisher's exact test. For the statistical analysis, the statistical software SPSS version 14.0 for windows (SPSS Inc., Chicago, IL) was used. All p values were 2-tailed, with statistical significance defined by $p \leq 0.05$.

Results:

During the period between January 2007 and January 2010, 1264 patients underwent isolated CABG procedures (after exclusion of all mortalities and sternal wound infections). Of these, 84 patients (6.64%) were complicated with GSV wound infection (group II).The remaining 1180 patients were taken as a control (group I).

Many risk factors for GSV wound infection were studied (table 1). Female gender (38.09% versus 7.37%), diabetes mellitus (83.33% versus 37.96%), obesity (51.19% versus 16.44 %), were significant risk factor predictors in groups 2 and 1 respectively ($p < 0.05$ for all).

The degree of GSV wound infection, according to the modified CDC's criteria [6], were mild (3.32%, n=42), moderate (1.74%, n=22) and severe (1,58%, n=20). Eighty percent of these infected wounds were in the thigh. Both mildly and moderately infected wounds were treated successfully with nonoperative management. Only oral antibiotics and discharge from hospital without delay for the mildly infected wounds while the moderately infected wounds were treated with intravenous antibiotics and daily dressing .The severely infected wounds needed debridement, intravenous antibiotics, then VAC was applied for all the wounds .The VAC was the definitive treatment in 40% of patients (n=8) , four of them (20%) could be sent home with a portable VAC. Two patients (10%) needed living skin equivalent as another nonoperative procedure . Ten patients(50%) needed another surgical intervention after VAC therapy in the form of delayed surgical closure in 45% (n=9) and local rotational flap in only one patient (5%) (table 2).

The most commonly isolated organisms were E.coli (40.61%, n=40) followed by pseudomonas aeruginosa (16.66%, n=14), methicillin sensitive Staphylococcus epidermidis (MSSE) (14.28%, n=12) and methicillin resistant Staphylococcus aureus (MRSA) (9.52%, n=8), (table 3). Ten of the infected wounds (11.9%) were culture negative.

Organisms	Number(%)
E.coli	40 (40.61%)
pseudomonas aeruginosa	14 (16.66%)
MSSE	14.28%))12
MRSA	8 (9.52%)

Table(3) : Causative Organisms for GSV wound infection: MSSE:methicillin sensitive Staphylococcus epidermidis. MRSA: methicillin resistant Staphylococcus aureus.

The duration of postoperative hospital stay was significantly increased from 9.15± 6.57 days for the control (group I) to 30.6 ± 4.67 days for infected patients (group II) ($p < 0.005$).

Discussion

The use of GSV grafts in CABG surgery is still the most

Variables	Group 1* (n = 1180)	Group 2**(n=84)	P value
Age (mean ± SD)	62.65 ± 7.08	63.04 ± 5.7	NS
Obesity %, (n=)	16.44, (194)	51.19, (43)	<0.05
Female %, (n=)	7.37, (87)	38.09, (32)	<0.05
Smoking %, (n=)	45, (531)	50, (42)	NS
Diabetes %, (n=)	37.96, (448)	83.33, (70)	<0.05
Hypertension %, (n=)	53.98, (637)	57.14, (48)	NS
LVEF (mean ± SD)	53.63± 6.49	52.65±8.06	NS
GSV graft number (mean ± SD)	2.01± 0.63	2.04± 0.76	NS
Cross clamp time (minute) (mean ± SD)	85.06±20.52	90.08 ± 25.31	NS
CPB time (minute) (mean ± SD)	125.55 ±28.54	130.11 ±23.15	NS
IABP%, (n=)	3.8%, (45)	3.57%, (3)	NS
PVD%, (n=)	10.59%, (125)	10.71%, (9)	NS
Hospital stay(days) (mean ± SD)	9.15±6.57	30.6±4.67	<0.05

Table (1) : Pre-intra-and postoperative characteristics among patients with and without GSV wound infection.
Group 1*: Patients without GSV wound infection.
Group 2**: Patients with GSV wound infection.
NS= Non significant IABP : Intraaortic balloon pump
PVD: Peripheral vascular disease

frequently used conduits in spite of the increased use of arterial grafts. Patients may complain about their leg wounds more than complain about their sternal wounds. The high possibility of tissue edema, systemic inflammatory response following CPB, lymphatic destruction, impaired venous drainage, hematomas, and poor tissue oxygenation in the site of vein harvest makes it more prone to poor healing and wound infection [7]. Prophylactic measurement to prevent GSV wound infections include delicate tissue handling, meticulous hemostasis, , minimal use of electrocutary, judicious use of drains if any doubt about hemostasis, good closure in multiple layers if necessary, skin closure without excessive tension with sutures or staples to minimize possibility of skin necrosis and postoperative measurement for decreasing tissue edema as diuretics, leg elevation and pneumatic compression [7]. Also Chukwuemeka and John described placing the leg incision 5 cm above the midpoint of the medial malleolus may significantly reduce the incidence of leg wound complications.[8] Despite of improved

Class	Number,%	Management
Mild	42, 3.32%	Oral antibiotic, discharge from hospital
Moderate	22, 1.74	Intravenous antibiotic, daily dressing
Severe	20, 1.58	Debridement….VAC..then: • No mor intervention(40%, n=8). • LSE(10%, n=2). • Surgical intervention(50%, n=10): -delayed surgical closure(45%,n=9) -local rotational flap (5%, n=1).

Table (2) : Degree and management of group 2 patient

understanding of the pathophysiology and improved methods of prevention and prophylaxis, wound infection remains the most common cause of postoperative morbidity and delayed hospital discharge and increased cost [9].

The incidence of leg wound complications after CABG in most of the literatures ranges from 1% to as high as 44% [2-5]. The incidence of GSV wound infection in the chest diseases hospital in Kuwait was 6.64%, with most of the patients were in mild degree of infection (3.32%,n=42), while moderate and severe infections incidences were 1.74%, n=22 versus 1.58%, n=2.

The significant risk factors of saphenous vein harvest wound complications were discussed in many other articles before. In our study we found only three significant risk factors. They were obesity, female gender and diabetes mellitus. Many other studies reported the same risk factors as ours [2,3,10,11,12,13]. Some studies also reported PVD and postoperative IABP as a significant risk factors [1,10,11] while the study done by Palette et al [1] could not find neither obesity or diabetes mellitus as risk factors. Also Goldsborough et al in a prospective, observational study, 547 consecutive patients who had coronary artery bypass grafting alone or in combination with other cardiac surgical procedures, reported prevalence of leg wound complications of 6.8%. He reported that neither diabetes nor peripheral vascular disease were predictive of complications, with risk factors included preoperative hospitalization, use of an Ace elastic bandage in the operating room, the length of time the leg incision remained open in the operating room, and administration of nicardipine intravenously in the intensive care unit [14]. This does not seem to be a consistent finding in other studies.

It is not apparent why women are more susceptible to saphenous vein harvest wound complications. It has been suggested that since many of these female patients undergoing CABG are postmenopausal, an estrogen deficiency may prevent uncomplicated healing [15] and administration of estrogen has been shown to increase the release of platelet-derived growth factor alpha and to stimulate fibroblastic and myofibroblastic wound contraction [16]. Obesity being a risk factor may be due to more difficulties in vascular graft harvesting , higher possibility for flaps or hematomas, improper dose of antibiotic prophylaxis and adipose tissue providing a good substrate for infection [1].

It is well known that diabetes mellitus is a major risk factor for poor wound healing. Proper control of diabetes mellitus preoperatively and postoperatively is extremely essential to minimize the effects of diabetes on the healing process. Hyperglycemia with the resulting higher concentration of glycosylated hemoglobin that has an increased affinity for oxygen, may contribute to low oxygen delivery at the capillary level together with impaired immune system may predisposes patients with diabetes mellitus to wound healing impairment at the GSV harvest site[17].

The major pathogens in this study were E.coli, pseudomonas aeruginosa, MSSE and MRSA, Ten of the wounds (11.9%) clinically suspected to be infected wounds were culture negative. Most of these wounds had mild infection, needed no specific intervention and did not adversely affect the cost of treatment or the hospital stay.

All severe wounds require some form of debridement leaving large opened wounds. Historically , these wounds were left open for daily dressing until healing by secondary intention or delayed wound closure with or without a split-thickness skin graft, rotational flap, or free tissue transfer[14]. All these interventions have their advantages , but have a common disadvantage of delayed recovery and delayed hospital discharge

Nowadays, there are other non operative alternative solutions for saphenous vein wound infection, these are VAC, Living skin equivalent (LSE) . Vacuum-assisted closure (VAC) is a negative pressure wound therapy that applies negative pressure though a sealed wound dressing system [18]. Once the wound is debrided, the VAC device can be applied. With currently available equipment, the patient may remain ambulatory during therapy and can be discharged home with a portable smaller device with dressing every 48-72 hours. Wound healing rates with this technique was reported good, making this treatment useful for infected GSV wounds and other chronic wounds.[19]

Living skin equivalent (LSE) provides another option for nonoperative treatment of these wounds and has been used for numerous chronic and surgical wounds with excellent results [20]. This procedure can be done in the outpatient or office setting without the need for anesthesia .Also this therapy allows the patient to remain ambulatory during the healing process. LSE increases the healing rate of these wounds and promotes healing of some wounds that might require more extensive therapy were LSE not available.

In our study, all severely infected GSV wounds (n=20, 1.58%) were debrided , then VAC was applied. The VAC therapy was the definitive treatment in 40%(n=8) of the severely infected GSV wounds, four of them (20%) could be sent home with a portable VAC. Another nonoperative procedure (living skin equivalent) was needed in two patients (10%) . Ten patients(50%) needed another surgical intervention after VAC therapy in the form of delayed surgical closure in 45% (n=9), and local rotational flap in only one patient (5%). Hospital stay was significantly affected by the infected GSV wounds from 9.15± 6.57 days for the control (group I) to 30.6 ± 4.67 days for infected patients (group II) ($p < 0.005$).

Conclusion

Post CABG surgery great saphenous wound infections prolongs hospital stay and cost. Female sex, diabetes mellitus and obesity were the important risk factors identified. Use of newer treatment modalities (as VAC and LSE) may be useful in the nonoperative treatment of these patients. The treatment cost could be be decreased if patients could be sent home with a portable VAC until the proper timing of a second procedure.

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Pulmonary regurge free - repair of tetralogy of Fallot, is it possible?

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Background : **There are several reports showing the deleterious effects of long-term pulmonary incompetence after repair of tetralogy of Fallot on RV functions and arrhythmias. That is why we adopted, since 2007, a strategy aiming to have a minimal/no PR after total correction of Fallot's tetralogy in our patients.**

In our study, we sought to determine the efficacy of this strategy to minimize postoperative PR in our tetralogy of Fallot patients and its reflection on the early and mid-term outcome in comparison to other techniques that result in free postoperative PR. Patients and

Methods: **Preoperative, operative and postoperative data of 114 Fallot patients who underwent total correction at cardiothoracic surgery department, Assiut University Hospital, Assiut, Egypt, between 2000 and 2010 were retrospectively analyzed. The patients were classified into 2 groups: Group I: 56 patients operated between 2007 and 2010 according to a uniform strategy that aimed to minimize postoperative pulmonary regurgitation This strategy involved four techniques: a) Pulmonary annulus sparing technique, b) Restrictive patch technique if trans-annular patching is inevitable (Z value > -2), c) Preservation of good functioning pulmonary leaflets, and finally d) Avoiding or minimizing infundibulotomy. and Group *II:* consisting of the 58 patients operated in the period between 2000 and 2007 by the same surgeons and a previous strategy of performing routine infundibulotomy in all cases to allow proper infundibular resection and infundibular enlargement with a pericardial patch.**

Results: **There were no significant differences between the two groups in all preoperative parameters except the McGoon's ratio which were significantly lower in group I than group II (1.95 ± 0.2 for group I vs 2.12 ± 0.28 for group II, P – value = 0.001). There are significant differences between the two groups in the use of trans-annular patch (51.8 % for group I vs 75.8 % for group II, P – value = 0.011) and the infundibulotomy (51.8 % for group I vs 93.1 % for group II, P – value = 0.001) (significantly less in group I). The right ventricular to left ventricular pressure ratio is significantly higher in group I than group II (0.43 ± 0.11 for group I vs 0.29 ± 0.2 for group II, P – value = 0.005). However, they were always less than 0.7. There were significant differences between the 2 groups in the inotropic support (the inotropic score was 11.46 ± 4.79 for group I vs 17.86 ± 4.1 for group II, P – value = 0.001), ICU stay (2.8 ± 0.89 for group I vs 4.3 ± 0.87 for group II, P – value = 0.001) and hospital stay (5.9 ± 0.87 for group I vs 7.2 ± 0.7 for group II, P – value = 0.001) being lower in group I. Although the Residual PS (pressure gradient through RVOT –PA) was significantly higher in group I (30.6 ± 15.39) than group II (20.26 ± 10.6), P – value = 0.000 in first postoperative echocardiography 1 week after correction, there was no significant difference between the two groups in the last postoperative echocardiography (6 – 12 months later) (14.09 ± 3.46 for group I vs 13.22± 3.54 for group II, P – value = 0.19). On the other hand, there is significant difference in the degree of the pulmonary regurgitation between the two groups being significantly lower in group I (0.78 ± 0.62 for group I vs 2.7 ± 0.8 for group II, P – value = 0.001).**

Conclusion: **Every effort should be done in order to minimize or even avoid the pulmonary regurgitation in total correction of Fallot's tetralogy. Adherence to PR avoiding strategy did not result in any increased mortality**

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or morbidity. Furthermore, it resulted in smoother uneventful early postoperative outcome.

In literature there are several reports showing the problems of long-term pulmonary incompetence after repair of tetralogy of Fallot, although this remains a controversial issue. Old studies [1, 2] reported good long-term outcomes after TOF repair with transannular patch, with low incidence of redo procedures, despite a significant, high degree of pulmonary regurgitation, and this is ascribed to the adaptive properties of the right ventricle. However, these findings are contradicted by recent studies showing the deleterious effects of pulmonary insufficiency on the right ventricle when more sensitive measurements are made, such as MRI examinations [3, 4, 5]. Investigators found that risk factors for RV dilatation after repair of tetralogy of Fallot include pulmonary insufficiency, RV outflow tract aneurysm/akinesia, and tricuspid regurgitation [6, 7, 8]. Deleterious effects of RV dilatation include RV dysfunction, arrhythmias (ventricular and supraventricular tachycardia), and sudden death [9, 10]. The ability to preserve the valve function and avoid or at least minimize the ventriculotomy should prevent the deleterious effects of free pulmonary regurgitation, preserving RV function and decreasing the incidence of late arrhythmias.

That is why we adopted since 2007 a protocol in repair of tetralogy of Fallot aiming to have a minimal/no PR after total correction of TOF in our patients. After reviewing the literatures about this aspect, we adopted 4 strategies for minimizing

postoperative PR:

Pulmonary annulus sparing strategy:

Avoid trans-annular patch as much as possible by accepting pulmonary annulus Z - value as small as – 2, accepting residual pulmonary stenosis (up to 40 mmgh or RV/LV pressures up to 0.7), hence avoiding the infundibulotomy as much as possible [11,12].

Restrictive patch technique if trans-annular patching is inevitable:

the width of the trans-annular patch at the PV annulus should be adjusted to just the exact Hegar size of the patient (avoid oversized patch at the annulus) [13].

Pulmonary valve leaflets preservation / repair:

Every effort should be made to preserve the already present PV leaflets, even if they are small or rudimentary, by: avoid excessive commissurotomy, re-suspension of any torn leaflets. In cases of trans-annular patching, the trans-annular incision should be done at the most anterior commissure area so that those preserved leaflets will form the posterior leaflets of the new PV. In cases of severely rudimentary or absent pulmonary valve, construction of a monocuspid new pulmonary valve by a polytetrafluoroethylene (PTFE) membrane (0.1-mm PTFE patch; W. L. Gore & Associates, Inc, Flagstaff, Ariz) should be done [14, 15].

Every effort should be made to avoid or minimize infundibulotomy:

Pulmonary infundibulum plays an active role in protecting the right ventricle against the deleterious consequences of chronic pulmonary regurgitation. So, damage created by the infudibulotomy during tetralogy of Fallot repair plays a major role in the development of right ventricular dilatation in these patients [16, 17, 18, 19] Thus, if the pulmonary infundibulum is not the passive conduit that it was once thought to be and instead it takes an active part in the right ventricular contraction and in pulmonary valve function, then operations for repair of TOF should be designed to aim at its preservation [20].

Objectives: In our study, we sought to determine whether these strategies to minimize postoperative PR in our tetralogy of Fallot patients are feasible and

Methods:

2.1 Patient population:

Preoperative, operative and postoperative data of 114 Fallot patients who underwent complete surgical repair at cardiothoracic surgery department, Assiut University Hospital, Assiut, Egypt, between 2000 and 2010 were retrospectively analysed. The patients were classified into 2 groups:

Group I: A group of 56 patients were operated on by a two surgeons (A. El-minshawy & A. Ghoneim) between 2007 and 2010 according to a uniform strategy that aimed to limit postoperative pulmonary regurgitation to avoid the deleterious effects of free pulmonary regurgitation on the long term and so preserving RV function and decreasing the incidence of late arrhythmias. In these patients surgery was performed after bicaval cannulation for cardiopulmonary bypass with moderate systemic hypothermia (28 °C nasopharyngeal temperature). Through a right atriotomy working through the tricuspid valve, the RV was explored for the site and size of the ventricular septal defect which was closed using a Dacron patch, and the presence of any low infundibular fibro-muscular stenosis. Any hypertrophied obstructing infundibular fibro-muscular bands were resected preserving the moderator band and trabecula septomarginalis to avoid right bundle branch injury. Then according to the pulmonary arterial stenosis, pulmonary arteriotomy was done and extended distally to the branch PAs if there was any distal hypoplasia or stenosis in them and extending down to just above the RV-PA junction (the annulus). The pulmonary valve was explored and the supravalvar tethering of the pulmonary cusps to the wall of PA was released and pulmonary commissurotomy is done. Then using a Hegar sizer of size that was calculated to be equal to the Z-value of 0 for patient's body surface area, the size of the pulmonary valve annulus is assessed (aiming to a pulmonary annulus size just enough to pass the desirable Hegar sizer of zero Z – value in the arrested heart which usually gives to a pulmonary annulus size of -2 in the contracting heart in the postoperative echocardiography). If the pulmonary annulus was found to be smaller than the desired Hegar sizer, the pulmonary arteriotomy was extended downwards through the pulmonary annulus into the RV infundibulum for just few millimeters that is just

enough to allow the passage of the desired Hagar dilator of zero Z-value. The transannular incision was done through the most anterior commissure to avoid damaging of any pulmonary cusp. Then, further infundibular resection may be required through the pulmonary arteriotomy if there was an element of high infundibular fibromuscular stenosis. Then, a pericardial patch was inserted to close this arteriotomy and enlarge the main PA with or without the very limited infundibulotomy. If necessary the patch was extended distally to repair any branch pulmonary artery stenosis. The trans-annular patch was tailored to restrict the pulmonary annulus diameter to a Z - score of 0 using an accordingly sized Hegar dilator in the outflow tract for guidance.

Group II: The data of Group 1 were compared to a cohort consisting of the 58 patients operated in the period between 2000 and 2007 by the same surgeons following previous surgical strategies depending on routine infundibulotomy in all cases to allow proper infundibular resection and infundibular enlargement with a pericardial patch in all cases even if trans-annular patch was not required [21, 22]. Based on the fact that tetralogy of Fallot is pathologically characterized by hypoplastic infundibulum. So, its repair should be aiming to allow free blood flow from RV to PA. Hence, according to the concept that the outlet portion of the right ventricle had only a passive role in right ventricular contraction, carrying the blood from the trabecular portion of the right ventricle to the pulmonary artery, as such, had to be as large as possible.

Patients with pulmonary atresia, absent pulmonary valve, double outlet right ventricle and patients in which homograft placement to reconstitute RV to pulmonary artery continuity was necessary, were excluded.

The parents of all patients gave their informed consent for all examinations and anonymised analysis of the data.

2.2- Echocardiography:

Transthoracic echocardiography was performed using a standardized transthoracic approach with a GE Vivid interfaced with multifrequency MHz transducer. Pulmonary Doppler recordings were obtained from the parasternal short axis view with the cursor placed at the level of the pulmonary annulus. The maximal RV outflow tract flow velocity was measured and expressed as metres per seconds. Pulmonary regurgitation severity (PR) was graded from being absent to mild, moderate, and severe. PR severity was assessed qualitatively by two investigators (blinded to the type of surgical repair) based on width of the regurgitant jet and level of the diastolic retrograde flow seen in the parasternal short axis RVOT view: branch PA (severe PR), main pulmonary trunk (moderate) and RVOT (mild) [23]. The diameter of the RV pulmonary trunk junction at the level of the pulmonary annulus was measured. In this study the term 'pulmonary annulus' was also used in the postoperative setting. All studies were stored on video tapes or digitally and therefore available for analysis.

To quantify the degree of any early or late postoperative RV outflow tract obstruction, an early postoperative echocardiogram performed during the first postoperative week then after 1, 3, 6, 12 months for all patients. After that echocardiography was done every year for with a median time interval from repair to the late echocardiographic assessment was 2.39 (range 0.01–4.7) years in Group 1 and 5.6 (range 0.8–14.6) years in Group 2.

2.3- Surgical data:

Data on the type of RV outflow tract reconstruction, bypass and ischemic times, and post repair RV/LV pressure ratio were collected from operation notes.

2.4 -Anesthetic technique:

If intravenous access is present, induction can be accomplished with ketamine (2 mg/kg) and fentanyl (5 g/kg). An intravenous induction is faster in patients with a right-to-left shunt because peak receptor site concentrations are attained faster. If intravenous access is absent, induction can be accomplished with an intramuscular injection of ketamine (4 mg/kg) especially in patients in whom a mask induction would be frightening. The option of a mask induction with oxygen sevoflurane is always a possibility,. Once the induction is completed and intravenous access is established, pancuronium (0.2 mg/kg) can be given to facilitate endotracheal intubation. Maintenance of anesthesia is accomplished with oxygen, volatile anesthetic agents, fentanyl (1 g/kg/h). An appropriately sized endotracheal tube should be placed according to the size and age of the patient.

2.5- ICU and postoperative follow up data:

Inotropic score, Duration of ventilation, ICU stay, The 1st 48 hs CVP pressure, Hospital stay, Residual PS (pressure gradient through RVOT –PA) by echo after 1 week and 6 – 12 months, Degree of PR, Reoperations, and duration of follow up.

Inotropic score: was calculated based on Wernovsky et al. [24]:

[(Dopamine + dobutamine +amrinone) × 1] + (milrinone × 20) + [(epinephrine +norepinephrine +isoproterenol) × 100]

(Dosage is expressed in ug/kg/min)

The incidence of any additional surgical re-intervention performed until June 2010 was also recorded from the patients' records.

2.6 -Statistical analysis:

Analysis was done using the statistical package SPSS PC (version 11.0) (SPSS INC., 444 N. Michigan Avenue, Chicago, IL 60611, USA). Continuous variables were presented as means ± standard deviations and range using ANOVA test. The level of statistical significance was set at a p-value of 0.05 or less. Categorical variables are presented as percentages. Pearson correlation coefficient was used for comparison between continuous variables. Correlation was significant at the 0.05 level (2-tailed).

Results:

Patient data are analyzed in both groups and compared as regarding: the preoperative patient data, operative data, ICU data, and postoperative echo data:

*: for purposes of analysis and comparison, we classified our cases into 5 groups according to the morphological pattern of RVOT obstruction according to Kirkiln & Barrett – Boyes classification (both by echocardiography, angiography and confirmed by intraoperative examination). The percentages mentioned in the leftmost column are those of Kirkiln & Barrett – Boyes [25].

**: by annular stenosis we mean pulmonary annulus Z – value < -2.

There were no significant differences between the two groups in all preoperative parameters except the McGoon's ratio which were significantly lower in group I than group II (1.95 ± 0.2 for group I vs 2.12 ± 0.28 for group II, P – value = 0.001).

No significant difference between the 2 groups in the ischemic & bypass times.

There are significant differences between the two groups in the use of trans-annular patch (51.8 % for group I vs 75.8 % for group II, P – value = 0.011) and the infundibulotomy (51.8 % for group I vs 93.1 % for group II, P – value = 0.001).

The right ventricular to left ventricular pressure ratio is significantly higher in group I than group II (0.43 ± 0.11 for group I vs 0.29 ± 0.2 for group II, P – value = 0.005). However, they were always less than 0.7.

There were significant differences between the 2 groups in the inotropic support (the inotropic score was 11.46 ± 4.79 for group I vs 17.86 ± 4.1 for group II, P – value = 0.001), ICU stay (2.8 ± 0.89 for group I vs 4.3 ± 0.87 for group II, P – value = 0.001) and hospital stay (5.9 ± 0.87 for group I vs 7.2 ± 0.7 for group II, P – value = 0.001) being lower in group I which can be explained by 2 factors: a) better RV functions with significantly lower CVP in group I than group II in spite of much less diuretic use with less negative crystalloid fluid balance during the early 48 hours postoperatively in group I than group II patients. , b) the lungs are not accustomed to sudden increase in pulmonary blood flow resulting in pulmonary congestion, increased bronchial secretions, pleural effusions and other respiratory problems with the need for chest care and physiotherapy; all of these were more pronounced in group II patients due to the free relieve of RVOT – PA obstruction.

Although the Residual PS (pressure gradient through RVOT –PA) was significantly higher in group I (30.6 ± 15.39) than group II (20.26 ± 10.6), P – value = 0.000 in first postoperative echocardiography 1 week after correction, there was no significant difference between the two groups in the last postoperative echocardiography (6 – 12 months later) (14.09 ± 3.46 for group I vs 13.22± 3.54 for group II, P – value = 0.19). In the other hand, there is significant difference in the degree of the pulmonary regurgitation between the two groups being significantly lower in group I (0.78 ± 0.62 for group I vs 2.7 ± 0.8 for group II, P – value = 0.001).

There were 2 reoperations among patients of group II (4 and 5 years after the first operation); both were for severe pulmonary and tricuspid regurgitation with marked RV & RA dilatation and marked hepatmegaly. In both patients pulmonary valves were replaced with tissue valves and tricuspid valves were repaired with no mortality. No re-interventions for the RVOT – PA were required up to now for group I patients. In spite of a shorter duration of follow up in group I than group II, it is not expected for group I patients to require reinterventions for the RVOT – PA in the future due to the acceptable residual PS (14.09 ± 3.46) and PR (0.78 ± 0.62) after 1 year follow up in comparison to group II patients who had a residual PS (13.22± 3.54) and PR (2.7 ± 0.8) after 1 year follow up.

Discussion:

In this study we compared 2 groups of patients of tetralogy of Fallot for total correction. Both groups were done by the same surgeons, however with 2 different strategies as regarding the management of the RVOT obstruction. In group I (done after 2007), combinations of 4 techniques were employed in every case in order to avoid or at least minimize the resulting postoperative PR (without the use of pulmonary valve replacement conduits). In the other hand, group II patients (done before 2007) were done without a uniform strategy to avoid postoperative PR. Both groups were similar in their preoperative criteria with no statistically significant difference as regarding their age, weight, degree of cyanosis, heamatocrit

	Group I (mean ± SD)	Group II (mean ± SD)	P –value
Number of patients	56	58	
Age (years)	5.01 ± 3.26	5.96 ± 3.49	0.138
Wt (Kg)	18.03 ± 10.21	20.02 ± 9.17	0.278
Preop. O2 sat on room air	80.75 ± 9.19	81.9 ± 7.2	0.459
Preop. Hct	48.28 ± 8.11	46.55 ± 6.4	0.2

Morphologic pattern of RVOT obstruction*:			
Type I: (isolated infundibular stenosis) 16%.	9 (16.1 %)	10 (17.2 %)	
Type II: (infundibular + valvar stenosis) 26%.	15 (26.7%)	18 (31 %)	
Type III: (infundibular + valvar + annular stenosis)** 26%.	13 (23.2 %)	12 (20.6 %)	0.724
Type IV: (diffuse outflow hypoplesia) 27 %.	16 (28.6 %)	14 (24.1 %)	
Type V: (dominant valvar stenosis) 5%.	3 (5.4 %)	4 (6.8 %)	
Level of Infundibular stenosis:			
• Low	24 (42.8 %)	28 (48.2 %)	
• High	13 (23.2 %)	12 (20.6 %)	0.844
• Long tubular narrow infundidulum	16 (28.6 %)	14 (24.1 %)	
Size of pulmonary annulus (Z – value)	- 2 ± -1.47	-1.74 ± -1.3	0.278
McGoon's ratio	1.95 ± 0.2	2.12 ± 0.28	0.001§

Table (1): preoperative patient data
§ Statistically Significant difference in comparison between group I & II.

level, types of RVOT obstruction, Z – value of pulmonary annulus. However, the McGoon's ratio (PA branch sizes) was statistically significantly lower in group I than group II (1.95 ± 0.2 for group I vs 2.12 ± 0.28 for group II, P – value = 0.001). This was because of the PR minimizing strategy used in group I enabled us to work on cases with smaller branch pulmonary arteries (with McGoon's ratio as small as 1.5) that usually result in severe PR with very dramatic postoperative course in classic repair techniques.

There were also no significant differences between the 2 groups as regarding the ischemic time and cross clamping time.

When comparing the results of the 2 groups in the rate of trans-annular patching we found a statistically significant less use of trans-annular patch in group I than group II (51.8 % for group I vs 75.8 %for group II, P – value = 0.011). This is because of pulmonary valve sparing strategy in group I patients with avoiding trans-annular patch as much as possible by accepting pulmonary annulus Z - values as small as – 2, and hence accepting residual pulmonary stenosis with RV/LV pressures up to 0.7. Stewart and colleagues [11] showed that the pulmonary valve (annulus) preservation is possible in most patients presenting for a complete repair of tetralogy of Fallot (80% of their patients). They demonstrated that favorable prognostic factors for a conservative strategy are a pulmonary annulus Z-score greater than –4, a tricuspid pulmonary valve, and a postoperative Prv/Plv ratio less than 0.7. Furthermore, Boni and associates found that after a pulmonary valve sparing procedure in TOF patients there is a statistically significant

	Group I (mean ± SD)	Group II (mean ± SD)	p - value
Ischemic time (min.)	76.96 ± 18.98	76.29 ± 14.52	0.832
Bypass time (min.)	99.96 ± 24	92.76 ± 15.25	0.057
Trans-annular patch	29 (51.8 %)	44 (75.8 %)	0.011§
Infundibulotomy	29 (51.8 %)	54 (93.1 %)	0.001§
Prv/lv pressure ratio	0.43 ± 0.11	0.29 ± 0.2	0.005 §

Table (2): operative data
§ Statistically Significant difference in comparison between group I & II.

	Group I (mean ± SD)	Group II (mean ± SD)	P – value
Inotropic score	11.46 ± 4.79	17.86 ± 4.1	0.001 §
Duration of ventilation	3.07 ± 1.2	5.3 ± 1.1	0.001 §
ICU stay (days)	2.8 ± 0.89	4.3 ± 0.87	0.001 §
The 1st 48 hs CVP pressure (mmHg)	10.7 ± 2.9	13.8 ± 3.2	0.001 §
Hospital stay (days)	5.9 ± 0.87	7.2 ± 0.7	0.001 §
Residual PS (pressure gradient through RVOT –PA) by echo:			
• after 1 week	30.6 ± 15.39	20.26 ± 10.6	0.001 §
• After 6 -12 months	14.09 ± 3.46	13.22± 3.54	0.19
Degree of PR by echo:	0.78 ± 0.62	2.7 ± 0.8	0.001 §
Grade 0	18	0	0.001 §
Grade I	32	5	0.001 §
Grade II	6	38	0.001 §
Grade III	0	9	0.001 §
Grade IV	0	6	0.001 §
Reoperations	0	2	0.001 §

Table (3): postoperative data
§ Statistically Significant difference in comparison between group I & II.

reduction of Prv/Plv ratio at medium-term follow-up, even in those babies with an immediate postoperative Prv/Plv ratio 0.70, (from 0.61 ± 0.16 to 0.49 ± 0.20, $p < 0.01$), and a consequent growth of pulmonary annulus from a mean Z-score of –1.62 ± 1.01 to –0.37 ± 1.62 [12].

Also when comparing the results of the 2 groups in the rate of use of infundibulotomy, we found a statistically significant less use of infundibulotomy in group I than group II (29 (51.8 %) for group I vs 54 (93.1 %) for group II, P – value = 0.001). This is because we limited the use of infundibulotomy only in cases of severe infundibular hypoplasia not allowing the passage of the suitable Hegar of 0 Z-score in spite of combined extensive trans-atrial and trans-pulmonary resection of any obstructing bands or ridges or thickened conal septum within the RVOT. Even more, if there was a high tight infundibular narrowing, in 13 (23.2 %) of group I cases, the trans-annular incision was extended just for few mm below the annulus but never a full length infundibulotomy in order to maintain adequate intact infundibular conus below the pulmonary valve or its remnants which help to limit the resulting PR. We believe that pulmonary infundibulum plays an active role in protecting the right ventricle against the deleterious consequences of chronic pulmonary regurgitation. So, damage created by the infudibulotomy during tetralogy of Fallot repair plays a major role in the development of right ventricular dilatation in these patients. Previous investigators thought that the outlet portion of the right ventricle had only a passive role in right ventricular contraction, carrying the blood from the trabecular portion of the right ventricle to the pulmonary artery and, as such, had to be as large as possible. However, a recent magnetic resonance imaging study performed on 85 adult patients who had undergone operation for tetralogy of Fallot confirmed that the predictive factors of right ventricular dilatation were not only the presence of pulmonary insufficiency, but also the identification of an akinetic or dyskinetic area in the right ventricular outflow tract [16]. This was confirmed by the work of d'Acoz and collegues who compared the late outcomes of patients who had undergone operations known to generate pulmonary insufficiency, namely, trans-ventricular repair of tetralogy of Fallot and pulmonary commissurotomy for isolated pulmonary stenosis. They found that in spite of patients with isolated pulmonary commissurotomy had similar degrees of moderate to severe pulmonary insufficiency as tetralogy of Fallot patients who had a right ventricular outflow patch, the freedom from adverse events related to right ventricular dilatation was far better in patients with isolated commissurotomy. So, they concluded that pulmonary insufficiency is not the only determinant of late symptomatic right ventricular dilatation

after repair of tetralogy of Fallot. In other words, long-term pulmonary insufficiency alone is responsible for a slight degree of right ventricular dilatation, but symptoms may develop much later if the contractility of the pulmonary infundibulum is preserved [17]. This might be explained by the very peculiar role played by the pulmonary infundibular area in right ventricular function. Studies in animals have shown that the right ventricular contraction begins at the base of the heart and progress as a wave toward the pulmonary annulus. This peristaltic mode of function is crucial in achieving a complete emptying of the right ventricular cavity. As the pulmonary infundibulum receives blood thrusted during this initial part of the contraction, it is not only relaxed but it also bulges outwards. Only 50 ms after the beginning of the contraction will the infundibulum start contracting, thereby evacuating the accumulated blood [18]. It then remains squeezed as a sphincter until late in the diastolic phase thus supporting and augmenting the pulmonary valve function in preventing the backward flow of blood during RV diastole. This is helped by the fact that the pulmonary valve has the peculiarity of being inserted inside the inner shell of an exclusively muscular cylinder, the contraction of which inevitably approximates the pulmonary cusps to each other and increases their coaptation length [19]. Thus, if the pulmonary infundibulum is not the passive conduit that it was once thought to be and instead it takes an active part in the right ventricular contraction and in pulmonary valve function, then operations for repair of TOF should be designed to aim at its preservation [20].

Of course those techniques of pulmonary annulus sparing, restrictive patch enlargement, minimizing use of infundibulotomy and preservation of intact leaflets, of course, resulted in higher RV/LV pressure ratio (0.43 ± 0.11 for group I vs 0.29 ± 0.2 for group II, P – value = 0.005) and higher residual stenosis across RVOT-PA (30.6 ± 15.39 for group I vs 20.26 ± 10.6 for group II, P – value = 0.001).

However, let's look at the postoperative parameters of the two groups and the delayed echocardiography data:

There were significant differences between the 2 groups in the inotropic support (the inotropic score was 11.46 ± 4.79 for group I vs 17.86 ± 4.1 for group II, P – value = 0.001), ICU stay (2.8 ± 0.89 for group I vs 4.3 ± 0.87 for group II, P – value = 0.001) and hospital stay (5.9 ± 0.87 for group I vs 7.2 ± 0.7 for group II, P – value = 0.001) being lower in group I which can be explained by 2 factors: a) better RV functions with significantly lower CVP in group I than group II (10.7 ± 2.9 for group I vs 13.8 ± 3.2 for group II, P – value = 0.001) in spite of much less diuretic use with less negative crystalloid fluid balance during the early 48 hours postoperatively in group I than group II patients. , b) the lungs are not accustomed to sudden increase in pulmonary blood flow resulting in pulmonary congestion, increased bronchial secretions, pleural effusions and other respiratory problems with the need for chest care and physiotherapy; all of these were more pronounced in group II patients due to the free relieve of RVOT – PA obstruction.

Although the Residual PS (pressure gradient through RVOT –PA) was significantly higher in group I (30.6 ± 15.39) than group II (20.26 ± 10.6), P – value = 0.000 in first postoperative echocardiography 1 week after correction, there was no significant difference between the two groups in the last postoperative echocardiography (6 – 12 months later) (14.09 ± 3.46 for group I vs 13.22± 3.54 for group II, P – value = 0.19). In the other hand, there is significant difference in the degree of the pulmonary regurgitation between the two groups being significantly lower in group I (0.78 ± 0.62 for group I vs 2.7 ± 0.8 for group II, P – value = 0.001).

There were 2 reoperations among patients of group II (4 and 5 years after the first operation); both were for severe pulmonary and tricuspid regurgitation with marked RV & RA dilatation and marked hepatmegaly. In both patients pulmonary valves were replaced with tissue valves and tricuspid valves were repaired with no mortality. No reinterventions for the RVOT – PA were required up to now for group I patients. In spite of a shorter duration of follow up in group I than group II, it is not expected for group I patients to require reinterventions for the RVOT – PA in the future due to the acceptable residual PS (14.09 ± 3.46) and PR (0.78 ± 0.62) after 1 year follow up in comparison to group II patients who had a residual PS (13.22± 3.54) and PR (2.7 ± 0.8) after 1 year follow up.

Cases with long tubular narrow infundibulum: found in 16 (28.6 %) cases out of 56 cases of group I, all had trans-annular patch due to small annulus (Z – value > 2). However, the trans-annular incision was extended just few mm below the annulus, (never involving the whole length of the infundibulum). Then through this small transannular incision, extensive resection of the fibrosis within the narrow infundibulum was done all around the infundibulum in addition to muscular resection from the conal septum and medial and lateral muscular bands to a degree just to allow the passage of the suitable Hegar dilator (adjusted to Z – score of -2 for that patient). Then the trans annular pericardial patch was sutured, the size of which was adjusted to allow passage of just the suitable Hegar dilator at the level of the annulus, this patch was made slightly wider below the annulus to create a sinus overlying the small opened distal part of the infundibulum which act with the preserved pulmonary cusps in decreasing the post-repair PR. All the 16 cases had only grade I – II PR and residual pressure gradient across the RVOT of 40 – 65 mmgh (mean 57 ± 22 mmgh) in the postoperative echocardiography after 1 week, however, that residual pressure gradient across the RVOT dropped to mean 24 ± 9 mmgh after 6 – 12 months. In group II patients, there were 14 (24.1 %) such cases and all were managed by full length infundibulotomy with overlying trans-annular pericardial patch which resulted in severe PR postoperatively in spite of low residual pressure gradient across the RVOT of 12 – 25 mmgh (mean 18 ± 6 mmgh) in the postoperative echocardiography.

Right ventricular outflow tract reconstruction with a polytetrafluoroethylene **monocusp valve**: only required in 2 cases of all our patients, both had severely rudimentary nearly absent pulmonary valve cusps. Both had grade II PR postoperatively which remained stable on the follow up echocardiography 1 year later. Brown and colleagues in their work about the use of this technique in 192 patients found that it

was simple and reproducible technique demonstrating excellent early postoperative function with minimal PI. Even more, the **monocusp valve** has functioned very well in most patients for the first 2 to 3 years and up to 10 years in some patients, and the **monocusp** has not produced recurrent RVOT obstruction, but some regurgitation develops as the RVOT grows [15].

Conclusions:

During repair of tetralogy of Fallot every effort should be done in order to minimize or even avoid the pulmonary regurgitation. This can be achieved, without the need for pulmonary valve replacement, by combinations of different techniques: Pulmonary annulus sparing strategy, restrictive patch technique if trans-annular patching is inevitable (Z value > -2), preservation of good functioning pulmonary leaflets, and finally the most important point is to avoid or minimize infundibulotomy. Adherence to PR avoiding strategy did not result in any increased mortality or morbidity. Furthermore, it resulted in smoother uneventful early postoperative outcome.

Long term follow up is required to address the stability of the presented results.

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Temporary detachment of the septal leaflet of the tricuspid valve for VSD closure in children

Ahmed Mohamed Fathy Ghoneim, MD.

Background: **VSDs can be successfully closed using a transatrial approach working across the tricuspid valve. Previous reports suggested tricuspid valve detachment technique (TVD) to improve exposure for closure of VSDs. However there has been concern that TVD might impair valve function, increase operative time and the incidence of postoperative heart block. Objectives: to review our experience with the use of TVD technique for transatrial closure of perimemberanous VSD in children and any resulting complications over one year postoperative follow up. Patients**

Methods: **Review of our cardiothoracic surgery database identified 158 children (91 males and 67 females) with mean age 3.16±2.6 ys and weight 12.5±8.5 kg underwent transatrial closure of perimemberanous VSD between 1/1/2000 and 31/12/2008 in the Cardiothoracic Surgery department, Assiut University Hospitals. Out of 158 children, 22(13.9%) were operated with TVD technique while 136 (86.1%) were non TVD. The diagnosis of VSD and the postoperative follow up (immediately and over 1 year) were done clinically and by echocardiography in the Pediatric Cardiology unit, Children University Hospital.**

Results: **VSD patch closure was done in 79% and primary closure in 21%. Mean cardiopulmonary bypass time was 58±14 min, cross clamp time was 41±13 min and postoperative hospital duration was 6.4±2.8 days with no significant difference between TVD and non TVD group. No postoperative permanent heart block or needs for pacemaker implantation were recorded in both groups. There was no statistical significant difference between TVD and non TVD patients as regarding postoperative tricuspid regurgitation more than grade I [2/22 (9.5%) vs 9/136 (6.5%), P – value = 0.652 immediately and (1/19) 5.5% vs (8/121) 6% after 1 year follow up, P – value = 1]. In non TVD group, insignificant residual VSD shunting was detected in 8% of patients immediately postoperative then spontaneous closure occurred on follow up with only residual in 2% of patients, with no residual VSD shunting detected in TVD patients. On follow up echocardiography detected improvement in almost all cardiac parameters with no significant difference in between groups.**

Conclusion: **TVD is a safe method to enhance the exposure of VSD and allow perfect closure with no residual VSD shunting. It does not increase the incidence of postoperative TR. Also, it does not result in any conduction block if done properly. It could be freely used for difficult VSD exposure; extensive chordal or tricuspid tissue attachments to the edges of VSD.**

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The most frequent congenital cardiac anomaly is ventricular septal defect (VSD). Many VSDs are small, asymptomatic and are assumed to close spontaneously [1]. In the VSDs that need closure, surgical treatment is aimed at prevention of pulmonary hypertension, endocarditis or in some instances of progressive aortic valve regurgitation [2]. Repair of VSD, either isolated or in association with other cardiac anomalies, is the most common operation in the surgery of congenital heart defects. Successful closure requires good visualization and avoidance of the conduction tissue. Transatrial closure of VSD requires adequate visualization of the margins of the defect in order to avoid residual VSD, creation of heart block, and distortion of the tricuspid valve [3]. The technique of detachment of the tricuspid valve septal leaflet from the annulus has been advocated by some investigators as a simple, reliable technique to improve visualization of the margins of perimembranus VSDs and was firstly described by Hudspeth and colleagues [4] or one of its numerous modifications [5, 6]. However there has been concern that detachment of the tricuspid valve leaflet might impair valve function, as well as increase operative time and the potential risk of increase the incidence of postoperative

tricuspid regurgitation and heart block [7]. Opinions vary among surgeons regarding usefulness of TVD as an approach for transatrial closure of VSD. Consequently, its frequency of use varies widely, from never being used to always being used [8, 9].

The aim of this work is to review our experience with the use of TVD technique for transatrial closure of pVSD in children and any resulting postoperative complications over the first postoperative year.

Methods:

Review of the cardiothoracic surgery database identified 158 children (91 males and 67 females) with mean age 3.16±2.6ys (1-10ys) and mean weight 12.5±8.5 kg (7.5-69 kg), who underwent transatrial closure of pVSD between 1/1/2000 and 31/12/2008 in the Cardiothoracic Surgery department, Assiut University Hospitals. Out of 158 children, 22 (13.9%) children were operated with TVD while 136 (86.1%) were operated without TVD technique (according to the surgeon's choice with TVD was used in cases with multiple chordal or extensive tricuspid leaflet tissue attachments to the rim of the VSD rendering the edge of the VSD, especially the posteroinferior edge, not well visualized or accessible). Written consent from the parents, and the approval of Ethics Committee of Assiut University Hospital were obtained for the study. VSD diagnosis and postoperative follow up were established clinically and by echocardiography in Pediatric Cardiology unit, Children University Hospital. Patients with types other than pVSD and patients who underwent VSD closure via either the pulmonary artery or ventriculotomy were excluded from the study. The follow up echocardiography was done immediately postoperative within 5-15 days and later on at least two follow up studies at 6 and 12 months. The immediate evaluation were done for all patients (n=158) and the later follow up were done for only 140 patients (as 5 deaths and 13 missed the follow up). The echocardiographic study including examination for residual VSD shunting, tricuspid, mitral, pulmonary and aortic valves function, left ventricular function, detection of pulmonary hypertension or vegetations of infective endocarditis were done. TR was graded as none, 1, 2, 3 and 4 on the area and length of the Doppler color jet.

Technique of temporary detachment of tricuspid valve (TVD):

When TVD was utilized to improve visualization, a circumferential incision was made in the septal leaflet 2 mm from the annulus. If necessary, the incision can be extended onto the anterior or the posterior leaflet to improve visualization of the superior or the inferior margin of the defect. The VSD is closed with a patch using a continuous suture or interrupted suture technique and the patch is attached to the annulus. The incision in the leaflet is closed with a second continuous suture of 6/0 polypropylene making sure not to consume excessive leaflet tissue in the suture line [7].

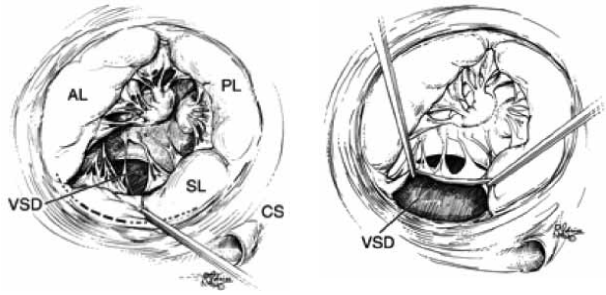

Fig (1) The septal leaflet crossing the margins of the VSD
Fig (2) The incision in the septal leaflet 1-2mm from the annulus

Fig (3): Working through the leaflet incision, the defect is closed with a patch, which is suspended from the annulus using a horizontal mattress suture. The leaflet incision is closed with a second suture

Statistical analysis:

Data are presented as mean±standard deviation and range. Comparisons between patient groups were performed using the independent samples t-test and Chi square. The level of statistical significance was set at a p-value of 0.05 or less. Data Analysis was done using the statistical package SPSS PC (version 11.0) (SPSS INC., 444 N. Michigan Avenue, Chicago, IL 60611, USA).

Results:

The descriptive data of the studied patients in table (1)

Additional procedures during surgical repair of VSD in table (2)

Descriptive and surgical data in TVD and non TVD patients in table (3)

Clinical findings pre and postoperative in TVD and non TVD patients in table (4)

Echocardiographic detection of TR pre and postoperative in TVD and non TVD patients in table (5)

Echocardiographic parameters pre and postoperative in TVD and non TVD patients in table (6)

There was no statistically significant difference between TVD and non TVD patients as regarding the presence of significant postoperative tricuspid regurgitation "more than grade I" [2/22 (9.5%) vs 9/136 (6.5%) immediately, P – value = 0.652 and (1/19) 5.5% vs (8/121) 6% after 1 year follow up, P – value = 1].

Discussion:

Isolated VSD is by far the most common congenital heart defect, and surgical closure of VSD is the most common open-heart procedure performed in pediatric cardiac surgery [1]. The goal of VSD closure should not only be attaining separation of the both circulations, but should also consider the geometry of the heart and induce minimal trauma to the myocardium. A technique that minimizes myocardial damage, leads to an unobstructed outflow tract, and includes a short ischemic period presents obvious advantages, especially in cases where VSD closure is only a part of a whole correction undertaken [10].

In the present study, review of the cardiothoracic surgery database identified 158 children (91 males and 67 females) with mean age at time of operation 3.16±2.6, and weight 12.5±8.5 underwent transatrial closure of pVSD. Out of 158 children, 22 (13.9%) children were operated with TVD while 136 (86.1%) were operated without TVD technique (according to the surgeon's choice with TVD was used in cases with multiple chordal or extensive tricuspid leaflet tissue attachments to the rim of the VSD rendering the edge of the VSD, especially the posteroinferior edge, not well visualized or accessible). Gaynor and associates [7] reported TVD in 21% of their patients in closing an isolated VSD, also, Bol-Raap and colleagues reported the need for TVD in 24% & 26% of their patients with VSD [8, 9]. Furthermore, Sasson and associates who used TVD in 22% of their patients for VSD repair, used it not only in cases of multiple chordal or extensive tricuspid leaflet tissue attachments to the rim of the VSD, but also in cases of VSDs extending into the outlet components of the interventricular septum that necessitate severe traction of the tricuspid valve to improve exposure. Detachment of the septal leaflet and a contiguous portion of the anterior leaflet open the peri-membranous part of the VSD and gives excellent exposure of all the margins of the VSD [11]. However, in our experience with closure of VSDs extending into the outlet components of the interventricular septum, we use a radial incision in the leaflet tissue of the anteroseptal commissure that we close by interrupted sutures at the end of the procedure.

In comparison between patients with TVD and non TVD technique, there were no significant differences regarding cardiopulmonary bypass time, cross clamp time or duration of

Age at time of op mean±SD (ys)	Weight at time of op mean±SD (kg)	Males/ Females (n)	TVD		VSD procedure Type of Closure		mean±SD time (min)		mean±SD postoperative Hospitalization (days)
			With (n)	Without (n)	Patch (n)	Primary (n)	Bypass	Cross clamp	
3.16±2.6	12.5±8.5	91/67	22 (13.9%)	136 (86.1%)	126 (79%)	32 (21%)	58±14	41±13	6.4±2.8

Table (1): The descriptive data of the studied patients All TVD patients were closed with patch closure

Additional procedures	Closure of ASD or PFO	Ligation of PDA	Pulmonary valvotomy or arterioplasty	Division of right ventricular muscle bundles	Resection of the subaortic membrane	Aortic cusp resuspension	Total (n=158)
No of cases	22 (13.9%)	18 (11.4%)	12 (7.5%)	5 (3.3%)	6 (3.7%)	8 (5%)	71 (44.8%)

Table (2): Additional procedures during surgical repair of VSD

	Age at time of op mean±SD (ys)	Weight at time of op mean±SD (Kg)	Male/ Female (n)	mean±SD time (min)		postoperative heart block (n)	pacemaker implantation (n)	mean±SD postoperative Hospitalization (days)
				Bypass	Cross clamp			
TVD (n=22)	2.3±1.34	9.9±4.3	16/6	59±13	44±16	0	0	6±2.4
non TVD (n=136)	3.1±2.8	12.1±8	75/61	52±14	39±13	0	0	7.2±3
P value	NS	NS	NS	NS	NS	-	-	NS

Table (3): Descriptive and surgical data in TVD and non TVD patients

Clinical findings	Preoperative (n=158)	Postoperative					
		immediately			on follow up		
		TVD (n=22)	non TVD (n=136)	Total (n=158)	TVD (n=19)	non TVD (n=121)	Total (n=140)
Cardiomegaly	131(83%)	9(41%)§	107(78.6%)*	116(73%)	2(10.5%)§	61(50%) *	63(45%)§
Heart failure	53(33%)	3(13%)§	15(11%)§	18(11%)§	0§	2(1.6%)§	2(1.4%)§
Murmurs	149(94%)	2(9%)§	35(26%)§*	37(23.4%)§§	0§	13(10.7%)§§*	13(9%)§§
Infective endocarditis	11(7%)	0§	1(0.7%)§	1(0.6%)§	0§	0§	0§
Chest findings	123(78%)	5(22%)§	36(26%)§	41(25%)§	1(5%)§	10(8%)§	11(7.8%)§
Deaths	-	0	0	0	1(5%)	4(3.3%)	5(3.5%)

Table (4): Clinical findings pre and postoperative in TVD and non TVD patients
****Significant difference in comparison of TVD with non TVD patients***
§ Significant difference in comparison of postoperative with preoperative patients (* and § = p<0.05, §§ = p<0.01)

Echocardiographic findings of TR	Preoperative (n=158)	Postoperative					
		immediately			on follow up		
		TVD (n=22)	non TVD (n=136)	Total (n=158)	TVD (n=19)	non TVD (n=121)	Total (n=140)
Peak velocity (m/sec)	2.96± 0.24	2.14± 0.32	2.8 ± 0.48	2.2±0.43	2.36± 0.16	2.65 ± 0.2	2.43±0.58
none	97(61%)	17(77%)	115(84.5%)	132(83.5%)	16 (84%)	107(88.5%)	123(87.8%)
Grade 1	32(20%)	3(13.5%)	12(9%)§	15(9.5%)§	2(10.5%)	6(5.5%)	8(5.7%)§
Grade 2	21(13.5%)	2(9.5%)	5(3.5%)§	7(4.5%)§	1(5.5%)	5(4%)	6(4.5%)§
Grade 3	8(5.5%)	0	4(3%)	4(2.5%)	0	3(2%)	3(2%)§
Grade 4	0	0	0	0	0	0	0
Total regurgitation	61(39%)	5(23%)	21(15%)§	26(16.5%)§	3(16%)	14(11.5%)	17(12.2%)§

Table (5): Echocardiographic detection of tricuspid regurgitation pre and postoperative in TVD and non TVD patients
§ Significant difference in comparison of postoperative with preoperative patients
(§= p<0.05)

Echocardiographic findings		Preoperative (n=158)	Postoperative: Immediately TVD (n=22)	Immediately non TVD (n=136)	Immediately Total (n=158)	on follow up TVD (n=19)	on follow up non TVD (n=121)	on follow up Total (n=140)
Residual VSD	No.		0	11(8%)*	11(7%)	0	3 (2.4%)	3(2%)
	Peak velocity (m/sec)		-	3.4±0.7	3.4±0.7	-	2.6±0.92	2.6±0.92
Mean±SD dimension (mm)	LA	39±4	32±3.7§	40±2.3*	36±4	29±3 §	32±2.3§	29±3.5§
	LV end diastolic	49±7	45±7	44±4.6	45±6.3	34±6§	36±2.6§	33±0.8§
	LV end systolic	33±9.2	30±6.6	32±6	30±7.1	29±5.2	31±4.7	30±4.2
	RV	28±3.5	28.4±5	27.5±6.6	27±4.4	24±5	25.3±6	24.9±7
	IV septum	5.9±0.8	5.6±0.5	5.2±2	5.3±0.6	4.1±0.7	3.9±1.3	3.9±0.9§
	LV post wall	4.3±0.2	4±1.2	4.6±0.9	4.1±0.5	3.9±3	4.2±0.8	4±0.6
	SF %	33.6±4.2	30±11	34±9.6	31.2±6.6	33±2.6	32±0.7	32.7±6
No. of patients with	LA dilatation (> 40mm)	22 (14%)	1 (4.5%)	9(6.6%)	10(6.3%)	0§	4(3.3%)§	4 (2.8%)§
	LV dilatation (> 55 mm)	16 (10%)	1(4.5%)	8(5.8%)	9(5.6%)	0§	4(3.3%)§	4(2.8%)§
	Pulmonary hypertension (> 35 mmHg)	13 (8.2%)	1 (4.5%)	4(2.9%)	5(3.1%)	0§	0§	0§
	Mitral regurgitation	9(5.6%)	2(9%)	7(5%)	9(5.6%)	0§	1(0.8%)§	1(0.7%)§
	Pulmonary regurgitation	11 (7%)	2 (9%)	5 (3.6%)	7(4.4%)	0§	1(0.8%)§	1(0.7%)§
	Aortic regurgitation	6 (3.7%)	1 (4.5%)	3(2.4%)	4(2.5%)	1(5%)	2(1.6%)	3(2.1%)
	SF (<25%)	11 (7%)	1 (4.5%)	5(3.1%)	6(3.7%)	0§	2(1.6%)§	2(1.4%)§
	Vegetation of Infective endocarditis	9(5.6%)	0§	1(0.8%)	1(0.7%)	0§	0§	0§

Table (6): Echocardiographic parameters pre and postoperative in TVD and non TVD patients
LV left ventricle, LA left atrium, SF% shortening fraction
****Significant difference in comparison of TVD with non TVD patients***
§ Significant difference in comparison of postoperative with preoperative patients (*and §= p<0.05)
No child in either group has undergone reoperation for TR or for residual VSD.

postoperative hospitalization. There was no postoperative heart block or need for pacemaker implantation in either group (table 3). This is in keeping with Gaynor and colleagues who stated that the technique is safe and no patient developed postoperative heart block [7].

In the present study color-Doppler echocardiography demonstrated small residual insignificant VSD shunts in 11(8%) of non TVD patients immediately postoperative then spontaneous closure occurred with residual VSD shunts in 3(2.4%) of them after one year of follow up without pulmonary hypertension (table 6). This is in keeping with Aeba and associats and Maile and colleagues who stated that small residual shunts are frequently noted after repair of VSD [5, 6]. Nygren and colleagues reported small residual VSD in (6%) of his patients with no signs of pulmonary hypertension or symptomatic arrhythmias [12]. On the other hand, patients in whom TVD

was used did not show any residual VSD shunting logically because of improved exposure of the proper edge of VSD with subsequent precise placement of the stitches (table 3 and 6). Our findings are in keeping with Gaynor and colleagues who stated that no child in the TVD group has required late reoperation for residual VSD, compared to two patients in the non-TVD group [7]. Also, Bol-Raap and colleagues stated that 21% of their patients had a trivial residual VSD (26% with TVD and 74% are non TVD) and one reoperation (non TVD) was performed 12.5 months after the initial surgery for recurrent VSD [9].

The anomalies of the tricuspid valve, which may be acquired secondary to left-to-right shunting, are frequently associated with perimembranous defects. These anomalies include excess septal or anterior leaflet tissue that can partially or completely occlude the defect and are associated with spontaneous closure of the VSD [13]. This situation alone, with or without chordal attachments crossing the VSD, may make the exposure of the VSD margins difficult, and the surgeon may need to exert traction on the tricuspid valve leaflets that may cause distortion of the tricuspid subvalvular apparatus and tricuspid regurgitation. As a result, temporary detachment of the tricuspid valve from the annulus not only optimizes visualization of the defect, but also may result in improved preservation of tricuspid valve function [11]. In our study, There was no statistical significant difference between TVD and non TVD patients as regarding postoperative tricuspid regurgitation more than grade I [2/22 (9.5%) vs 9/136 (6.5%) immediately and (1/19) 5.5% vs (8/121) 6% after 1 year followup]. Frenckner and colleagues reported the use of TVD in 27 patients undergoing VSD closure without significant residual VSD, TR, or heart block. In their work, postoperative echocardiography showed that tricuspid insufficiency in the detached group was even considerably lower compared to the non-detached group. In the detached group the valve will keep its original strength and elasticity [14]. In the non-detached group, however, the valve may experience mechanical stress by stretching the chordae or the leaflets that could lead to temporarily insufficiency [7, 14].

Deaths from non cardiac causes occurred in 3.5% of patients on follow up with no significant difference between TVD and non TVD patients (table 4). This is in keeping with Roos-Hesselink and colleagues who recorded late deaths in 4% of his patients but were of cardiac causes as right ventricular hypertrophy due to long-standing right ventricular pressure overload, causing ventricular arrhythmia [15].

Conclusion:

We can conclude that TVD is a safe method to enhance the exposure of VSD and allow perfect closure with no residual VSD shunting. It does not increase the incidence of postoperative TR. Also, it does not result in any conduction block if done properly. It could be freely used for difficult VSD exposure; extensive chordal or tricuspid tissue attachments to the edges of VSD.

Studies in the long term should tell us whether the growth of the tricuspid valve is appropriate and if the incidence of arrhythmias is reduced.

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Size 19mm Mechanical Bileaflet Aortic Valve in Adult Rheumatic Patients

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Abstract: **Rheumatic heart disease disfigures the normal morphology of the cardiac valves. Using the right size and design of the prostheses in these patients to some extent determines the surgical outcome. The aim of the current retrospective study was to assess the heamodynamic outcome after implantation of size 19mm mechanical bileaflet prosthetic aortic valves in adult rheumatic heart patients.**

Methods: **Over a ten-year period 60 consecutive adult rheumatic heart patients underwent aortic valve replacement in Al-Azhar University Hospitals, Cairo, EGYPT. There were 21 males (35%) and 39 females (65%). Their ages ranged from 17 to 55 years mean of 27.4+/-9.4 years. Their body surface area ranged from 1.3 M2 to 1.86 M2 mean of 1.6+/-0.15 M2. Six patients (10%) were in NYHA class 4 and 54 patients (90%) were in NYHA class 3. Ten patients (16.7%) were diagnosed having double aortic valve lesions with dominant stenotic valve. Eleven (18.3%) were diagnosed to have isolated aortic valve stenosis. Thirty nine patients (65%) were diagnosed to have aortic and mitral valve lesions. These patients two (3.3%) of them had moderate isolated AI, 3 (5%) AS& moderate AI and 34 (56.7%) had isolated AS. Over all aortic valve lesions consisted of 45 (75%) stenotic, 10 (16.7%) double lesions with dominant stenosis, 2 (3.3%) AI and 3 patients (5%) with fixed orifice. The pre-operative mean systolic pressure gradient ranged from 35 to 85mmHg with mean of 57.7+/-12.49 mmHg. Two patients (3.33%) reported to have poor LV function, 38(63.33%) of moderate and 20 (33.33%) of good LV function.**

Results: **There were three different manufacture models of size 19mm aortic valves used; St. Jude (13), Carbomedics (14) and Sorin (33) valves. All were seated using interrupted 2/0 Ethicon sutures. There was marked improvement in clinical out come after surgery. NYHA was class 3 in 2 (3.3%), class 2 in 10 (16.7%) and class 1 in 48 patients (80%) (P< 0.05). The mean systolic pressure gradient at rest has dropped significantly post-operatively. The range post-operatively was 7 to 25 mmHg and mean of 14.52 +/-5.25 (P< 0.05). Thirteen patients (21.6%) reported gradient of 7-9 mmHg, 25 (41.7%) of 10-16 mmHg and 22 (36.7%) of 17-25 mmHg. There was also improvement in LV function, 18 patients (30%) had moderate and 42 patients (70%) had good LV functions. Using multivariate analysis there was no significant correlation between post-operative gradient and age. However, there was direct correlation between post operative gradient and body surface area. This relation was quite obvious in those patients (36.7%) who have BSA 1.7 M2 and more.**

Conclusion: **The study verdict showed that size 19mm mechanical bileaflet aortic valve can be used in adult rheumatic patients preferably with body surface area less than 1.69 M2.**

Rheumatic heart (RhD) disease disfigures the normal morphology of the cardiac valves. In this context not all cases behave post-operatively the same. This is related to many reasons. Rheumatic fever (RhF) affects the myocardium as well as the valves. Severity of the disease differs from patient to another. The duration of the disease progression to performance of surgery has great impact related to the numbers of episodes of rheumatic attacks and the degree of subsequent healing of the damaged tissues. Not only primary rheumatic pathological changes but also the secondary complications like enlargement of the cardiac chambers, atrial fibrillation and calcification of the valves burden the patient's circumstances too.

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Using the right size and design of the prostheses in those patients to some extent determines the surgical outcome. Small aortic ring escalates the challenge which any surgeon could face to choose the right size. Several techniques have been developed to overcome these difficulties to enlarge the annulus. However, this technique might be difficult to achieve in some circumstances (1,2). Many controversies have been raised regarding using stentless bioprostheses (3) or mechanical prostheses inserted on top of the aortic ring (4,5). Therefore, replacement of the diseased valve by a prosthesis that fits into the existing root could be the acceptable work-out to the problem.

This debate has led to the aim of the current retrospective study in assessing the heamodynamic outcome after implantation of size 19mm mechanical bileaflet prosthetic aortic valves in adult rheumatic heart patients. This was based on clinical evaluation (NYHA classification); echocardiography pre- and post-operatively measuring the mean pressure gradient across the aortic valve and ventricular function at rest. This was in correlation to age, gender and body surface area (BSA) of the patient.

Methods

Over a ten-year period (August 2000 and August 2010), 60 consecutive adult rheumatic heart patients underwent aortic valve replacement (AVR) in Al-Azhar University Hospitals, Cairo, EGYPT. Retrospective informations for these patients were obtained from the patients' clinical records including pre-operative assessment, operative reports and follow up data. There were 21 males (35%) and 39 females (65%). Their ages ranged from 17 to 55 years mean of 27.4+/-9.4 years. There were 9 patients (15%) of 17 years of age and 8 patients (13.3%) of age above 40 years.Their body surface area was ranged from 1.3 M2 to 1.86 M2 mean of 1.6+/-0.15 M2. Fourteen patients (23.3%) had BSA less than 1.5 M2, 24 patients (40%) between 1.51-1.69 and 22 patients (36.7%) above 1.7 M2.Clinical assessment included New York Heart Association (NYHA) as base reference for judgement in pre and post-operative out come was used. Six patients (10%) were in NYHA class 4 and 54 patients (90%) were in NYHA class 3.

Laboratory Investigations, plain CXR, ECG and echocardiography were performed. M mode, two D, Doppler (continuous and pulsed) and colour flow Doppler were used for pre- and post-operative echocardiographic assessment. The degree of valve incompetence and the mean systolic pressure gradient through the native valve and the prostheses were measured in all studied patients. Diagnostic Coronary angiography was done as routine investigation for patients above 40 years of age.

Ten patients (16.7%) were diagnosed having double aortic valve lesions with dominant stenotic valve. Eleven (18.3%) were diagnosed having isolated aortic valve stenosis. Thirty nine patients (65%) were diagnosed of having aortic and mitral valve lesions. These patients two (3.3%) of them had moderate isolated aortic incompetence (AI), 3 (5%) aortic stenosis (AS) with moderate AI and 34 (56.7%) had isolated AS. Regarding the mitral valve, 4 patients (6.7%) had severe mitral valve incompetence (MI), 20 (33.3%) with mitral valve stenosis (MS) (gradient 12-17 mmhg) and 15 (25%) with double valve lesions. Over all aortic valve lesions consisted of 45 (75%) stenotic, 10 (16.7%) double lesions with dominant stenosis, 2 (3.3%) AI and 3 patients (5%) with fixed orifice.

The pre-operative mean systolic pressure gradient ranged from 35 to 85mmHg with mean of 57.7+/-12.49 mmHg. Two patients (3.33%) had poor left ventricular (LV) function, 38 (63.33%) moderate and 20 (33.33%) good LV function. Calcific aortic valve was present in 7 patients (11.7%), healed ring abscess in one patient (1.7%) and atrial fibrillation in 19 patients (31.7%) who had aortic and mitral valves lesion.All studied patients had their operation performed electively and received size 19mm mechanical bileaflet prostheses for replacing the aortic valve. One patient (1.7%) had redo valve replacement for degenerative bioprostheses. This patient had his second operation 7 years after the first operation. She required mitral valve replacement in the second operation too. All patients started having oral anticoagulant in the first post-operative day unless there was surgical bleeding. The study included patients who have been followed for 6 months and their files up to the follow up were complete to get the required data.

Statistical analysis

Continuous data are expressed as means (+/- standard deviation or values with 70% CLs) and categorical variables as percentage. Means were compared with unpaired t-test and proportions with Chi-square or Fishers exact test as appropriate. Risk factors for post-operative mean systolic pressure gradient were examined using multivariate logistic regression. Kaplan-Meier estimator and actuarial method estimated Time related events (dichotomous variables). A probability value of $P< 0.05$ was considered as significant.

Results

There were no signs of rheumatic activity before or during surgery in all studied patients. There were three different manufacture models of size 19mm aortic valves being used; St. Jude (13), Carbomedics (14) and Sorin (33) valves. All were seated using interrupted 2/0 Ethicon sutures. Regarding the used mitral valve for replacement (39 patients), 5 patients had size 25mm, 21 patients had 27mm and 13 patients had 29mm. Three valves were St. Jude, 4 Sorin and 32 Carbomedics.

Two patients (3.3%) required three stitches to be taken from out-in through the wall of the aorta then through the sewing ring of the prosthesis. The first patient had heavily calcific right coronary cusp and the second patient had healed ring abscess between the right and non coronary cusps. One patient (1.6%) had delayed recovery (Pt. No.3) after surgery (58 hours on mechanical ventilation). She was 55 years old, double stenotic aortic and mitral valves. She was NYHA class 4 with mean systolic pressure gradient of 65 mmHg across the aortic valve pre-operatively. At 6 months of follow up one patient (5.3%) out of 19 remained in sinus rhythm after conversion from AF

during surgery. One patient (1.7%) had stitch sinuses required debridement. There was marked improvement in clinical out come after surgery (fig.1). NYHA was class 3 in 2 (3.3%), class 2 in 10 (16.7%) and class 1 in 48 patients (80%) (P< 0.05). results.The mean systolic pressure gradient at rest has dropped significantly post-operatively (fig.2).

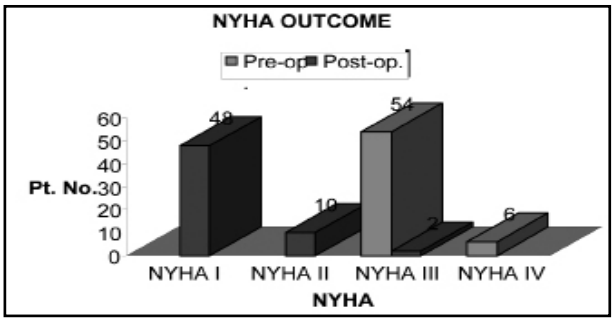

Fig.1: pre- and post-operative NYHA results.

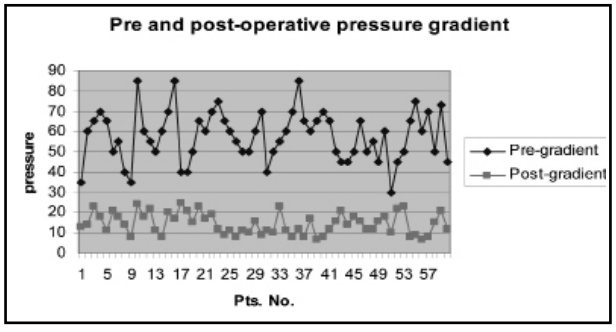

Fig. 2: Pre and post-operative pressure gradient.

The range post-operatively was 7-25 mmHg and mean of 14.52 +/-5.25 (P< 0.05). Thirteen patients (21.6%) reported gradient of 7-9 mmHg, 25 (41.7%) of 10-16 mmHg and 22 (36.7) of 17-25 mmHg.There was also improvement in LV function (fig.3), 18 patients (30%) had moderate and 42 patients (70%) had good functions.

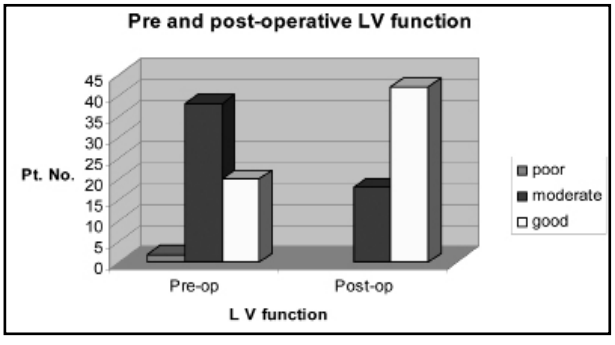

Fig.3: Pre and post-operative LV function.

Using multivariate analysis there was no significant correlation between post-operative gradient and age (fig.4).

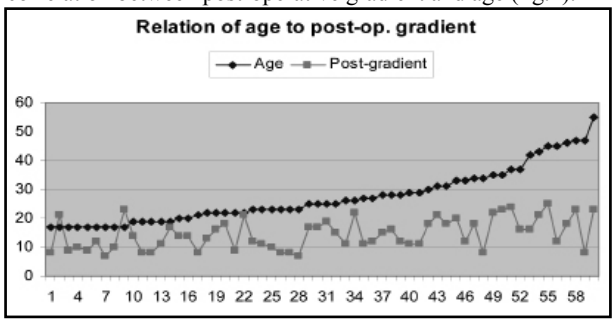

Fig. 4: Relation between age and post-operative gradient.

However, there was direct correlation between post operative gradient and body surface area (fig.5). This relation was quite obvious in those patients (36.7%) who have BSA 1.7 M2 and more.There was no reported valve thrombosis, malfunction or endocardities after 6 months of follow up.

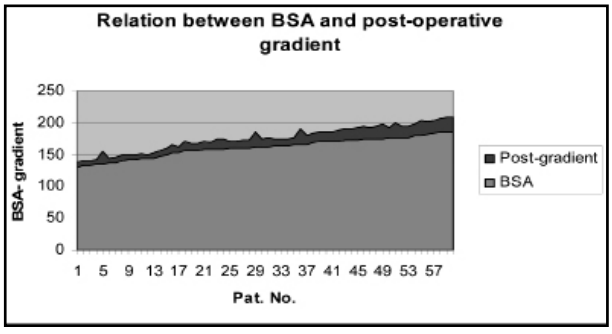

Fig. 5: Relation between BSA and post-operative gradient.

Discussion

Rheumatic fever and its sequelae, chronic rheumatic heart disease, remain important causes of morbidity and mortality worldwide (6). It affects children and young adults living in developing countries where poverty is widespread (7). Frequent relapses; often result in prolonged hospitalisation and surgery with long-lasting adverse effects on life style and employability (7). Early treatment, secondary antibiotic prophylaxes and primary prevention are cost effective at all levels in tackling the disease (8,9). The majority of the study population experienced symptoms of RhF in history period of their illnesses. However, all of them had very little knowledge about the fate of recurrent episodes and subsequent complications of their situation. Even doctors who were dealing with their management until recently don't appreciate the value of the secondary antibiotic prophylaxis. The society takes management of fever in children lightly. Unfortunately sub-clinical recurrences are common and their end results usually end by rheumatic RhD diseases and surgery.

Mechanical heart valves are widely used to replace dysfunctional and failed heart valves. Although valve replacement is among the most common cardiovascular surgical procedures, its outcome is often difficult to predict (10). One of the reasons is the design and choice of the material used for the fabrication of the prostheses (10). Selection of the prosthesis type is most likely to maximize early and late outcome (11).

The bileaflet mechanical heart valves are very popular due to its superior heamodynamics. They account about two thirds of the prosthetic heart valve market (12). Through the last ten year period of the study there has been marked improvement of the mechanical valves' design. The sewing cage which is occupying part of the anatomical aortic orifice has become thin and less tense. Moving of the aortic valve leaflets inside the metallic cage is another advantage, especially in patients who develop secondary hypertorphic out flow septum. Reported regression of this hypertrophy (11,13) after surgery has encouraged surgeon to proceed for replacement avoiding septal resection. There were no much obvious differences in the three mechanical valve models which were used in the current study. They had been used based on the stock availability during the procedures in the department. Lee, et al; 2007 studied the hydrodynamic characteristics of three bileaflet mechanical heart valves (ATS, St. Jude and Sorin Bicarbon) in an artificial heart and concluded that there was no significant differences between all of them (14).

However, with these tremendous efforts to improve the performance of the mechanical valves, still insertion of size 19mm mechanical bileaflet valve in adult rheumatic heart patients represents a challenge to any surgeon. Matching the existing anatomical orifice with suitable mechanical valve size sometimes does not fulfil the physiologic demands. Tulga, et al; 2007 used dobutamine stress echocardiography in assessment of peak pressure gradient through replaced aortic valve (15). He concluded that patients who have valve size 21mm gain higher peak pressure gradient than the patients who have valve size bigger than 21mm. This difference increases significantly with stress (15). However many studies concluded that moderate mismatch is common and is tolerable (16,17,18,19). There are many methods to over-come the small aortic ring (1,2). On the other hand some factors could let down these alternative options. Seventy five percent of the study population were suffering from aortic stenosis with small aorta. Sixty five percent had concomitant mitral valve lesion with dominant stenosis and they underwent double valve replacements. With presence of in and out flow left ventricular stenosis the left ventricular dimensions would be relatively less than it should be expected. Manipulation by enlargement of such situation during surgery might increase ischeamic myocardial time and might make redo-valve replacement if it is required at any stage in future a bit hard.

There was marked gradual improvement of the clinical out come at 6 months of follow up and about 90% of them had been able to go back to work with full duties. Early limitation of activities was related to healing consequences. Tarantini, et al; 2003 reported drastic changes in the natural history of the aortic stenosis after aortic valve replacement with significant changes of NYHA classes and LV function (20).Left ventricular performance was correlated to the clinical improvement. At 6 months of follow up there was no patient with poor left ventricular function. Many reports had the same out come of improvement of the LV function with significant greater relief of symptoms and prolonged survival (21,22).

There is no doubt that replacement of the diseased valve improves the heamodynamics due to drop of the mean systolic pressure gradient through the aortic valve. This was quite significant in all studied patients. However, this improvement was not the same in every patient in spite of using same valve size. Concern has been raised about residual significant gradients when small aortic prostheses are used (23), particularly in patients with large body surface area (24). Oka, et al; 1990 compared size 19mm and 21mm in two groups of patients. He founded improvement in NYHA functional classes and cardiac index at rest in both valves (25). He added that size 19mm was acceptable for small aortic annulus in elderly woman whose body surface area was less than 1.47 (25). Hunziker, et al; 1998 reported increase in trans-valvular gradient with replacement of 19mm with dobutamine stress test (26). These results were dependant on valve model, age and body surface area in his final conclusion (26). There was a direct relation between body surface area and postoperative gradient through the results of the current work. Patients who had body BSA above 1.7 M2 attracted postoperative mean pressure gradient more than 17mmHg at rest.The current study characterized by presence of young (17 years of age) and middle ages patients, all reported significant drop of the trans-prosthetic mean systolic pressure gradient. Hunziker, et al; 1998 showed that postoperative trans-prosthetic gradient has a strong relation with age when activities are required (26). However, statistical analysis of the current study showed no specific relation between gradient and age at rest in spite of relative elevation of the trans-prosthetic gradient in few patient of age above 40 years. Majority of retrograde studies recommended enlargement of the annulus in young who seeks physical activities and patients with BSA above 1.47 m2 if they can not accommodate size bigger than 19mm (25,26,27).

Drop of trans-valvular mean pressure gradient in all studied population in the current study reported no specific statistical relation to gender at rest. For the fact men are more active than women, concern as well has been raised regarding young girls who want to get pregnant. It is more realistic measuring the effective orifice area of the valve to the body surface area (16,17,18) considering future expected activities when AVR is inevitable.Thinking once and twice to use size 19mm for replacement of the aortic valve in adult is an important intra-operative decision which will determine the patient's activities through the rest of his life.

Conclusion:

The study verdict showed that size 19mm mechanical bileaflet aortic valve can be used in adult rheumatic patients preferably with body surface area less than 1.69 M2.

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Thoracic

Bilateral Pectoralis Major Muscle Flap And /Or Omental Flap in Treatment of Post-sternotomy Mediastinitis After CABG. What and When to choose?

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The surgical treatment of poststernotomy acute mediastinitis remains challenging. Due to the unsatisfactory results obtained in patients managed by a single pectoral muscle flap or omental flap alone, we shifted towards a combined pectoral muscle and omental flap technique in heavily infected. *Methods:* From march 2007 until march 2009., 20 patients (6 female/14 male) were operated for mediastinitis, mediastinitis was , defined as wound and sternal dehiscence with mediastinal pus and positive culture. Mean age was..65 years (55–68 years). Twenty patients (100%) underwent isolated CABG using single mammary artery .

Results: **We performed an omentoplasty in 10 patients (group A), a pectoralis muscle flap associated with an omentoplasty in other 10 patients (group B). The reconstruction surgery occurred at an average of 14 days (10–24) after primary surgery.. Hospital mortality was 1 patient (10%) was in NYHA IV with inotropic support in group A and one case of recurrence with fistula persistanse in the same group... Late Incisional epigastric hernia was seen in one patient from group B. There were no early or late flap failures in group B.**

Conclusion: **In our experience, omental and pectoralis flaps for poststernotomy acute mediastinitis provides good outcome of our stable patients. We would reserve this technique for severly infected cases with extensive necrotic sternum .**

Mediastinitis after cardiac surgery continues to represent an important complication associated with major morbidity and significant mortality. Reported mediastinal and sternal infection rates from 0.4 to 5.1% but is 1 to 2% in most series [1–6]. Because subsequent septicemia and sepsis seeding to the heart, the sutures lines and prosthetic conduits or valve can be life-threatening, a rapid and effective treatment is required to avoid high mortality in these patients. Optimal treatment for poststernotomy mediastinitis remains controversial. Surgical debridement followed by reclosure of the sternum with continuous antibiotic irrigation was first reported by Shumacker and Mandelbaum [7] in 1963. Later, Lee et al. [8] treated those patients who failed catheter irrigations with wide debridement followed by omental flap closure. The omentum known as the 'policeman of the abdomen' has since been described for the treatment of a variety of cardiothoracic infectious complications. Jurkiewics et al. described in 1980 an effective use of pectoralis muscle flap for refractory deep sternal infection [9]. Despite successful reports in the literature using primary reclosure, many conservative techniques have a high failure rate [3,4,10,11].. After unsatisfactory results with a conservative management of post CABG mediastinitis [3]. We shifted in 2008 towards a more effective and aggressive surgical management.

Patients and Methods

To assess the combined flap for poststernotomy wound infection 20 patients were selected between March 2007 and 2009. The cases were operated upon in Kasr el einy university and teaching hospital and at Nasser institute hospital.The 20 patients were with severe acute mediastinitis, representing 4% of all sternotomies for CABG (n=500) performed during the same period. Mediastinitis was defined as wound and sternal dehiscence with mediastinal pus and positive cultures

Patients not responding to these three criteria were considered as superficial wound infection or deep wound infection with negative culture or having mechanical sternal

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dehiscence (malunion) and were excluded from the study. The shift towards the combined muscle flap treatment for all proven (3 criteria) poststernotomy mediastinitis was due to the disappointing results we obtained with a more conservative management [3]. A lesser aggressive treatment for probable mediastinitis was avoided. The average patient age was 65 years (range 55–68 years). 14 patients were male, and six were female. Tobacco abuse was encountered in 40% (n=8) of our patients. There were 13 patients (65%) with diabetes mellitus, of which 5 patients insulin dependent, and 2 (10%) with severe chronic obstructive pulmonary disease (COPD) (Table 1). All median sternotomies were performed for CABG. Twenty patients underwent CABG of whom 20 had left internal thoracic (ITA) artery harvesting. (Table 2). In all patients, prophylactic antibiotic therapy with first generation cephalosporin (Cefazoline, 2 g at induction of the anesthesia) was routinely administered and every 6 h for the following 24 h. Primary pericardial closure was possible in all patients.

DATA MANAGEMENT

Data was collected , revised, verified and edited on a personal computer .Then data was analyzed statistically using SPSS statistical package version 18

The Following testes were used

Arithmetic mean (x) & standard deviation (SD) were calculated as follows: $X=\sum X/n$ Where $\sum X$ = sum of data , n= number of data, $SD=\sqrt{\{\sum(X)2-(\sum X)(X)\}/n-1}$ where $=\sum(X)2$ = sum of squares of data ,$\sum X$ = sum of data , X = the mean , n= number of data

· The student's T test of significance for comparison between the means of the different groups of patients, this was calculated as follows $t = X1-X2 /\sqrt{\{(S1)2/n1+(S2)2/n2\}}$ where X1= mean of the first group ,X2 = mean of the second group S1= standard deviation of the first group , S2 = standard deviation of the second group, n1&2 = number of patients in first and second groups.

Feature	Omental Group	Combined Group
Mean age (y)	66	68
Sex (female)	20%	20%
Diabetes mellitus	30%	40%
Obesity	20%	30%
Congestive heart failure (class III or IV)	10%	10%
Ejection fraction9mean)	43%	49%
Methicillin-resistant Staphylococcus aureus	10%	10%
Pulmonary disease	10%	10%

Table 1. Preoperative risk factors of the 20 patients

Surgical intervention	n
CABG	20
1 ITA	20

Table 2. Primary surgical intervention (n=20)

· Chi square test (x2) for qualitataive analysis and was calculated as follows, $X2=\sum((O-E)2/E))$ where O = observed frequency and E = expected frequency.

For all statistical comparisons, a P value of <0.05 was considered significant and a P value of < 0.01 was considered highly significant.

Surgical technique;

In all cases with a severe septic sternal destruction, partial or total V-shape resection of the sternum was performed. A great effort was made to perform extensive mediastinal debridement and to remove all exposed foreign bodies and all infected or necrotic tissues. The mediastinal wound was then irrigated with povidone–iodine solution. Midline incision was prolonged to the upper part of the abdomen. An omental pedicle was fully mobilized on the gastroepiploic artery by dividing the branches to the great curvature of the stomach. The pedicle was brought up in the anterior mediastinum through a small V-shape incision in the diaphragm and fixed to the upper part of the mediastinum.

Based on its thoracoacromial blood supply, the pectoralis major muscles were fully mobilized following division of their costal origin, dissedted and sutured together without tension on the midline above the omentum flap, as described by Jurkiewicz et al. [9]. The subcutaneous tissue and skin were then closed. drains were left in the pectoralis pockets and in the lower part of the mediastinum. One underwater sealed drain was positioned in the upper part of the mediastinum in contact with the omentum flap. Patients received postoperatively 2–4 weeks of intravenous antibiotics following the specific antibiogramme. Patients with Staphylococcus mediastinitis were treated by Flucloxaciline (3x2 g/24 h) or Vancomycine (1 g/24 h). Patients with gram-negative micro-organisms were treated by a third generation Cephalosporine (Cefepim 2x2 g/24 h) or by Quinolones (Ciprofloxacine 2x250 mg/24 h). After intravenous antibiotic treatment was discontinued, all patients received oral Oxaciline or oral Quinolone for 2 weeks. The mediastinal drainage samples had to be sterile in all patients before removal of the suction devices.

Results

Following radical debridement, the operating cardiac and plastic surgeon decided intraoperatively which flap to use for reconstruction.

Reoperation for mediastinitis was performed an average of 11 days (range 6–26 days) after the initial operation. Tissue cultures were obtained in all patients. The microbiological results. Staphylococci were the predominant germs accounting for 55% (n=11) of the patients, and 45% of the patients had

gram negative infection. None of our patients had mixed infection with two or more micro-organisms.

Simultaneous debridement and omental flap transposition was performed in 10 patients, (figure 1). Combined transposition of omental flap and bilateral pectoralis flap to the midline was performed in 10 patients, (figure 2& 3)

The operative mortality was 10% (n=.1 in group A). The patient died of cardiac failure and In this patient the primary procedure was complicated by a perioperative mycocardial infarction and low cardiac output syndrome.

All survivors were seen 3 months after discharge. During follow up 1 patients had late reintervention group A. one patient had a sub-xyphoid hernia. There was no late recurrence.

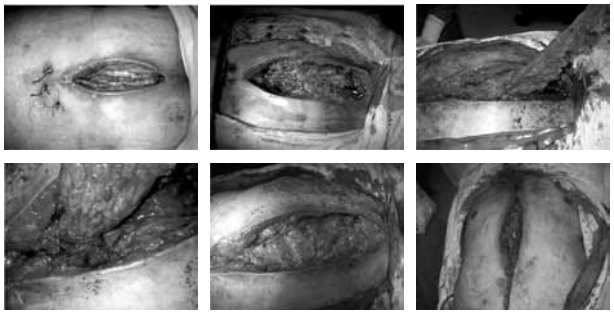

Figure 1: a case of mediastinitis extensive treated with omental flap only.
a. Mediastinitis with severe infection and bone exposure.
b. The mediastinal wound after debridement.
c. Omental flap mobilization.
d. Passage of omental flap through the diaphragm.
e. Little skin mobilization with omental flap in place.
f. Skin closure only over the omentum.

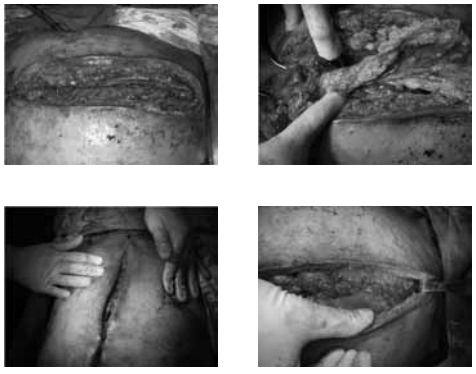

Figure 2: A male case with mediastinitis with retro-sternal collection which was treated by omental flap and bilateral pectoralis major mobilization and reattachment.
A: Sternal wound after wires removal and debridement and collection evacuation
B: Trans-diaphragmatic passage of omental flap after its mobilization.
C: Closure and re-attachment of bilateral pectoralis major muscles.
D: skin approximation before final closure.

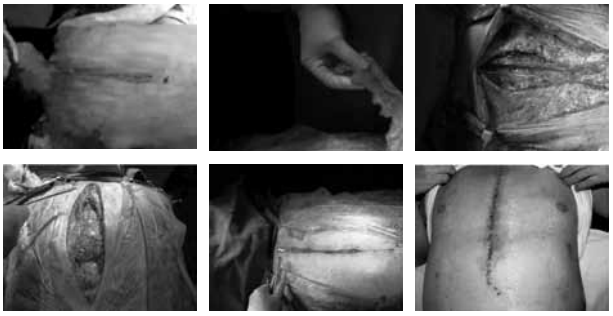

Figure3 : a male patient with mediastinitis post CABG treated by omental flap and bilateral pectoralis major mobilization and reattachment.
a. Mediastinitis wound.
b. Omental flap elevated.
c. Skin undermining and bilateral pectoralis major mobilization.
d. Closure of the muscles over the omental flap with vicryl 2.
e. Closure of skin
f. 3 weeks postoperative with complete healing of the scar.

Discussion:

Since the introduction of the median sternotomy incision by Julian in 1957, mediastinal wound infection has been a major problem with lethal results. The earliest treatment of infected sternotomy wounds consisted of debridement and open sternal drainage, which had a mortality rate of 50%. The treatment of this devastating complication has evolved to the current state of early, aggressive debridement and flap closure.

Krabatsch and Hetzer (12), studied 140 patients who had omental flaps in-hospital mortality rate after flap procedure was 19.2 %.. Their findings including the relative short times and minimal complications supports the results of our study mortality 10 % in groupA and encourage the use of omental flap transfer

. Yasuura and associates(13) reported a low rate persistent infection in patients with mediastinitis treated by isolated omental flap (5%). 50% of these patients had methcillin-resistant s aureus infections. In our study ,one patient (10%) suffered from subcutaneous infection early postoperatively which did not persist after drainage and antibiotic therapy in the group A.

\ A study by Milano and colleagues [14] compared the omental flap and pectoralis flap for poststernotomy mediastinitis with specific regard to obtain a healed wound. This study found that omentum flap had a lower mortality and improved the early outcome; it seemed to be a more effective therapy with no flap failure or local recurrence. They did not focus on total sternectomy.

However a study by pascal schroeyers(15) with , four out of the eight patients (50%) who had only partial sternectomy and had to be reoperated on for chronic fistulas. We strongly recommended aggressive total V-shape sternectomy to prevent any late fistula from bone or cartilage. Failure is directly related to persistent infection of bone, cartilage, or retained foreign bodies.

Pairolero([16) et al. reported that patients who had resection of the manubrium, sternum, and costochondral arches were significantly less likely to develop late recurrence than those who had debridement only. Furthermore, in all patients where infection recurred for a second time, debridement rather than resection as management for the first recurrence had been performed. Our first choice to obliterate the mediastinal gap after radical debridement is the omentum. It contains high amounts of immunologically active cells which seems to be responsible for the high anti-infective activity of the omentum. Its extensive vascularisation as well as its neovascularisation potential increases the blood supply leading to higher concentration of antibiotics at the infection site. Furthermore, by absorbing wound secretion, it eliminates substrates for bacterial growth. Pectoralis muscle is used to cover any remaining bony structure and to provide a stable and uniform surface underneath the skin. The use of uni ITA does not preclude the use of pectoralis flap as transposition flap based on his strong thoracoacromial pedicle,however in our study bilateral mammary was not included in this study mammary artery was in our study due to special antibiotic prophylaxis and absence of diabetes and younger age of patients with smaller body mass in cases that we choose total arterial revascularization.

Furthermore Kohman [17] investigating the effects of pectoralis flap closure on pulmonary function, demonstrated that exercise tolerance and pulmonary function may not differ from a control group of cardiac surgical patients. Moreover, the use of the shoulder girdle muscles do not significantly affect strength of the shoulder. True poststernotomy mediastinitis, which has not always been defined in the same way, remains a deadly complication. The mortality ranges from 20% to 46% [3,11,18,19] The observed overall mortality of 20% in our patients is high, but is in accordance with mortality rates reported by other authors and is due to our selected group of patients presenting an acute severe poststernotomy mediastinitis defined by our three criteria. This suggests that in, in haemodynamic unstable patients or in patients on prolonged ventilatory support, surgical stress should be minimized. Early mediastinal drainage and open or closed chest vacuum suction device could be proposed. t. Debridement and omental flap chest closure may result in an uneventful clinical course when the patient is off ventilatory support or hemodialysis. In the other hand, Soloman and associates(20) conclude that bilateral pectoral flap repair is safe technique to cure severe mediastinitis necessitating complete sternal resection with good cosmotic results as well as chest wall stability. Our study is with this indication in addition to omental flap to avoid recurrence.

In summary , although both techniques should be used individually according to the extent of infection but our experience is with considering the combined omental flap surgery is the first surgical strategy in cases with severe sternal wound infection that requires partial or total sternectomy then omental muscle flap is the second choice in unstable patients

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The role of cervical mediastinoscopy in the diagnosis of benign thoracic lymphadenopathy: Eight year experience

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Background: **Cervical mediastinoscopy is the gold standard in evaluating mediastinal lymphadenopathy, including benign and malignant etiologies. In this report we audit the sensitivity, specificity and complications following mediastinal lymph node biopsy for benign pathologies.**

Methods: **Between 2002 and 2010, 223 patients underwent cervical mediastinoscopy at Cairo University Hospitals to diagnose mediastinal lymph node enlargement: 67 patients had a benign pathology and were retrospectively evaluated in this study. Demographic data, different etiologies, sensitivity, specificity and complications were analyzed.**

Results: **67 patients underwent cervical mediastinoscopy for benign mediastinal adenopathy, with radiographic evidence of absent or inconclusive pulmonary lesion. There were 45 females and 22 males with mean age of 35.1 year. The main complaint was dry cough in 70 % of patients and 9 patients (13.4 %) were asymptomatic. Histopathological evaluation revealed a final diagnosis of TB adenitis in 29 patients (43.2 %) , sarcoidosis in 33 patients (49.2 %), reactive adenitis in 3 patients (4.4 %) and a single patient with Castleman's disease (1.4%). Sensitivity, specificity and accuracy of this procedure were 100 % with no mortality or major morbidity.**

Conclusion: **Given its safety and efficacy mediastinoscopy should currently be used routinely in the diagnosis of benign mediastinal adenopathy particularly in the absence of pulmonary lesion in chest radiography..**

Mediastinal lymph node biopsy is a mandatory step for the diagnosis and management of mediastinal node enlargement, including benign and malignant pathologies. Mediastinoscopy is considered the 'Gold Standard' for this procedure [1]. The current revolution in technology allows less invasive lymph node sampling using ultrasound guided image through bronchial and / or esophageal endoscopy. The efficacy of mediastinoscopy in the preoperative staging is well established, with procedural sensitivity greater than 90 % and specificity of 100 % [2]. Similarly, it has been shown to be efficacious in the diagnosis of mediastinal disease other than bronchogenic carcinoma [3]. To our knowledge there has not been previous report focusing on mediastinoscopy in the diagnosis of benign mediastinal disease. In this retrospective study we analyzed, the safety, efficacy and the current role of mediastinoscopy in the evaluation of benign mediastinal etiologies.

Methods

Between January 2002 and December 2010, we retrospectively reviewed the medical records of 213 patients who underwent mediastinoscopy to evaluate their mediastinum at Cairo university hospitals. 67 patients had a final diagnosis of benign mediastinal disease. These patients were selected and their data were analyzed in this study. All patients in this study underwent thorough medical examination, routine laboratory investigations including sputum for acid fast bacilli if patients have productive cough, tuberculin skin test, calcium level, ESR, chest X-ray, CT scan and fibro-optic bronchoscopy including bronchoalveolar lavage (BAL) and either transbronchial needle aspiration (TBNA) or endobronchial ultrasound-guided transbronchial needle aspiration (EBUS-TBNA) when the enlarged mediastinal nodes had a diameter > 10 mm in their short axis. All patients were referred to mediastinoscopy when no definite diagnosis was achieved.Cervical mediastinoscopy (Karl Storz mediastinoscope, Tuttlingen, Germany) was performed with the classic cervical approach as described previously [4]

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Results:

A total number of 67 patients underwent cervical mediastinoscopy during a period of eight year. They were referred when other tools failed to provide definitive diagnosis. In this referred group of patients bronchoscopy was done in 47 patients (70 %), 15patients (31.9 %) underwent TBLB, and in 32 patients (68 %) EUBS-TBNA was done. In this study BAL fluid analysis was negative for acid fast bacilli.

Patients demographic data were analyzed (Table 1). There were 45 females and 22 males, with mean age of 35.1 year. The most common presentations in this group of patients were dry cough (70 % of patients) and easy fatigability (58 % of patients). 9 patients were asymptomatic and were discovered during routine radiography for pre-employment screening. Tuberculin skin test was positive (>10 mm skin induration) in 16 patients (23.2 %) and about half of patients who were diagnosed as T.B lymphadenopathy. Patient radiographic data were analyzed in (Table 2). Almost ¾ of the patients had widened mediastinum only on chest X-ray, and almost 1/3 had associated hilar lymphadenopathy. CT scan shows associated pulmonary lesions in 37.3 % of patients.

During mediastinoscopy 1-3 punch biopsies were taken from each lymph node station. In 11 patients (16.4 %), 5 stations were explored, in 18 patients (26.8 %), 3 stations were explored, in 34 patients (50.7 %), 2 stations were explored and in 4 patients (5.9 %), one station was explored. The most frequent lymph node station was the right inferior or R4 (Table 3). In this group of patients the mean operative time was 41 ± 8.1 minute, all patients were transferred to the recovery room where they spend 60 minute and then sent to the ward. They spent 4-6 hours before they were discharged home. Patients who lived outside Cairo (19 patients 23 %) were kept overnight in the hospital before they were discharged next morning. There was no intra-operative mortality or major morbidity. One patient had wound discharge that required expectant treatment.

Age	
Mean	35.1 ±10.6
Range	18-56
Sex (M:F)	1:2
Presentation	
Cough	49/67 (75.1 %).
Shortness of breath	31/67 (46.2 %).
Fever	11/67 (16.4 %).
Weight loss	15/67 (22.3 %).
Easy fatigability	39/67 (58.2 %).
Asymptomatic (adenopathy on radiography)	9/67 (13.4 %).
Tuberclin skin test	
-ve	51/67 (76.1 %).
+ve	16/67 (23.8 %).
Calcium level above 10.5 mg/dl	1/67 (1.4 %).

Table 1. Patients demographic data.

Chest X-ray	
Widened mediastinum	47/67 (70.1%).
Widened mediastinum and hilar adenopathy	20/67 (29.8 %).
Associated pulmonary lesion	14/67 (20.8 %).
CT-scan	
Size of mediastinal lymph nodes	49/67 (75.1 %).
1.Range	(0.5-1.5)
2.Mean	1 ± 0.2
No. of mediastinal lymph nodes	
1.Range	(1 – 8)
2.Mean	3.4 ± 2
Associated pulmonary lesion	25/67 (37.3 %).
a)Ground glass appearance	1367(19.4 %).
b)reticulo-nodular	9/67 (8.9 %).
c)fibrosis	3/67 (4.4 %).

Table 2. Radiographic data

The histopathological (Table 4) evaluation in this study revealed, 29 patients with tuberculous lymphadenopathy (caseating granuloma). 33 patients were diagnosed as sarcoidosis (non-caseating granuloma). 3 patients revealed a histopathology of follicular reactive hyperplasia. One patient had Castleman's disease (angiofollicular hyperplasia). She had a unicentric lymphadenopathy that was excised on thoracotomy. Sensitivity, specificity and accuracy of mediastinoscopy in this study were 100 %.

Discussion

In this series a total number of 67 patients underwent mediastinoscopy in an effort to diagnose mediastinal adenopathy after exhausting clinical and radiological investigations. Bronchoscopy was done in 47 patients (70 %) and failed to establish the diagnosis. In this series 30 % of patients refused to consent for any bronchoscopic procedure when they were informed that the yield is between 40 and 60 % and choose mediastinoscopy due its near 100 % yield. The sensitivity, specificity and accuracy of mediastinoscopy in this study were 100 % obviating the need for any further evaluation. These results were consistent with data from other reports, Venissac and colleagues reported results like ours [5], others reported sensitivity between 93-97 % for benign diseases [3, 6, 7]. The 3 patients with reactive lymphadenopathy were asymptomatic being discovered during pre-employment screening. They were followed up with regression of their lymphadenopathy in 3, 6 and 8 months respectively.

In the present study, mediastinoscopy was shown as a safe tool for evaluation of the mediastinum with no mortality or major morbidity following the procedure. The only minor morbidity in this series was one patient with wound discharge. In other larger series with more than 2000 mediastinoscopies the mortality

was as low as 0.05 % [6, 7]. Morbidity mentioned in previous studies as pneumothorax, vocal cord dysfunction, injury to the pulmonary artery, innominate artery, and aorta or laceration to the esophagus and trachea account for less than 1 % following mediastinoscopy [5-7]. In this study we didn't encounter any of these complications. Except for 19 patients 23 % in this series, all patients were discharged on a day case basis. Only those who had to travel outside Cairo were offered over night stay at the hospital to be discharged before next day noon.

In this study we analyzed patients who underwent mediastinoscopy for benign mediastinal disease. Almost all the previous studies focused on the fundamental role of mediastinoscopy in the management of lung cancer patients for both diagnosis and staging purposes [8-11], few published their results of malignant and benign disease combined [6,7] and fewer focused on some benign mediastinal disease as TB adenitis [12].

The current evaluation of mediastinal adenopathy is towards noninvasive procedures, imaging techniques, such as computer tomography (CT) and, more recently, positron emission tomography (PET) are the standard examination for the assessment of the mediastinum. Although these techniques are highly sensitive for detecting enlargement of lymph nodes, their diagnostic accuracy in distinguishing between malignant and benign node is often insufficient for taking a clinical decision [13].

Bronchoscopy as a less invasive procedure and its new real-time EBUS with needle aspiration technique is safe and highly sensitive method for identifying neoplastic invasion of mediastinal and hilar nodes in patients with suspected or known bronchopulmonary neoplasms. Sensitivity values exceeded 85 % in many studies [14-19]. The relatively high false negative rates documented in some studies highlight the need for negative results to be confirmed via other surgical techniques [20].

The studies that evaluate EBUS-TBNA for other pathologies, including sarcoidosis and lymphoma were few [21, 22]. Its sensitivity in the diagnosis of sarcoidosis was 71 % [23], with more than 85 % of patients being diagnosed [24, 25]. To date there has been no large series published evaluating EBUS in the diagnosis of patients with TB adenopathy.

In conclusion, our experience with the safety and efficacy of mediastinoscopy suggests that it should currently be used routinely in the diagnosis of benign mediastinal lesions particularly when no pulmonary lesion is noted on chest radiography.

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Surgical management of middle lobe syndrome: six year experience in different age groups.

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Aim of the study: **To review our surgical experience concerning the indications for surgical management, results and follow up in different age groups for patients presenting with middle lobe syndrome (MLS).**

***Methods*: From February 2004 to December 2010, patients undergoing surgery for middle lobe syndrome were retrospectively studied. 84 consecutive patients were divided into two groups. Group A (< 15 year) and group B (>15 year). The indication for operation was chronicity , bronchiectasis, hemoptysis, and malignancy. We studied the different presentations, pathologies, surgical results and outcome in both groups.**

***Results*: In this study there was no mortality or morbidity and cough was the main symptom (> 90 %) in both groups. Middle lobe collapse was present in 65 % and bronchiectasis was present in 35 % in both groups. The main etiological factor for MLS was non-specific infection (87.1 %) in group A, and malignancy (40 %) in group B. The surgical outcome was excellent in both groups except for patients with malignancy, where 8/18 patients (44.4 %) of this subgroup could survive 4 years.**

Conclusion: **Surgical management for MLS could be carried out safely. Outcome after surgical intervention depends on pathology which was dismal when malignancy was the cause.**

The term "middle lobe syndrome" was first introduced by Graham and colleagues (1) for isolated middle lobe atelectasis caused by lymph node compression. Other causes of a shrunken middle lobe without lymph node compression was pointed out later by Rubin and Rubin (2) including benign and malignant tumors or bronchiectasis. The clinical presentation of middle lobe syndrome (MLS) differs among age groups. In children it is a cause for persistent or intermittent wheezing in atopic and non atopic children making early recognition difficult and a lag between diagnosis and treatment is the rule. In adults specific clinical presentations like fever, cough, purulent sputum and hemoptysis usually point to early recognition for the clinical syndrome (3, 4). In this study we retrospectively analyzed the etiology, indications and results of surgical intervention in the past six years for patients with MLS in different age groups.

Methods:

A retrospective review of 84 consecutive patients with different age groups presented with MLS and who were treated at the departments of cardiothoracic surgery and chest medicine, Cairo University Hospitals between February 2004 and December 2010 was undertaken.

Our patients were divided according to their age group into pediatric group < 15 years old (39 patients) and adult group > 15 years old (45 patients). Both groups followed the same protocol of medical management prior to referral for surgical management.

In this study we excluded patients with a history of foreign body inhalation.

At the chest department all patients underwent detailed history taking, thorough medical examination and an initial chest radiograph in both postero-anterior and lateral views showing middle lobe collapse / consolidation and or bronchiectasis. The initial management was conservative in the form of broad spectrum antibiotics, physiotherapy, mucolytics, inhaled bronchodilators, and inhaled corticosteroids. Re-evaluation after 4 – 6 weeks was done and in the event of persistent or recurrent of symptoms and lack

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of radiographic amelioration, these patients were subjected to high resolution CT-scan (HRCT) and bronchoscopic evaluation including bronchial lavage (BAL). Patients who were thought to be a high risk for malignancy e.g. age, smoking were placed on a faster track with initial HRCT and bronchoscopic biopsy.

WHO protocol for triple anti TB therapy was adopted in patients who were diagnosed with tuberculosis. They were sent for surgery after sputum negative result was obtained.

Referral for surgical management was based on failed conservative treatment, chronicity of the disease, bronchiectasis, hemoptysis, destroyed lobe, and malignancy.

Fibro-optic bronchoscopic evaluation was done in all patients in the adult group to explore the tracheobroncheal tree in general particularly in patients presenting with hemoptysis and the middle lobe bronchus in particular for abnormal take off, stenosis, F.B, granulation tissue, mucus plugs or tumors. BAL was sent for quantitative culture and sensitivity for aerobic, anaerobic, and acid fast bacilli. Patients below 10 years had rigid bronchoscopy as a routine.

Surgical management included mediastinoscopy, video assisted thoracoscopy and resection of the middle lobe and/or lingula.

All patients were followed up at 4 weeks, 3 months and every 6 months and then yearly for 1-4 years at the outpatient clinic.

Results

Eighty four consecutive patients were enrolled in this study and who fulfilled the inclusion criteria for MLS. They were divided into two groups. Group A (patients < 15 years old) and Group B (patients > 15 years old). Table one, shows patient data and clinical presentations concerning both groups. The main presenting symptom in both groups was cough. Wheezing was the second common presenting symptoms in group A, while shortness of breath was the second common presenting symptom in group B.

Both groups show a long period between symptoms and intervention ranging from 2 months – 4 years. However, in patients presenting with hemoptysis or malignant etiology this period was short 1-3 months.

Radiological findings show middle lobe collapse, bronchiectasis, associated pleural effusion and/or mediastinal lymphadenopathy in some cases. Table two shows radiological data.

All patients had bronchoscopy before surgical intervention, patients below 10 years had routine rigid bronchoscopy to rule our F.B. Bronchoscopic evaluation included comments on the mucosa, luminal, endo-luminal, and extra luminal obstruction. Table 3 shows analysis of bronchoscopic data in both groups.

In this study, 19 patients (48. 7 %) in group A where culture positive, where as 18 patients (40 %) in group B where culture positive. Table 4 shows etiological organisms that were cultures from both groups.

In this report, the main etiological factor in group A causing middle lobe pathology was non-specific infection in 34 patients (87.1 %), 4 patients (10.2 %) were tuberculous and one patient (2.5 %) had endobronchial hamartoma causing MLS. In group B, 13 patients (28.8 %) were due to non-specific infection, 14 patients (31.1 %) due to TB and 18 patients (40 %) were due to malignant etiology.

Surgical intervention varies according to the pathology, in group A, 36 patients (92.3 %) underwent middle lobectomy, 2 patients (5.1 %) underwent lingulectomy and one patient underwent staged left lower lobectomy followed 4 weeks later by middle lobectomy. In group B, 33 patients (73.3 %) underwent middle lobectomy, 3 patients (6.6 %) underwent lingulectomy. Bilobectomy was done in 3 patients (6.6 %) when the tumor mass from the middle lobe crossed the fissure. 2 patients (4.4 %) underwent staged bilateral lobectomies bilateral bronchiectasis. Mediastinoscopy was done for 2 patients (4.4 %) to evaluate associated mediastinal lymph nodes that were positive for adenocarcinoma. Video assisted thoracoscopy was done for 2 patients who had associated moderate pleural effusion to evaluate the pleura for possible malignant spread. Both patients had positive pleural nodules (adenocarcinoma).

In this series there was no morbidity or mortality; outcome varies according to the pathology. In group A, 25 patients (64.1 %) underwent middle lobectomy for a collapsed lobe. 14 patients (31.1 %) presented with bronchiectasis, 11patient underwent middle lobectomy, 2 patients underwent lingulectomy and 1 patient had bilateral staged lobectomy. Left lower lobectomy was primary targeted due to extensive disease, followed 4 weeks by middle lobectomy when patient symptoms didn't improve dramatically. This group of patients with bronchiectasis had excellent improvement except for 1 patient who had mild recurrence of symptoms 3 years after the operation, and whose CT scan showed bronchiectatic changes at the apical segment of the right lower lobe, she was controlled by medical treatment. In group B, 28 patients (62.2 %) had middle lobectomy due to collapse, and 17 patients (26.6 %) had resection for bronchiectasis (Table 2). All had excellent outcome with control of symptoms at follow up that extended for 3 years. 18 patient in this group had malignant etiology, 14/18 patients underwent resection of the middle lobe and additional 3/14 had lower lobectomy. 4 patients were inoperable due to metastasis (2 patients with mediastinal lymph nodes and another 2 patients with malignant effusion). 10 patients (22.2 %) in this group survived 7-36 months with a mean of 17.7 ± 10.6, while 8 patients (17.7 %) exceeded 4 year follow up.

Discussion

Middle lobe syndrome (MLS) is characterized by a spectrum of diseases from recurrent atelectasis and pneumonitis to bronchiectasis of the middle lobe. It has been described among all age groups (5). In this study 84 consecutive patients presented with MLS were divided into pediatric age group A and adult age group B. 2/3 in both groups presented with atelectasis and 1/3 with bronchiectasis. These findings agree with previous reports (6, 7). Non- specific infection was present in 87.1 % of patients and 10.2 % had TB in group A. Malignancy was the main etiology in group B accounting for

40 % of patients and almost 30 % had TB. This data is similar to conclusions in other studies (7) except for the considerable incidence of TB in this report compared to others. However this could be explained by the prevalence of TB cases in the Egyptian community which was estimated to be 27/100 000 population according to WHO report (8).

In all cases of group A and more than 90 % of cases in group B cough was the main symptoms. Wheezing was the second common presentation in the pediatric group and together with cough may explain the delayed diagnosis due to non specific symptoms in our report as well as others (9).

The pathological changes that led to MLS are either obstructive or non-obstructive. In this series 31 patients (36.9 %) had no obstruction on bronchoscopy (10 patients in group A and 21 patients in group B), and a deep fissures were noted at operation separating the middle lobe from both the upper and lower lobe and thus interrupting any collateral ventilation and explaining the collapse. 53 patients (63 %) had obstruction on bronchoscopy ranging from partial (27 patients (32.1 %) in group A and 18 patients (21.4% in group B) to complete (2 patients in group A and 6 patients in group B) obstruction. In these 53 patients deep oblique fissure was complete in all cases; however in few patients 7/53 (13.2 %) the transverse fissure was incomplete.

This supports the findings of other investigators who postulated that isolated middle lobe and lingula provides a barrier to collateral ventilation, thus predisposing to chronic inflammation and persistent atelectasis (10).

The management of MLS is essentially conservative in pediatric age group particularly when early intervention is followed. However in our series patients were referred after failure of conservative treatment in 2/3 of patients and bronchiectasis in 1/3 of patients. In group A one patient (2.5%) had hemoptysis, one patient had endobronchial obstruction by a mass proved to be hamartoma and 4 patients (10.2 %) had TB. The management in adult group is conservative in inflammatory category of this group of patients representing 27 patients (60 %), however due to chronicity and hemoptysis in 14 patients (31.1 %) surgery was indicated. In the malignant subgroup of the adult group, 18 patients (40 %) presenting with malignancy were managed surgically. In the malignant subgroup 14/18 patients (77.7 %) were operable and underwent lobar resection, 4 patients (22.2 %) were inoperable due to distant metastasis.

There was no mortality or morbidity in this series. The outcome depends on the pathology causing MLS. In patients who presented with inflammatory cause shows complete resolution of their symptoms with excellent outcome except for one patient in group A, who has recurrence of symptoms 3 years after the operation. This patient was managed with medical treatment with good control of her symptoms. Patients with malignant pathology show the unfavorable prognosis with 8/18 patients (44.4 %) survived 4 year follow up.

In conclusion, surgical management of MLS is safe. The outcome depends on the etiology, in this series inflammatory causes carries the best prognosis, whereas malignant causes have unfavorable prognosis.

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Variables	Group A (no. 39)	Group B (no.45)
Age (Mean and range)	10.5 ± 2.7, (5-15).	39.7 ± 14.2, (20-72)
Sex (m:f)	18m:21f	24m:21f
Presentation		
Cough	39 (100 %)	41 (91.1 %)
Wheeze	26 (66.6 %)	16 (35.5%)
Sputum	17 (43.5 %)	26 (57.7%)
Shortness of breath	10 (25.6 %)	22 (48.8 %)
Recurrent infection	23 (58.9%)	10 (22.2 %)
Hemoptysis	1 (2.5 %)	14(31.1 %)
Chest pain	3 (7.6%)	5 (11.1 %)
Weight loss	3 (7.6%)	16 (35.5 %)
Pleural effusion	0	2 (4.4 %)
Duration of symptoms before diagnosis (Range and mean)	3-48 mo 14.5	2-36mo 9.4

Table 1: Patients demography and clinical presentation

Radiological findings	Group A (no. 39)	Group B (no. 45)
Collapse	25 (64.1 %)	28 (62.2 %)
Bronchiectasis	14 (35.8 %)	17 (37.7 %)
a) Middle lobe	11 (28.2 %)	12 (26.6 %)
b) Lingula	2 (5.1 %)	3 (6.6 %)
c) Bilateral	1 (2.5 %)	2 (4.4%)
Pleural effusion	-	2 (4.4%)
Mediastinal lymphadenopathy	-	2 (4.4%)

Table 2. Radiological data.

Variables	Group A (no. 39)	Group B (no. 45)
Bronchial stenosis	1 (5.1 %)	0
Endobronchial obstruction		
1) Mucosa edema.	22 (56.4 %)	13 (28.8 %)
2) Granulation tissue.	1 (5.1 %)	0
3) Mucus plug.	4 (10.2 %)	1 (2.2 %)
4) Blood clot.	1(5.1 %)	5 (11.1 %)
5) Mass /tumor.	1 (5.1 %)	5 (11.1 %)
Extra-luminal obstruction	1 (5.1 %)	0
Normal	7 (17.9 %)	20 (44.4 %)
Purulent discharge	19 (48.7 %)	15 (33.3 %)

Table 3: Bronchoscopic data

Organisms	Group A (no.=19/39)	Group B (no.=18/45)
S. Aureus	8 (20.5 %)	4 (8.8 %)
H. Infleunzea	4 (10.25 %)	-
P. Aeruginosa	2 (5.1 %)	9 (20 %)
S. Pneumoniae	2 (5.1 %)	-
K. Pneumoniae	2 (5.1 %)	4 (8.8 %)
TB	1 (2.5 %)	1 (2.2 %)

Table 4: Quantitative culture results

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Should Patient Economics Influence The Choice Of Airway Stents ? A Prospective Pilot Study

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Background : **This report aims to compare the efficacy of silicon and metal airway stents in benign and malignant lesions by taking into consideration clinical outcome and economic constraints in developing countries.**

Methods : **Between January 2007 and January 2008, 20 patients with malignant and benign tracheobronchial lesions were stented following evaluation. All patients were followed-up for 1 yea r.**

Results : **The cohort consisted of 12 males (60%) and 8 females (40%), with a mean age of 54 ±17.4 years (range 21-76 years). Obstructions were malignant in 13, and benign in 7. Fifteen patients (75%) had metal stents, 5 (25%) had silicon stents. All benign lesions received metal stents, while 8 malignant lesions had metal stents. Most patients improved following stenting, irrespective of the type of stent deployed. Stent migration and coughing out of silicon stents in 3 patients warranted stent replacement, and subsequent higher cost implications when compared to metal stents.**

Conclusions : **Although metal stents are more expensive, considering the low incidence of migration, and high replacement cost in silicon stent failure, metal stents are safe and as effective as silicon stents in treating benign lesions. In addition to clinical factors, the economic benefits of metal stents could be an important deciding factor in developing countries.**

Central airway obstruction is life threatening due to impending respiratory failure. Resection and surgical reconstruction provides the best opportunity for definitive management. Bronchoscopy is the initial step in providing diagnosis, stabilizing the obstructed airway, and evaluating surgical resectability 1. Minimally invasive endoscopic techniques, such as the use of airway stents, are valuable alternatives 1 in unresectable obstructions owing to anatomic limitations, metastatic disease, or coexistent medical co-morbidities. Although the long- term prognosis in these patients is often dismal, the temporary relief of airway obstruction provides significant palliation, with a marked improvement in the quality of life, and in some cases, prolongation of life.

Several previous publications have compared the efficacy of metal and silicon stents in malignant and benign lesions 2,3. Although it has been suggested that silicon stents should be used in benign lesions 4, both silicon and metal stents have their own advantages and disadvantages. Hence, there appears to be no "ideal stent", and no clear consensus on which kind of stent should be used in these diverse pathologies 3.

On reviewing the literature on airway stents, it was noted that most of the publications were based on the western population 2,3,5,6,7, with very little information about patients from developing countries, which represents a very large, yet unique patient population

when considering the late stage of disease presentation. Furthermore, patients from developing countries have limited medical cover due to non-availability or restricted availability. Since most airway stents are placed on an emergency basis, patients in developing countries have to meet the cost of these stents due to incomplete coverage by medical insurance and governmental funds. This poses a distinct dilemma on doctors to choose an airway stent that is cost effective, yet efficient in treating the airway pathology.

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This report aims at comparing the efficacy of silicon and metal airway stents in benign and malignant lesions, by evaluating clinical outcome, pulmonary function tests, and arterial gasometry, while also taking into consideration the economic constraints on patients from the developing world. To our knowledge, there is no previously reported work that analyses all these observations.

Methods:

This was a prospective pilot study that was approved by the Ethics Committee and the Research Committee of the Faculty of Medicine at Alexandria University.

Between January 2007 and January 2008, 20 patients who presented to the Faculty of Medicine at Alexandria University with diverse tracheobronchial lesions underwent

airway stenting following clinical assessment, radiological evaluation, and bronchoscopy. Fully informed, written consent was obtained from all patients prior to commencement of this study.

Measurements :

All patients were subjected to comprehensive clinical history taking, which included specifically enquiring about dyspnea, hemoptysis, cough, and chest pain. In addition to physical examination and routine laboratory investigations, all patients underwent respiratory assessment including chest radiography (postero-anterior view), computed tomography (CT), arterial blood gas (ABG) analysis, pulmonary function tests, and fiber-optic bronchoscopy.

Stenting Technique

Patients were placed supine with mild neck extension. Although stents can be deployed using flexible bronchoscopy under sedation, we preferred to place stents under general

anaesthesia and antibiotic cover, under direct vision using rigid bronchoscopy with fluoroscopic guidance. Following detailed evaluation of the airway lesion and determination of the appropriate length of the stent, the desired distal position of the stent was marked with a radio-opaque marker. Appropriate size stents were deployed over a guide wire. The metal stents used in this series were Ultraflex (Boston Scientific, Natick,

MA), while the silicone stents used were Dumon (Novatech Dumon TM, Plan de Grasse, France).

The above described technique reduced patient stress, and provided good airway control. Large biopsy forceps was used to remove any obstructive intraluminal tumor, and the tip of the rigid bronchoscope facilitated dilatation of the airway for stent insertion. In case of complete or near complete airway occlusion, excision was undertaken using electrocautery prior to stent deployment. Good suctioning was mandatory, along with corticosteroid therapy. Chest X-ray and ABG were assessed immediately post-procedure, and pulmonary function tests were undertaken after one week. In 2 cases, that had primary oesophageal carcinoma, covered metal stents were deployed into the oesophagus using upper gastrointestinal endoscopy under fluoroscopic guidance, prior to airway stenting.

Results:

The 20 patients who underwent airway stenting prospectively consisted of 12 males (60%) and 8 females (40%), with a mean age of 54 ±17.4 years (range between 21 and 76 years). 13 patients had malignant obstructions, while 7 had benign lesions. Patient demographics, including the site of the lesion, the type and size of stent used, and the airway pathology are summarized in Table 1.

The trachea was the most common site of stenting in this series (55%), with 40% of patients receiving a 16 size stent. 15 patients (75%) had metal airway stents, while 5

patients (25%) had silicon stents. All benign lesions (7 patients) received metal stents, while 8 malignant lesions (61% of all malignant lesions) had metal stents. Early in the series, silicon stents were deployed in 5 malignant lesions, considering the palliative nature of the procedure, and the relatively lower cost of silicon stents. However, there was a high rate of silicon stent migration and coughing out of silicon stents (in 60%, i.e., in 3 out of 5 patients) that required re-stenting with metal stents, resulting in additional costs. Hence, it was decided to change strategy, and to deploy metal stents in all the subsequent patients.

All 20 patients had complaints of dyspnoea prior to stenting, of which 15 patients (8 malignant and 7 benign) improved following stenting. Out of these 15 patients, 12 (80%) received metal stents. The 5 patients who did not have improvement in their dyspnea were in the malignant group, as a result of their very advanced disease stage. Similarly, for cough, chest pain, and haemoptysis, metal stents appeared to be more efficient, or comparable to silicon stents (Table 2).

Radiological findings"

Atelectasis was observed in 9 patients (6 left lung, 3 right lung) pre-stenting, due to airway obstruction secondary to endobronchial lesions or extrinsic compression. The high incidence of left side atelectasis could be attributed to its relatively narrow lumen and anatomical orientation in comparison to the right. Atelectasis resolved in all 9 patients due to restoration of the original airway lumen following stent insertion, and also probably due to rigid bronchoscopy which had the added advantages of providing good suctioning and aeration of both lungs. One patient developed left lung atelectasis post-stenting, due to the upward migration of a silicon stent that was seated in the right main bronchus, leading to partial obstruction of the left main bronchus. The same silicon stent was re-inserted after 24 hours, resulting in the resolution of atelectasis within 4 days. It was decided that if there was any subsequent migration of the silicon stent in the future, it would be replaced with a metal stent.

Patient No.	Age	Sex	Site	Type of Stent	Size	Reason for stenting
1	68	F	B	S	12	Malignant
2	46	F	B	S	12	Malignant
3	60	M	T&B	S-Y	13	Malignant
4	60	M	T	S	16	Malignant
5	57	F	T&B	S-Y	13	Malignant
6	45	M	T	MC	16	Benign
7	53	M	T	MUC	16	Benign
8	76	M	T	MC	14	Malignant
9	56	M	T	MC	14	Malignant
10	72	M	B	MC	12	Malignant
11	28	F	T	MUC	14	Benign
12	67	M	B	MC	10	Malignant
13	68	M	B	MC	12	Malignant
14	26	F	T	MUC	16	Benign
15	58	M	B	MC	12	Malignant
16	63	F	T	MUC	16	Benign
17	21	F	T	MUC	16	Benign
18	68	M	B	MC	10	Malignant
19	73	M	T	MC	16	Malignant
20	23	F	T	MUC	16	Benign

Table 1: Age, gender, site of the lesions, type and size of stents, reason for stenting of the studied cases
M = Male ; F = Female ; B = Bronchial ; T = Tracheal ; S = Silicon
MC = Metal Covered ; MUC = Metal Uncovered ; Y = Y- shape stent

Pleural effusion was observed only in 1 patient (5%) which was minimal, and bilateral, due to malignant pleural invasion.

Spirometric data:

Out of the 20 patients, 16 patients (80%) underwent both pre- and post-stenting spirometry. The remaining 4 patients (20%) had either pre- or post-stenting spirometry. Pulmonary function tests (PFT) were estimated 24 hours before stenting, and repeated again within one week after the procedure.

Irrespective of the type of stent used, there was improvement in Forced Vital Capacity (FVC) after stenting in 85% of the patients, in 90% for Forced Expiratory Volume in 1 second (FEV1), in 85% for FEV1/FVC, in 85% for Peak Expiratory Flow Rate (PEFR), and in 90% for Maximum Voluntary Ventilation (MVV). The mean value of FEV1 showed a significant increase from 1.58 L before stenting to 1.77 L after stenting (p=0.02), while the mean FEV1, as a percentage of the predicted value, significantly increased from 54% to 60% (p=0.02).

The mean value of FVC showed a significant increase from 2 L before stenting, to 2.19 L after stenting (p=0.017), while the mean FVC, as a percentage of the predicted value, showed a significant increase from 55.72% to 60.77% (p=0.009). The mean value of

FEV1/FVC increased from 79.95% before stenting to 83.89% after stenting (p=0.06), however, this increase was not statistically significant. Although both the absolute value,

	Dyspnea	Cough	Chest pain	Heamoptysis
	No.	No.	No.	No.
Complaining	20/20 100%	5/20 25%	10/20 50%	2/20 10%
Improved	15/20 75% (12 metal, 3 silicon)	3/5 60% (1 metal, 2 silicon)	6/10 60% (4 metal, 2 silicon)	2/2 100% (2 metal)
Not improved	5/20 25% (3 metal, 2 silicon)	2/5 40% (1 metal, 1 silicon)	4/10 40% (3 metal, 1 silicon)	0/2

Table 2: Effect of stenting on the presenting symptoms No. =Number of patients, % = Percentage of patients

No.	Type of Stent	Immediate complications	During 3 month follow-up
1	S	Atelectasis, stent migration (required intubation)	None
2	S	None	Coughing of the stent after 3 weeks.
3	S-Y	None	Needed reinsertion at 1 month
4	S	Accumulation of secretions	Recurrent chest infections
5	S-Y	Chest infection	Granulation tissue growth
6	MC	None	None
7	MUC	None	Needed bronchoscopic suction after 7 days
8	MC	Intubation	Died 3rd day post operative
9	MC	None	Recurrence of dyspnea
10	MC	None	Chest infection
11	MUC	None	None
12	MC	None	Died after 6 weeks
13	MC	None	Died after 2 months
14	MUC	None	None
15	MC	Accumulation of secretions	Died after 1 month
16	MUC	None	None
17	MUC	None	None
18	MC	None	Proximal obstruction and removal of growth
19	MC	Aspiration,intubation	Died on 2nd day
20	MUC	Chest infection	None

Table 3: Complications immediately after stenting, and during the 3 month-follow-up

and the mean predicted value of PEFR and MVV increased following stenting, these increases were not statistically significant.

Arterial gasometry:

The mean arterial oxygen saturation at rest increased from 91.9% before stenting to 94.35% after stenting (p=0.001), and the mean arterial PaO2 demonstrated a statistical increase from 72.1mmHg to 82.7mmHg (p=0.001). The mean arterial PaCO2 decreased from 43.7 mmHg to 41.8 mmHg after stenting (p=0.238), however, this decrease was not significant. Similarly, the mean arterial pH did not show any significant change following

stenting (p=0.832). There were no differences in any of these arterial gasometry values between metal and silicon stents.

Complications:

Complications occurred in 45% (9 patients; 4 silicon and 5 metal stents), and these included stent migration, chest infections, atelectasis, and re-intubation (Table 3). 75% (15 patients; 7 benign, and 8 malignant) survived longer than 3 months after stenting. Five patients (all malignant) died within 3 months, with 2 related to advanced malignancy

causing respiratory failure, 2 due to distant metastasis, and 1 due to myocardial infarction. Stent migration and coughing out of stents was noted only in silicon stents (in 3 patients). Other complications were either related to the actual disease, or procedure, but not dependent on the type of stent deployed.

Discussion:

Patients with central airway obstruction are critically ill, presenting with impending respiratory failure due to diverse anatomic and functional deficits caused by both benign and malignant lesions. Stenting of airway obstruction is almost always palliative, and is usually considered when definitive surgical therapy is not feasible 8.

The present study involved the deployment of 15 metal, and 5 silicon airway stents in 20 patients over a period of 1 year who were treated for malignant and benign obstructions and studied prospectively. Double stenting of the airway and the oesophagus was

undertaken in 2 patients for malignancies affecting both lumen. Thus, a total of 22 stents were used in this series.

Although several publications have compared the efficacy of metal and silicon stents in malignant and benign lesions 6,7,9,10,11, there appears to be no clear consensus on which

kind of stent should be used in these diverse pathologies. There are several distinct benefits of metal stents over silicon stents, in that they are easily deployed, preserve mucociliary activity, are less likely to be displaced, and result in a larger airway lumen 3. However, these advantages need to be balanced against its prime disadvantage, since it has been advised that metal stents should not be used in benign lesions because they get incorporated into the luminal tissue, rendering it challenging to remove them at a later stage 3. In contrast, silicon stents impair mucociliary activity, tend to migrate, and result in a relatively small internal airway lumen owing to the thickness of the stent wall 3. Furthermore, silicon stents are recommended to be replaced every 2 years, in contrast to the longer durability of metal stents.

In addition to these already documented differences, we aimed to analyse if there is an economic benefit in deploying metal stents instead of silicon stents in benign airway lesions. This is especially significant in the context of developing countries, where unlike in the western countries, due to delayed/ inadequate medical coverage in government funded hospitals, and decreased coverage by medical insurance, patients usually have to pay for the cost of stents. Furthermore, patients in developing countries represent a

unique sub-type usually presenting late in their disease process due to several socio-economic factors. Thus, since patient economics is a limiting factor in developing

countries, doctors have to strike a balance when choosing the optimal treatment which is both medically efficient and also cost-effective. Our search of the literature revealed that data about airway stenting represented primarily the western population 2,3,5,6,7, with very little published data about the developing countries. Our report analyses not just the efficacy of metal and silicon stents in malignant and benign airway lesions, but also takes into account patient economics when trying to choose the most cost-effective stent.

Our series comprised of 13 malignant, and 7 benign lesions that required airway stenting. The 13 malignancies consisted of 4 inoperable primary lung carcinomas (3 squamous cell carcinoma, 1 adenocarcinoma), 2 cases of lymphoma, 1 case of lymphosarcoma, 1 rhabdomyosarcoma, 1 case of malignant thymoma, and 4 primary oesophageal carcinomas presenting with associated airway invasion and compression. In 2 patients with oesophageal carcinoma, double stenting of both the oesophagus and trachea was undertaken as suggested by Venuta et al 5.

The 7 benign lesions consisted of 5 cases of tracheomalacia, 1 case of tuberculosis, and 1 case of idiopathic tracheal stenosis. The diagnosis of idiopathic tracheal stenosis was made based on a negative clinical history, infiltration of the tracheal wall by non-specific chronic inflammatory cells, and a diagnostic multi-slice CT of the chest. Although

surgical resection and reconstruction is the treatment of choice for idiopathic tracheal stenosis 12, our patient was not a good candidate for surgery due to long-segment involvement, and also the patient's refusal for surgery. This rendered the uncovered metal stent a suitable option.

In the present study, dyspnea improved in 75% (15 patients) of cases and this could be attributed to the resolution of pulmonary or lobar atelectasis, resulting in improvement of

post-obstructive pneumonia. The remaining 25% (5 patients) did not show any improvement in dyspnea, and this may be attributed to the associated chest infection, advanced disease stage, and cancer cachexia.

The parameters of the pulmonary function test, namely, FVC, FEV1, FEV1/FVC, PEFR, and MVV all improved following stenting, although statistical significance was observed only in FVC, and FEV1. Similarly, arterial gasometry demonstrated improvement in mean arterial oxygen saturation, and PaO2, with no significant change in PaCO2 and pH. These improvements in pulmonary function and arterial gasometry could be attributed to the effective restoration of the airway lumen following stenting, irrespective of the type of stent deployed. Furthermore, stenting prevents lobar atelectasis, and decreases the

shunt effect of unventilated/hypoventilated lung units, thereby correcting the ventilation-perfusion mismatch 13.

All the above clinical parameters suggest that metal stents are at least as effective as silicon stents in treating benign airway lesions. Our initial experience in the series demonstrated a high incidence of stent migration and coughing out of silicon stents in 3 patients, which warranted stent replacement, and consequent higher cost implications. Although metal stents are marginally more expensive when compared to silicone stents, keeping in mind the long life of metal stents, the less incidence of migration and failure, and most of all, the high cost of stent replacement in case of silicon stent failure, led us to choose metal stents over silicon stents. It is also important to keep in mind that the cost implications include not just the cost of the stent itself, but also the cost involved in repeating the interventional procedure, in addition to increasing patient's stress.

Although we have described a small cohort of patients with malignant and benign disease who underwent airway stenting, our observations suggest that metal stents may be generally safe and effective in benign airway lesions. Our series represents the initial observations of a prospective pilot study that was followed-up for 3 months, and is part of an ongoing, larger series of patients with longer follow-up periods with detailed statistical

and economic analysis. The large number of metal stents used in this study, was primarily due to the high replacement cost in case of silicon stent failure warranting subsequent replacement by a metal stent. Our initial observations suggest that in addition to other factors, the economic benefits of using metal airway stents in patients in developing

countries could be an important deciding factor. Results of the long term study could help reaffirm the conclusions drawn on these aspects of this pilot study.

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Video-Assisted Thoracic Surgery (VATS) drainage for Fibrinopurulent Thoracic Empyema

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Marwan Taher Al Matthanh MD **

Background : **Empyema remains a serious complication of pneumonia, traumatic hemothorax, subphrenic abscess and other conditions. The standard treatment of empyema has been intravenous antibiotics and insertion of chest tube drainage for early stages and open thoracotomy and decortication for chronic stages. In the transitional phase (fibrinopurulent) empyema, VATS drainage and debridement and or intrapleural injection of fibrinolytic agents has been used successfully in many hospitals.**

In this study we report our experience using VATS drainage and debridement for transitional phase or stage II (fibrinopurulent) empyema.

Methods: **Thirty two cases of fibrinopurulent empyema, diagnosis confirmed radiologically to have thin adhesions or multi-locules, were managed by VATS from 2005-2010. Patients with extensively thickened pleura or markedly trapped lungs were not managed by VATS and were directly taken for classic open decortication.**

Results : **68.75% were males and 31.25% were females with a median age of 35 years. The operating time was 60 + 15 minutes. In 4 cases conversion into open decortication was required. In 3 cases postoperative persistence of locules were found. Diagnosis of underlying malignancy and pulmonary TB was confirmed in 6 cases. There were no mortalities. The length of preoperative period was 10 ± 2 days, and the length of postoperative hospital stay was 12 ± 4 days.**

Conclusion : **Early VATS for fibrinopurulent empyema is a very effective line of management. Early drainage and debridement of the thoracic cavity could be achieved decreasing the number of cases subsequently requiring open decortication. In addition visualization of the thoracic cavity and taking biopsies will help in diagnosing rare cases of empyema.**

Empyema thoracis is a purulent pleural effusion which can be localized (encapsulated) or can involve the entire pleural space [1, 2]. In 1962, The American Thoracic Society divided the empyema into 3 distinct stages; exudative, fibrinopurulent (Transitional phase) and organizing (chronic) stage [1]. This staging is important for choosing the proper management. The fibrinopurulent (transitional) stage of empyema is characterized by the formation of fibrin deposits on both pleural surfaces and the fluid is turbid or frankly pus. Although locules are formed and the lung is less mobile, but it can still be re-expanded [3].In this stage pleural drainage can be achieved by many methods, such as intercostal tube drainage, VATS drainage or open thoracotomy and decortication. Before the use of VATS, several authors performed early open thoracotomy to drain acute empyemas with multiple locules [1, 4, 5, 6].Radiologists achieved drainage by insertion of pig tail catheters with US or CT guidance. Injection of intrapleural fibrinolytic enzymes has been used in many patients with success [7, 8]. VATS is an ideal procedure for debridement and drainage of fibrinopurulent empyema with good results, short hospital stay and better cosmotic outcome [9, 10,11].

Methods

This is a retrospective study of 32 patients with fibrinopurulent empyema that were treated between 2005 and 2010, in King Fahad University Hospital, Al Khober, Saudi Arabia. All of these cases were on broad spectrum antibiotics before being referred to cardiothoracic surgery. Eight patients (25%) already have chest tubes inserted before presentation and were ineffective (Fig 1).

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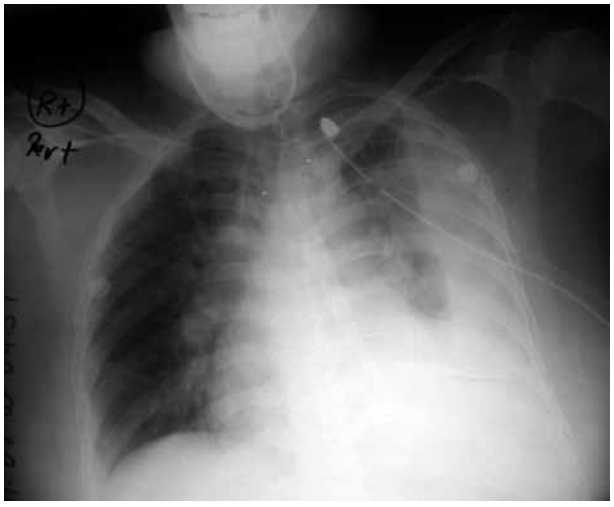
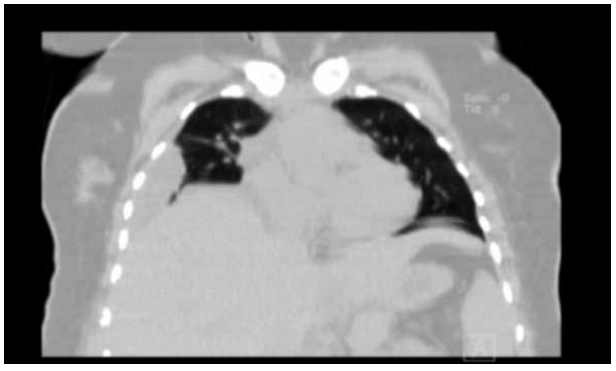


Figure 1: CXR Posteroanterior view (PA): showing a large left sided encysted empyema, with ICT inserted and ineffective in draining the empyema

CT chest was done as a routine to all cases and confirmed the presence of locules & pleural thickening. Patients confirmed to be in a fibrinopurulent stage of empyema were managed by VATS without a trial of chest tube insertion (Fig 2 & 3).



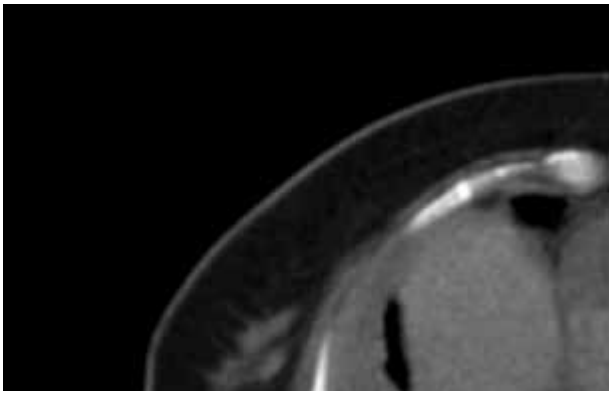


Figure 2 & Figure 3: Plain CT Chest- Coronal view & mediastinal window of the same patient: Showing a right sided loculated empyema which was offered VATS drainage.

The presence of extensive pleural thickening and lung trapping in chronic stages excluded patients from VATS and they were offered open decortication (Figure 4).

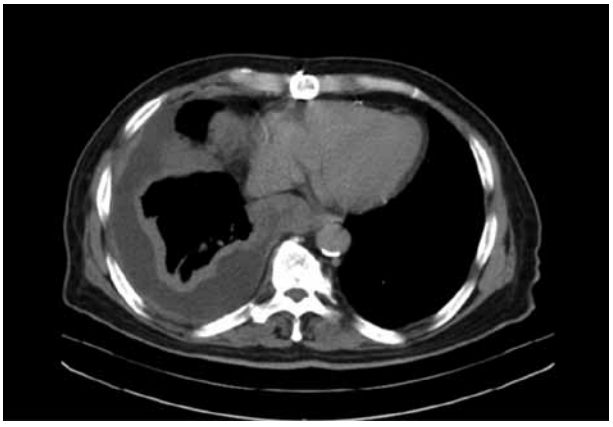


Figure 4: Plain CT Chest – medistinal window: showing a right sided loculated empyema with very thick adhesions and lung trapping. Patient offered decortication.

Surgical technique:

General anesthesia was conducted with a double –lumen endotracheal tube to allow ipsilateral lung collapse. Local anesthesia and sedation was used in 2 old patients was poor left ventricular function.

All patients were positioned in the lateral position as for a thoracotomy. A 12 mm trocar was inserted in the 4th - 6th intercostal space in the posterior axillary line, to introduce the "0" degree telescope. Suction of the cavity was done and all the fluid collected and sent for further laboratory investigations and cytology examination. One or two more trocars were inserted in the mid axillary or anterior axillary line according to the position of the collection. The pleural peel grasped and removed and proper debridement was done to free the underlying lung. Exploration of the cavity was done and any suspicious lesions of the pleura or lung was taken for biopsy. At the end of the procedure the cavity is irrigated and the lung is tested for air leakage. Two large intercostal tubes were inserted through the VATS ports and the other opening was closed by vicryl.

In 4 cases the adhesions were found to be very extensive and it was impossible to complete the procedure with VATS. Conversion into formal thoracotomy and classic decortication was done. Postoperatively, all patients were extubated at the end of the procedure. Intercostal tubes were connected to negative suction and routine chest x-rays were done daily for follow up.

Results

Twenty two patients were males (68.75%) and 10 patients (31.25%) were females with a median age of 35 years (range 14 years to 82 years). The operating time was 60 + 15 minutes. In 4 cases (12.5%) the procedure could not be completed thoracoscopically and conversion into open decortication was required.

In 3 cases (9.3%) postoperative persistence of locules were found and further management by streptokinase injection through the intercostal tubes was done and gave a good result.

VATS also aided in the diagnosis of underlying lung disease in such patients. Malignancy and pulmonary TB was confirmed in 6 cases (18.75%). There were no hospital deaths. The length of preoperative period was 10 ± 2 days, and the length of postoperative hospital stay was 12 ± 4 days.

Discussion:

Pleural empyema remains a serious problem. Despite the aggressive use of broad spectrum antibiotics and the availability of modern diagnostic techniques and facilities, these patients are referred late for surgical management .It is very important to use the CT scan early to stage the patient and not only the plain CXR[6]. Although the management of early and late stages has been setteled, controversy remains regarding stage II or fibrinopurulent empyema. In the past many authors recommended open thoracotomy and decortication to be done early for cases with multiloculated empyema [1,4,5,6]. Although they had good results with proper drainge of the thoracic cavity, still it is a major operation with many morbidities. Radiologists achieved drainage of the thoracic cavity by CT or US guided insertion of drainage catheter. It is appropriate for early empyema, but with multilocules it will not be effective. The procedure will be repeated many times with frequent blockage of the draining catheters[7].

Tube thoracostomy with injection of streptokinase has been widely used but also doesn't result in full drainage of the thoracic cavity in stage II empyema. [7,8].

Since the reports of Casina et al, the VATS has been widely used for stage II empyema [1, 3, 9,10,11]. It has the advantage of being a safe minimally invasive procedure, less painful, and with a minimal hospital stay. We used VATS in 32 of our patients that were confirmed radiologically to be in stage II. We achieved the procedure even in cases unfit for general anesthesia by only sedation and local anesthesia. In addition visualization and full exploration of the thoracic cavity exposes any suspicious lesions and help in the diagnosing the underlying pathology. In 6 of our patients (18.75%) we identified the cause of empyema to be malignant or tuberculous, and not to be due to parapneumonic effusion as was suspected. We could not complete the procedure by VATS in 4 cases (12.5%), and we converted into open classic decortication due to the extensive adhesions and marked lung trapping, for the safety of the patient. Post VATS debridement and drainge, 3 cases (9.3%) re developed pleural locules diagnosed radiologically. We injected streptokinase through the intercostal tubes with a good result. There were no hospital deaths. The length of postoperative hospital stay was 12 ± 4 days.

Conclusion

Early VATS for fibrinopurulent empyema (stage II) is a very effective line of management. Early drainage and debridement of the thoracic cavity could be achieved decreasing the number of cases subsequently requiring open decortication. In addition it aids in diagnosing the underlying cause of empyema.

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Case report

Successful Resection Of Huge Interventricular Septal Fibroma With Bilateral Outflow Tract Obstruction

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Primary cardiac tumors are a rare entity. They have an autopsy frequency of 0.001%–0.28% (1). Approximately three-quarters of primary heart tumors are benign with atrial myxomas comprising three-quarters of those (2). Cardiac fibromas are benign neoplasms of fibroblasts in the myocardium. Most commonly originating from the left ventricle, these lesions are rarely observed in adults and are the second most common tumor in the pediatric population following rhabdomyomas(3,4,5,6) Cardiac fibroma has no specific clinical presentation. Its recognition is important because of the risk of sudden death(7,8)

Here we present a case of 9 years old girl presented with vague chest discomfort right hypochondrial pain and palpitation .Two dimensional transthoracic echocardiography revealed large mass involving the muscular and perimembranous portions sparing only the apical part ,the ballooned interventricular septum was encroaching on both right and left ventricular outflow tracts causing obstruction with gradient 50mmHg on the right and 36mmHg on the left. The definitive diagnosis was confirmed by MRI that showed a soft tissue mass 5x6.5x4.5cm occupying the outlet septum and most of the sinus septum and encroaching on both right and left ventricular cavities (figure1 and 2).

Surgical technique

Under general anesthesia and standard CPB right atriotomy and good retraction of tricuspid valve showed the ballooned right ventricular aspect of the IVS. The tumor mass was firm in consistency extending from just below the septal leaflet of tricuspid to the apical muscular septum, consuming all the muscular part of muscular septum and extending to the outlet septum, obstructing the way to the pulmonary valve. Pulmonary arteriotomy just above P annulus was done and pulmonary cusps were retracted from above to expose the cephalic end of the tumor mass the posterior pulmonary annulus. Through the right atriotomy and tricuspid valve a split thickness vertical incision incision was done in the most thinned out septal myocardium on the prominent convexity of the mass by both blunt and sharp dissection the thinned out septal myocardium was shaved from the right ventricular surface of the tumor then by holding the tumor mass by artery forceps it was retracted up to continue the dissection on the deeper aspect (LV side) of the tumor .The cephalic end was sharply dissected from the pulmonary annulus and out flow of the septum till complete separation of the mass from the septal tissue taking care not to destroy the septal muscle or perforate the IVS .Small septal perforators supplying the tumor were meticulously controlled and the mass was finally removed from the right ventricular aspect from the tricuspid valve (figure 3).Reconstruction of the interventricular septum by fine 6- zero proline between the dissected right ventricular layer and left ventricular side of the septum was done by interrupted sutures .A large autopericardial patch (fig. 4) was sutured to the right ventricular aspect of the inerventricular septum with the smooth surface of the pericardium toward the right ventricular cavity side separate stiches were taken

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to fix the central part of the patch to the ventricular septum to avoid any dead space in between.Right atriotomy and pulmonary arteriotomy were closed and the normal cardiac sinus rhythm was resumed after declamping the aorta .Smooth weaning from cardiopulmonary bypass on 10 mic/kg/min.dobutamine and 2 mic/kg/min.tridil was achieved.Post-operative course :The patient passed a smooth post operative course and weaned from ventilator after 6h and from inotropics after18h with good hemodynamic and neurological state.Post-operative echocardiography revealed good left and right ventricular functions (LV EF 52% ,RV EF 50%) ,normal interventricular septal thickness (8mm) with a small cystic space 3x10 mm in the midsepum .The patient was discharged from ICU after 48h and from hospital in the 8th post-operative day.

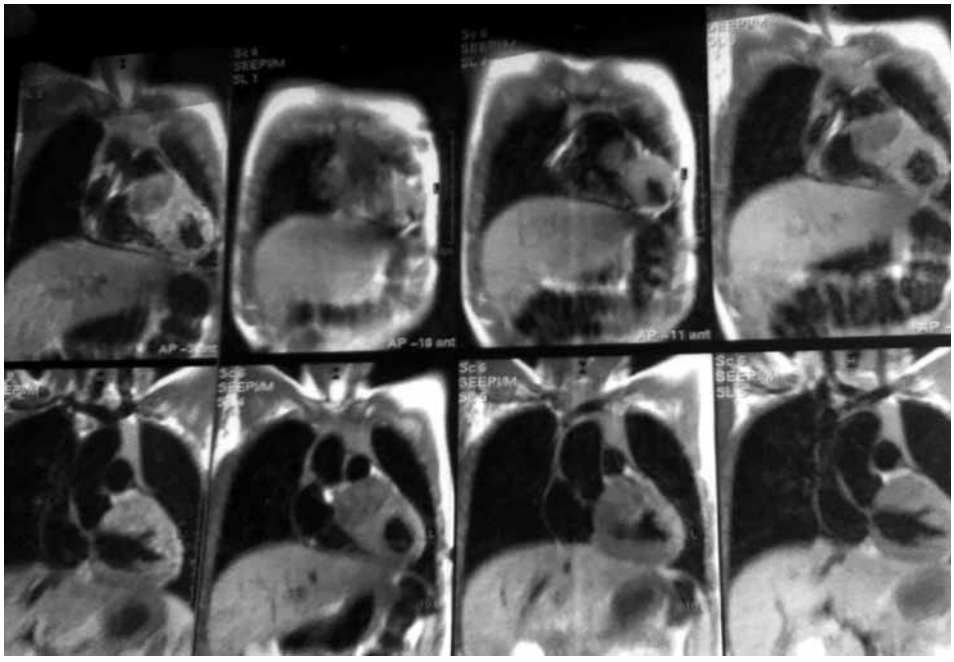

Figure 1 : Preoperative MRI picture of IVS mass (coronal view)

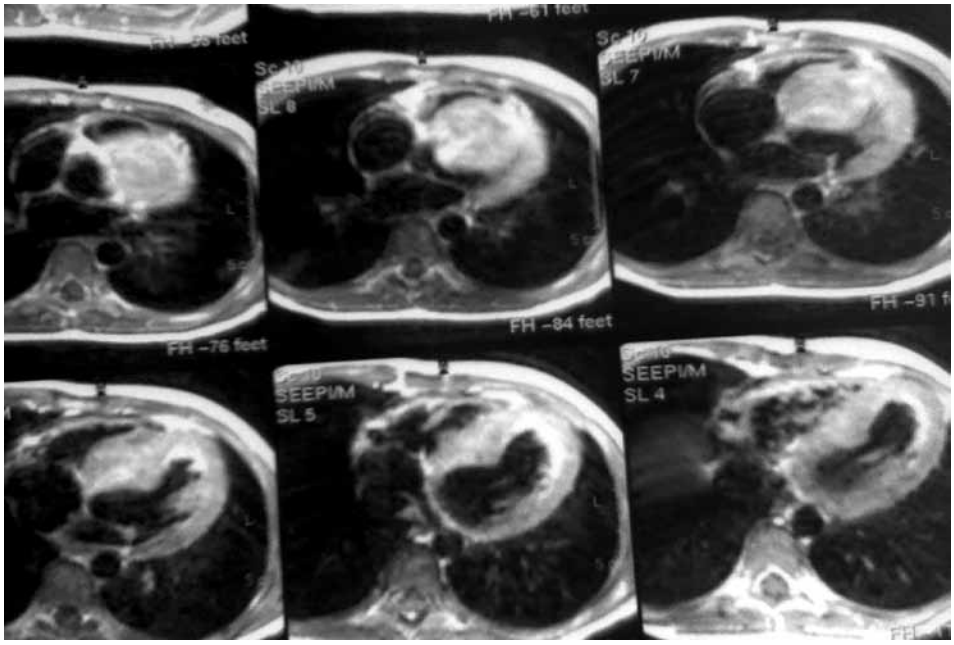

Figure 2MRI cross sectional view of IVS tumor

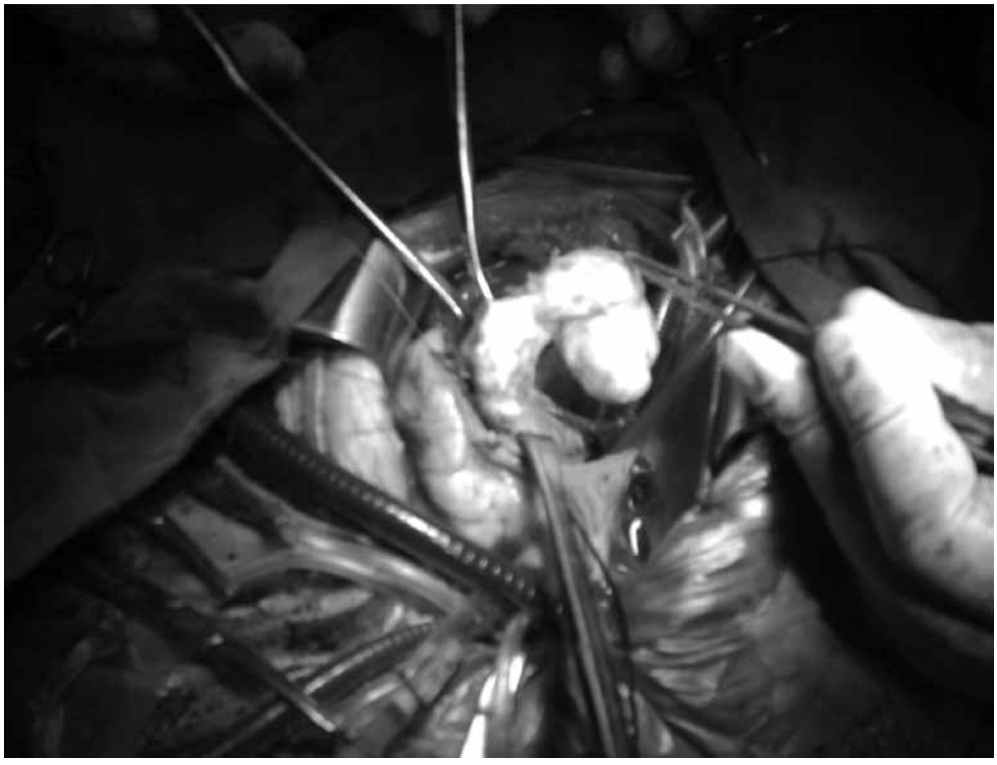

Figure 3 Transatrial transtricuspid view of dissected mass from IVS

Figure 4 Reconstruction of the IVS by suturing autopericardial patch to the bed of resected mass

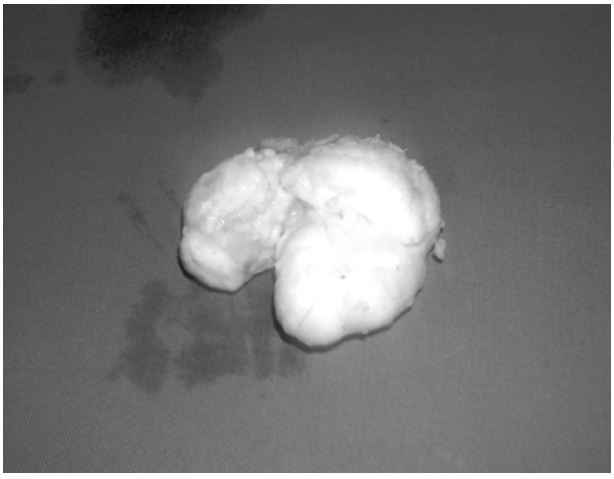

Fig 5 ;Gross picture of large lobulated fibroma resected from IVS

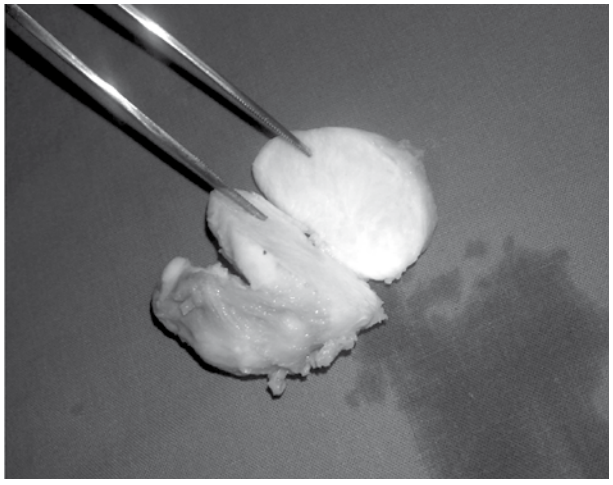

Fig 6 Bisectedmass resected from IVS

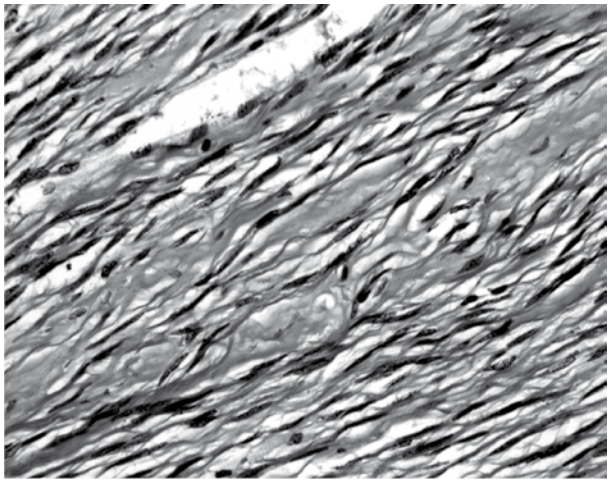

Fig7 High power view of resected benign fibroma

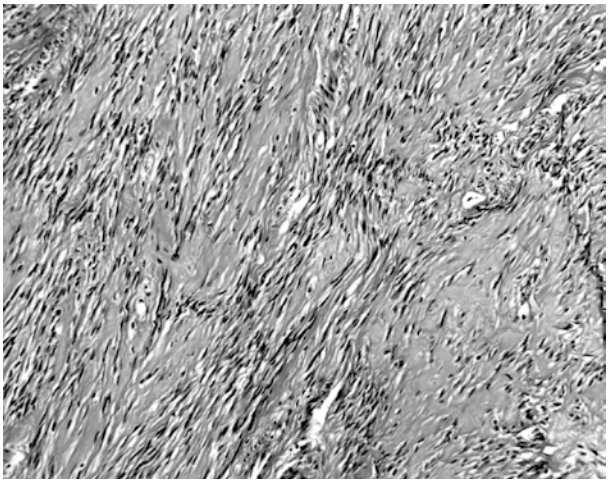

Fig 8 lowpower view of the resected fibroma showing abundant fibrous tissue

Pathology

Gross picture (figure 5,6) showed an irregular white glistening mass 3x5x7cm with firm consistency with gritting sensation on cross section with whorly grayish lines on cross section Microscopic picture (figure 7,8) mature fibrocytes without any signs of malignancy with interlacing fibrin in between. The diagnosis was benign fibroma of interventricual septum

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