Volume 18 Jan - Jun 2010 Number (1-2)

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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

Volume 18 **Jan - Jun 2010** **Number (1-2)** **ISSN 1110-578X**

THORACIC

Guidelines for Authors

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

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

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

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A] Cover Letter

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

B] Complete Manuscript

□ Title page .
□ Title of article
□ Full name(s), academic degrees, and affiliation(s) of authors.
□ Corresponding author .
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□ Abstract (250 words; double-spaced) .
□ Ultramini-abstract (50 words) .
□ Text (double-spaced).
□ References (double-spaced; separate pages).
□ Tables (double-spaced; separate pages).
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□ Figure legends (double-spaced; separate pages) .
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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

■ **27 - 28 May 2010 Boston, MA United States [iCalendar] Postgraduate Course In General Thoracic Surgery Royal Sonesta Hotel CME available**

For information, contact: Phone: 1 617 384-8600 Fax: 1 617 384-8686 Email: hms-cme@hms.harvard.edu Additional information: https://cme.med.harvard.edu/index.asp

■ **28 - 29 May 2010 Philippines [iCalendar] 4th PATACSI Postgraduate Course for Nurses Dagupan, Pangasinan CME available**

For information, contact Annia S. Paceño 2nd Floor, Management Service Office Medical Arts Building, Philippine Heart Center East Avenue, Quezon City Phone: (632) 9293826 Fax: (632) 9293826 Email: patacsi_tcvs@yahoo.com or patacsi@skyinet.net Additional information: http://www.patacsi.org

■ **28 - 30 May 2010 Phuket Thailand [iCalendar] The 2nd CDI International Heart Disease Summit - "The State of the Art vs. Modern Technologies in the Era of Changes" Chest Disease Institute**

For information, contact: Secretariat Department of Surgery, Chest Disease Institute Tiwanond Road Nonthaburi 11000, Thailand Fax: 662 591 8943 Email: info@cdiheartdisease.org Additional information: http://www.cdiheartdisease.org

■ **3 - 4 September 2010 Hong Kong China [iCalendar] Fourth Asian Pacific Conference: Perspectives in Lung Cancer**

For information, contact: Organizer, Imedex 325 Alexander Drive Alpharetta, GA 30022-3740, USA +1 (770) 751 7334 Phone: +1 (770) 751 7332 Email: meetings@imedex.com Additional information: http://www.imedex.com

■ **3 September 2010 Dublin Ireland [iCalendar] Coronary Artery Surgery Workshop Royal College of Surgeons In Ireland**

For information, contact: Ms Orla Mockler Course Administrator Surgical Training Office Royal College of Surgeons in Ireland, 121 St Stephen's Green, Dublin 2, Ireland Phone: +353 1 402 2233 Fax: +353 1 402 2459 Email: omockler@rcsi.ie

■ **7-9 September 2010 Istria Croatia (Hrvatska) [iCalendar] First Heart Surgery Forum Meeting - How to Manage Unsolvable Cases And Major Disasters In Cardiac Surgery Kempinski Adriatic Hotel, Savudrija**

For information, contact: Andrea Grospi? Phone: +385 1 4886 777 Fax: +385 1 4886 770 Email: andrea grospic@als.hr or hsfmeeting@hsfmeeting.com Additional information: http://www.hsfmeeting.com

■ **9 - 10 September 2010 Homburg Saar Germany [iCalendar] Aortic Valve Repair Module 2 Saarland University CME available .**

For information, contact: Professor Dr. Hans-Joachim Schäfers Phone: +49 6841-1632000 Fax: +49 6841-1632005 Email: cardiovascular.surgery@uks.eu Additional information: http://www.uks.eu/cardiovascularsurgery

■ **9 - 10 September 2010 Liverpool United Kingdom [iCalendar] Part III Revision (A highly interactive course on all aspects of cardiothoracic and oesophageal) Liverpool Heart and Chest Hospital**

For information, contact: Mr. Mike Poullis, BSc(Hons), MBBS, MD, FRCS(CTh) Liverpool Heart and Chest Hospital Thomas Drive Liverpool L14 3PE UK Additional information: http://www.mpoullis.com/courses.htm

■ **11-15 September 2010 Geneva Switzerland [iCalendar] 24th EACTS Annual Meeting Palexpo .**

Abstract submission deadline: 1 April 2010 For information, contact: EACTS Executive Secretariat 3 Park Street, Windsor, Berkshire SL4 1LU, UK Phone: +44 1753 832166 Fax: +44 1753 620407 Email: info@eacts.co.uk Additional information: http://www.eacts.org

■ **16 September 2010 Philippines [iCalendar] 5th Scientific Meeting TCVS Consortium**

For information, contact: Annia S. Paceño 2nd Floor, Management Service Office Medical Arts Building, Philippine Heart Center East Avenue, Quezon City Phone: (632) 9293826 Fax: (632) 9293826 Email: patacsi_tcvs@yahoo.com or patacsi@skyinet.net Additional information: http://www.patacsi.org

■ **16 - 18 September 2010 Athens Greece [iCalendar] 5th International Meeting of the Onassis Cardiac Surgery Center: Current Trends in Cardiac Surgery and Cardiology Eugenides Foundation Congress Center Abstract submission deadline: 1 March 2010**

For information, contact: Liana Iliopoulou Triaena Tours & Congress 206 Sygrou Avenue 176 72 Athens (Kallithea) Phone: +30 210 7499353 Fax: +30 210 7705752 Email: lianae@triaenatours.gr Additional information: http://www.ocsc2010.gr

■ **20 November 2010 Woluwe, Brussels Belgium [iCalendar] 15th Congress on Cardio-Thoracic Surgery Sodehotel Abstract submission deadline: 1 August 2010**

For information, contact: Dr. A. Poncelet Phone: +32 (2) 764 6107 Fax: +32 (2) 764 8960 Email: alain.poncelet@uclouvain.be Additional information: http://www.bacts.org

■ **26 - 27 November 2010 Bordeaux France [iCalendar] 1ères Rencontres Multidisiplinaires des Cardiopathies Congénitales Mercure Bordeaux, Cité Mondiale, Centre de Congrès 18 parvis des Chartrons**

For information, contact: Dr. Philippe Pouard Coordinateur Scientifique Hôpital Necker-Enfants-Malades Réanimation de chirurgie cardiaque pédiatrique 149, rue de Sèvres 75743 Paris Cedex 15 Phone: +33 (0)1 44 38 19 05 Email: pp@invivo.edu or cardiocongenitale@overcome.fr Additional information: http://www.multi-cardio-congenitale.fr/

■ **2 - 3 December 2010 Liverpool United Kingdom [iCalendar] What You Need To Know As A Year One Registrar In Cardiothoracic Surgery (An interactive course on all aspects of imaging and perfusion in cardiothoracic and oesophageal surgery) Liverpool Heart and Chest Hospital**

For information, contact: Mr. Mike Poullis, BSc(Hons), MBBS, MD, FRCS(CTh) Liverpool Heart and Chest Hospital Thomas Drive Liverpool L14 3PE UK Additional information: http://www.mpoullis.com/courses.htm

■ **6 December 2010 Philippines [iCalendar] PATACSI-Getz Scientific Research Forum 2010 Abstract submission deadline: 18 September 2010 For information, contact:**

Annia S. Paceño 2nd Floor, Management Service Office Medical Arts Building, Philippine Heart Center East Avenue, Quezon City Phone: (632) 9293826 Fax: (632) 9293826 Email: patacsi_tcvs@yahoo.com or patacsi@skyinet.net Additional information: http://www.patacsi.org

■ **8 December 2010 9 - 11 December 2010 Dallas, TX United States [iCalendar] Dallas Leipzig International Valve 2010 Westin Galleria Hotel**

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■ **13 - 16 February 2011 Stuttgart Germany [iCalendar] German Society For Thoracic and Cardiovascular Surgery 40th Annual Meeting Abstract submission deadline: 20 September 2010**

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Editorial

CIRCLE OF LIFE

IN THE CIRCLE OF LIFE IT IS THE HEART WHICH MATTERS

Every start has an end which leads to a new start .Life has always gone in circles; loops of success and loops of failure , driven sometimes forwards and other times backwards. By the end of the day it is not winning or losing which matters but all is about the way we fought our battles , if with honor and pride ; that is the true glory .

Our Egyptian Society Board Governance by may this year is coming to an end, most of its members will be out of office. All of us hoped ,dreamt and tried to our best sincerely without gaining any personal interest or benefit ,may be achieved may be not its for you to decide .

To our next distinguished elect members we wish all the best, all the victory in battles we did not win.

We leave a base for you to build upon : National Database Program to get an accurate statistical analysis reflecting the magnitude of cardiac surgical practice in Egypt; you have to urge all Centers and Consultants to use it or even a better different version and until then we will never have a proper record of our practice to be able to improve and mend its deficiencies.

For the first time the society has a library with diverse books , journals and videos for most of the cardiothoracic procedures in addition to the full curriculum of American board of lectures taped.

The society managed to organize regular summer scientific activity in collaboration with other centers as an extension to our annual Grand Meetings.

Society as well organized gathering and festival events as part of our social program ;trying to attract funds to support the practice of certain centers .

Periodical Lectures for postgraduate students in collaboration with Ain Shams University under the supervision of Dr Ezz and Dr M Mosatafa.

Last but not least Face lift to our journal in form and content initiated by Dr Ezz Abdel Rahman as extension to the pioneer efforts of Dr Mohamed Elfikki and Dr Hassouna .

These are some of the achievements of the present board, part of the circle which is coming to an end leading to a new cycle inshaa Allah more fruitful and prosperous hoping to all of You Members and Readers all the best, for our Society and Journal all the advancement and excellence cycle after cycle in the circle which contains in its Center our Hearts.

Yours Sincerely

Yasser Hegazy MD , FRCS
Editor-In-Chief
Journal of The Egyptian Society
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Statistics for clinicians: Prognostic studies.

Ahmed Hassouna, MD.

A prognostic variable is a variable which is linked to the studied point of interest e.g. histological type of cancer and patient's survival. Patient outcome may vary significantly with the presence (or absence) of a certain factor or disease e.g. tobacco smoking during pregnancy and low fetal birth weight, diabetes mellitus and lower patency rates after PCI and coronary artery stenting, etc...Those prognostic/risk factors induce significant variability of the studied point of interest/patient outcome and, unless they are taken into consideration during the study, they can become a major source of bias that jeopardizes the credibility of the research and falsifies the interpretation of the results.

As example, a study was designed to evaluate the curative role of a new antibiotic (x), in the treatment of chest infection. The number of patients necessary to demonstrate a significant clinical difference between the antibiotic and placebo was calculated by a simple formula (1). One-hundred and sixty patients were randomized into 2 equal groups to either receive treatment (x) or placebo. Unfortunately, the result of the study was deceiving as only 24 patients (30%) responded to treatment (x), compared to 20 patients (25%) who received a placebo instead (P>0.05) and the study was not published.

Few months later however, those data were reviewed by another investigator who discovered the following: 1) both treatment and placebo groups were not initially comparable from the start, with significantly more patients with (the virulent) MRSA staphylococci found in treatment group compared to placebo group. 2) Although the overall curative effect of treatment (x) was unsatisfactory, the antibiotic showed an excellent (90%) response on non-MRSA staphylococcal infection; compared to only 30 % cure in placebo group. In the first unpublished scenario, the use of (x) in the treatment of chest infection would have being discouraged, while in the second scenario; (x) would have being a drug of choice in the treatment of non-MRSA chest infection.

The problem of the first researcher was that he missed/ignored the importance of the prognostic variable (MRSA staphylococcal infection) both: 1- during randomization when he permitted the assignment of more patients with MRSA staphylococci to the treatment group, as compared to placebo as well as: 2- during the analysis when he overlooked the effect of the prognostic variable (having/not having MRSA) on the overall results of the study (although the overall treatment group did not benefit from «x», the subgroup

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of non-MRSA patients showed a significant benefit, compared to placebo group). In fact, all prognostic (or risk) factors must be taken into consideration: 1- as early as the time we plan our study and, 2- then carried out the whole way till the time of statistical analysis as well. In statistical terms, the 2 procedures that can achieve these 2 goals are known as: 1- stratification and 2- adjustment; respectively. The details of each of the 2 procedures will be the subject of a future article.

In brief, stratification involves taking into consideration the prognostic variable during planning of the analysis by evenly distributing those particularly high risk patients who are expected to have a bad prognosis (MRSA staphylococcal chest infections) between the 2 study groups: treatment and placebo. In other words, stratification aims to compose 2 groups that are initially comparable at the beginning of the study (comparable percentages of MRSA and non-MRSA patients in each group), so that any resulting difference at the end of the study would be attributed to the effect of the treatment alone.

Adjustment, on the other hand, is to take this factor into consideration during the analysis itself by evaluating the effect of this factor (type of organism in our example) on the main point of interest (effect treatment). In other words, besides studying the overall effect treatment, the aim of adjustment is to show how it would variate with the prognostic/risk factors? Returning to our example, the second researcher reexamined the data and remarked that patients with MRSA and non-MRSA staphylococcal infections have responded differently to the studied antibiotic and hence, he realized that besides the effect treatment, there is a second effect in the study which is the effect of the prognostic variable (MRSA staphylococci). Before presenting how both effects (treatment effect and effect prognostic variable) should be correctly tackled, we will review the wrong approaches to the problem which include:

1- Let us remind that the study showed an overall non-significant difference between the 2 main compared groups (treatment versus placebo; including MRSA and non-MRSA patients) and a common trap is to try to perform a subgroup analysis (MRSA versus non-MRSA patients) in the absence of a statistically significant difference between the main compared groups. In fact, the first assumption in any comparative study is that both compared groups issue from the same population and hence, if they will show different outcomes at the end of the study we can attribute such difference to the treatment effect. As we failed to demonstrate treatment effect for the main groups (treatment and placebo), a significant difference between the outcomes of their subgroups (MRSA and non-MRSA) would mean that these subgroups were different from the start and that their outcomes will not be dependent upon the effect treatment but on the initial differences in themselves. This put a big question mark on the study design and results. Consequently, subgroup analysis should only be allowed after the demonstration of a statistically significant difference between the main compared groups. In our study, we cannot compare the subgroups of patients who received treatment (MRSA versus non-MRSA) to each other unless the initial comparison between the 2 main groups (treatment and placebo; including both MRSA and non-MRSA patients) was statistically significant; which was not the case.

2- Another bad (option) is to totally ignore the MRSA patients and carry on the analysis on non-MRSA patients only. This analysis loosens many ties and carries many traps. First, it will put the process of randomization in question because patients were distributed between the main 2 groups by a «randomized order» and hence, taking out MRSA patients from that order will put in question the initial comparability of groups that was supposed to be insured by the randomization process. Second, the applied test will lose the statistical power necessary to put in evidence a significant difference between treatment and placebo groups; i.e. the researcher will diminish his chances to demonstrate a statistically significant treatment effect in non-MRSA patients, even if such difference does exist.

3- Now suppose that the first researcher did find a statistically significant treatment effect between the 2 main groups and hence, he is entitled to perform a subgroup analysis. As there will be no point to comparing subgroups in main placebo group, he will attempt to find the effect of the prognostic variable (MRSA versus non-MRSA) only in the main treatment group. Besides the inherent problems of analysis of small (subgroups) of patients, this second step comparison involves using the same data twice and hence, inflates the primary risk of error; i.e. a smaller P value than 0.05 will be needed to declare the usual statistical significance at the 5% level (2), as will be shown in a future paper.

Another important point in such a legitimate subgroup analysis, is that it will deal with the 2 studied effects (effect treatment and effect type of organism) on the outcome (cure of chest infection) as being 2 separate (independent) issues: First we proved that there is an effect treatment (the percentage of the cure of treatment group was better than that of placebo group), second we have proved that there is effect type of organism (the cure of non-MRSA patients was better than MRSA patients) and third we have to assume (but we can never exactly measure) the links between the 3 effects. Adjustment offers the researcher the opportunity to evaluate the significance of each of the following effects: 1- the originally studied point of interest (cure of chest infection by antibiotic «x» in our example) 2- the adjustment qualitative variable (having/not having MRSA) and, 3- the possible interaction between the previous two variables. Two-Way Analysis of variance is a simple test to use for adjusting the effect of a single prognostic variable on a quantitatively measured outcome and it will be presented in a future paper.

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Aortic Valve Replacement in advanced Chronic Aortic Regurgitation

Usama A. Hamza

Background: **Severe aortic regurgitation results in progressive left ventricular dysfunction that affects results of late surgical intervention. This study is conducted to assess the results of aortic valve replacement in patients with severe aortic regurgitation and left ventricular end diastolic dimension (EDD) ≥70 millimeters compared to patients with EDD < 70 millimeters.**

Methods: **Fifty patients with aortic regurgitation undergoing aortic valve replacement at Mansoura University and Mansoura International Hospitals were prospectively studied. Patients were divided into two groups according to the degree of left ventricular dilatation at the end of diastole as assessed by echocardiography; group I (patients with EDD ≥ 70 mm) and group II (patients with EDD < 70 mm). All patients were subjected to full preoperative physical and routine lab examination. Transthoracic echocardiography was done preoperatively and 3 months postoperatively. Intraoperative left ventricular biopsy was taken in all patients. Statistical analysis of all preoperative, operative and postoperative data was done.**

Results: **preoperatively, both groups were similar regarding age, gender and body surface area. NYHA class and left ventricular dimensions and ejection fraction were worse in group I. cardiopulmonary bypass time and cross clamp times were similar in both groups. Postoperatively, NYHA functional class improved in both groups, however, it remained significantly better in group II (p value 0.05). Also, echocardiographic assessment three months postoperatively showed improvement in left ventricular function and dimensions in both groups, however, group II remained significantly better as regards the ESD and EF. Postoperative complications were more with group I. ventilation time, ICU stay and hospital stay were significantly higher in group I (p value 0.002, 0.001 and 0.001 respectively). Left ventricular biopsy revealed higher muscle fiber thickness and less interstitial fibrosis in group II.**

Conclusions: **Aortic valve replacement improves both functional class and left ventricular dimensions and functions even when left ventricle is severely dilated. However earlier intervention carries better postoperative results. Worsening of ventricular dimensions and function correlates with structural changes within the left ventricular myocardium.**

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Severe aortic regurgitation results in progressive left ventricular dilatation and eccentric hypertrophy leading to adverse clinical outcome.1 Eventually, this is associated with myocardial fibrosis and left ventricular dysfunction.2 Such dysfunction may persist even after surgical correction of the valve lesion.3.

Timing of surgery is difficult and important at the same time as it affects the clinical outcome and the degree of left ventricular remodeling.4, 5

The aim of this prospective study is to assess the results of aortic valve replacement in patients with severe aortic regurgitation and left ventricular end diastolic dimension (EDD) ≥70 millimeters compared to patients with EDD <70 millimeters. This is done through evaluation of the symptomatic and echocardiographic improvements as well as assessment of the histopathologic examination of the left ventricular endomyocardial biopsy.

Methods

From July 1st, 2004 to June 30th, 2007, fifty patients with severe chronic aortic regurgitation who underwent aortic valve replacement at Mansoura University and Mansoura International hospitals were prospectively evaluated in this study. Informed consent was obtained from every patient.

Patients were divided into two groups according to the degree of left ventricular dilatation at the end of diastole as assessed by echocardiography; group I (patients with EDD ≥ 70 mm) and group II (patients with EDD < 70 mm).

We excluded from this study patients who have associated aortic stenosis, other valve lesions, congenital cardiac anomalies, infective endocarditis or coronary artery disease.

Routine preoperative patient evaluation and preparation including full clinical examination, routine lab investigations, Chest x-ray, transthoracic echocardiography were done to all patients. Echocardiography was repeated 3 months after surgery.

Left ventricular endomyocardial biopsies were taken from all patients intraoperatively. After putting the patients to cardiopulmonary bypass, cross clampming the aorta and arresting the heart, the aortic valve is exposed through transverse aortotomy and excised. Then, endomyocardial biopsies were taken with small number 11 scalpel from the anterolateral wall of the left ventricle. Biopsy specimens are in the form of tiny pieces with 2 mm depth and 3-4 mm width. The biopsy specimens were fixed in gluteraldehyde and sent for histopathological examination.

After staining the biopsy slides with Hx. and E. stain the slides are examined by light microscopy to the power of 100 with the aid of two special round discs put on the eye piece. One disc is the measuring graticule and is divided into measuring units of microns to measure the diameter of the muscle fiber thickness.

The second disc is the counting graticule which is divided into small squares by vertical and horizontal lines. This is used to count of cross points occupied by either muscle fiber or fibrous tissue in three different areas of the slide and mean is taken.

The percentage of fibrous tissue is calculated according to the following equation where the number 441 represents the total number of cross pointson the counting graticule :

$$\text{Fibrous tissue \%} = \frac{\text{Mean number of fibrous tissues cross points} \times 100}{441}$$

Data were anal yzed using SPSS (Statistical Package for Social Sciences) version 10. Qualitative data were presented as number and percent. Comparison between groups was done by Chi-Square test. Quantitative data was tested for normality by Kolmogrov-Smirnov test. Normally distributed data was presented as mean±SD. Student t-test was used to compare between two groups. P value < 0.05 was considered to be statistically significant.

RESULTS:

Patients were equally divided between the two groups (25 patients each). Preoperative, operative and postoperative data are demonstrated in table (1).

Mean age was 32 ± 6.2 and28 ± 7.5 years and body surface area was 1.81± 0.11 and 1.79 ± 0.09 in groups I and II respectively. There were 15 men patients (60%) in group I and 18 patients (72%) in group II. There was no significant statistical difference between the two groups as regards age, gender or body surface area.

Duration of symptoms was 5.44±14 years in group I and 4.79±63 years in group II making no significant statistical difference similar in both groups though it was slightly higher in group I.

As shown in table 2, Patients in group I showed more advanced NYHA functional class than group II. There were 14 patients in NYHA class III in group I compared to 16 patients in NYHA class II in group II. We found significant statistical difference between two groups (P value 0.001).

Preoperative transthoracic echocardiographic assessment showed ESD, EDD and ejection fraction of 5.11±0.8, 7.72±0.44 and 41.24±2.1 respectively in group I and 4.23±0.56, 6.61±0.22 and 52.11±4.6 respectively in group II. There was a statistical difference between both groups as regards the three parameters with a p value of 0.002, 0.005 and 0.001 respectively (table 2).

Cardiopulmonary bypass was 58.34±11.2 minutes in group I and 62.83±10.4 minutes in group II. Also, aortic cross clamp time was 42.61±12.2 minutes in group I and 44.23±10.4 minutes in group II. There was no statistical difference between the two groups (p value 0.351 and 0.511respectively).

Parameter	Group I (n = 25)	Group II (n = 25)	P value
Age (mean ± SD) years	32 ± 6.2	28 ± 7.5	0.213
Male gender %	60%	72%	0.122
BSA (mean ± SD)	1.81 ± 0.11	1.79 ± 0.09	0.310
Duration of symptoms (years)	5.44 ± 14	4.79 ± 63	0.233
Operative Data			
CPB time	58.34 ± 11.2	62.83 ± 10.4	0.351
X-clamp time	42.61 ± 12.2	44.23 ± 13.6	0.511
Valve size			
19 mm	0	0	
21 mm	5	3	
23 mm	11	10	
25 mm	4	7	
27 mm	5	5	
Postoperative Morbidity			
LCO	1	0	
Heart Block	0	1	
Arrhythmias	3	1	
Bleeding	1	0	
Renal Failure	1	0	
Wound sepsis	2	1	
Mediastinitis	1	0	
Ventilation (hours)	12.11 ± 5.6	6.71 ± 2.3	0.002
ICU Stay (days)	3.6 ± 1.8	1.8 ± 0.3	0.001
Hospital Stay (days)	8.76 ± 3.1	5.8 ± 1.8	0.001
Operative Mortality	0	0	0.000

Table (1): Preoperative, operative and postoperative data.

Mechanical prostheses used were St. Jude Medical, CarboMedics and sizes varied from 21 mm to 27 mm. size 19 mm was not used in any patient while size 23 was the commonest size used in our patients (11 valve in groups I and 10 valves in group II)

Parameter	Group I (n = 25)	Group II (n = 25)	P value
NYHA Class			
Class I	1	4	
Class II	6	16	0.001
Class III	14	5	
Class IV	4	0	
NYHA Class			
Class I	4	15	
Class II	10	7	0.05
Class III	9	3	
Class IV	2	0	
Preop. Echo			
ESD	5.11 ± 0.80	4.23 ± 0.56	0.002
EDD	7.72 ± 0.44	6.61 ± 0.22	0.005
EF	41.24 ± 2.1	52.11 ± 4.6	0.001
Postop. Echo			
ESD	4.45 ± 0.55	4.01 ± 0.65	0.210
EDD	6.25 ± 0.63	5.47 ± 34	0.001
EF	46.6 ± 3.8	54.96 ± 4.73	0.002

Table (2): preoperative and 3 months postoperative NYHA functional class and echocardiographic assessment.

Postoperative ventilation time was 12.11±5.6 hours in group I while it was 6.71±2.3 hours in group II. Also intensive care stay time was 3.6±1.8 days in group I and 1.8±0.3 days in group II. Similarly, hospital stay was 8.76±3.1 days in group I and 5.8±1.8 days in group II. These values were statistically significant (p value 0.002, 0.001 and 0.001 respectively) as shown in table 1.

Postoperative complications in both groups included low cardiac output (1 patient in Group I), arrhythmias (3 patients in group I and 1 patient in group II), complete heart block (1 patient in group II), bleeding that necessitated reopening for exploration (1 patient in group I), renal failure that was transient and did not need dialysis (1 patient in group I), wound infection that was managed by frequent dressings (2 patients in group I and 1 patient in group II) and mediastinitis that was managed conservatively (1 patient in group I). No mortalities occurred in both groups (table 1).

Three months' postoperative echocardiography showed improvement in left ventricular end systolic and end diastolic dimensions and ejection fraction. There was statistical difference between both groups in both end diastolic dimension and ejection fraction while the end systolic dimension failed to show any differences (table 2).

Histopathological examination of the left ventricular endomyocardial biopsy showed increased muscle fiber diameter in group II (39.37±5 µm compared to 33.1±5 µm in group I), while there was increase in interstitial fibrosis percent in group I (24±4 % compared to 18.68±5 % in group II). Both increments were statistically significant (p value 0.001 and 0.004 respectively) as shown in table 3.

Parameter	Group I (n = 25)	Group II (n = 25)	P value
Muscle fiber diam (µm)	33.10 ± 5	39.37 ± 5	0.001
Interstitial fibrosis (%)	24 ± 4	18.68 ± 5	0.004

Table (3): Endomyocardial biopsy findings.

DISCUSSION:

Chronic severe aortic regurgitation is defined as the degree of backflow across the aortic valve that results in progressive left ventricular dilatation in association with adverse clinical outcome.1

In our study, the two patient groups were similar as regards the age, gender and body surface area. However, statistical differences were found in the NYHA functional class. Also, preoperative assessment showed significant increase in left ventricular EDD, ESD and EF. This is naturally explained by the selection criterion of both groups according to the left ventricular end diastolic dimension and the close relation between the degree of left ventricular dilatation and symptomatic functional class.

The male gender was predominant in our study (60% in group I and 72 % in group II). This is consistent with many reported series. 6, 7 Interestingly, Sutton and colleagues found that female patients tend to develop left ventricular decompensation and deterioration of their functional class before reaching high left ventricular dimensions. However, they failed to find any explanation. 7

In this study, the mean age in both groups (32±6.2 and 28±7.5 years in groups I and II respectively) was less than most published international series. This may be attributed to the predominance to rheumatic pathology in our country.7, 8

It was found that patients remain asymptomatic for long periods and symptoms usually emerge when diastolic dysfunction occurs. 9, 10 In our series, at least 5 years were spent before patients came for surgery, however, it was extremely difficult to estimate the time lasted while patients actually had significant aortic regurgitation and remained asymptomatic. This might be explained by the lack of screening programs and shortage of detailed medical records for every patient.

In group I, the majority of patients (18 patients) were in NYHA class III and IV preoperatively compared to 11 patients postoperatively, while in group II majority (16 patients) were in NYHA class II compared to 15 patients in class I postoperatively.

Stone and colleagues found 77% of patients in class III or IV preoperatively and 16% postoperatively.11 Kvidal and associates concluded that the presence of severe symptoms is a definite indication for surgery. They added that surgery in these patients results in symptomatic relief and decreases the long term mortality than those patients with severe symptoms who are treated medically. 12 symptomatic improvements in our study were well demonstrated especially in group II patients.

The two groups did not show statistical difference in cardiopulmonary bypass time and cross clamp time which did not appear to be affected by the degree of regurgitation. However, care should be taken not to prolong the operative time. Stressing on that point, many authors considered stentless valve implantation for patients with severe left ventricular dysfunction a relative contraindication and the best procedure for those patients is the quickest one. 13, 14, 15

Improvements in left ventricular EDD, ESD and ejection fraction were observed in the echocardiographic studies done three months postoperatively. Many Several studies reported similar results as regard EDD, ESD and EF and even correlated that improvement with long term prognosis. 16, 17, 18, 19

No operative mortality was found in our study which may reflect the relatively small number of cases. Same applies to the number of postoperative complications, although similar numbers are found in other high volume series. 4, 20

Postoperative complications occurred in both groups with very slight increase in number in group I, but again the number of patients and complications failed to show a statistical difference.

The significant increase in the postoperative ventilation time, ICU stay and hospital stay demonstrated the slower recovery in patients with more advanced regurgitation or higher functional class as shown with other studies. 21, 22

In left ventricular endomyocardial biopsy the cardiac muscle fiber thickness and the percentage of interstitial fibrosis has been chosen as two important indices for left ventricular deterioration. 23

Rothenburger and associates suggested that, in chronic severe aortic regurgitation, the compensatory mechanism leads to myocardial fibrosis possibly as a result of myocardial ischemia. With more deterioration, thinning of muscle fibers occurs and eventually leads to irreversible damage.24

Some authors found this correlation not close and explained this by the fact that the contractile function is influenced by a variety of other factors such as ventricular geometry and loading conditions.23, 25 However, many others linked well the ejection fraction, clinical stages and the long term course of the hemodynamic to the thickness of the muscle fibers and fibrosis percentage. 26, 27

As shown before, group I had significant decrease in the muscle fiber thickness and increase in the interstitial fibrosis. This correlated well with the increase in the left ventricular dimensions, impaired function as well as the deterioration in the clinical status in patients in this group compared to patients in group II both pre and postoperatively.

Conclusions:

Aortic valve replacement improves both functional class and left ventricular dimensions and functions even when left ventricle is severely dilated. However earlier intervention carries better postoperative results. Worsening of ventricular dimensions and function correlates with structural changes within the left ventricular myocardium.

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Mitral valve incometence with isloated aortic stenosis: single or double valve surgery?

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Background **Mild to moderate mitral incompetence (MI) often found with severe aortic stenosis. Concomitant replacement of the aortic and mitral valves is associated with increased morbidity and mortality compared to an isolated AVR. The purpose of this study was to investigate the change in moderate or moderate-severe MR after isolated AVR for aortic stenosis to decide the need of mitral valve surgery in patients subjected for AVR.**

Methods **Between January 2005 and January 2008, 50 patients(18 women, 32 men, aged 52 ± 11 years) with isolated aortic stenosis with moderate or moderate-to-severe MR on preoperative echocardiography underwent AVR Preoperatively, the majority of patients were in New York Heart Association (NYHA) class II or III (45 patients, 90%). Left ventricular ejection fraction was 52% ± 13%. All patients were subjected to mechanical aortic valve replacement with associated CABG in 10 patients .**

Results **mean cross clamp time 68±12 minutes, ICU stay 28±12 hours, inotropic support in 20 patients and IABP counter pulsation in 4 patients. There was no mortality related to this study.The degree of MI decreased in 18 of 50 patients, remained unchanged in 24 of 50 patients, and worsened in 8 of 50 patients 6 months after AVR. Improvement was more frequent in the ischemic MI group, 7 of 10 and in the functional MI group, 8 of 10 than in the rheumatic group, 3 of 30.**

Conclusion**, our patients undergoing isolated AVR for aortic stenosis with significant MI before surgery showed that MI improved in ischemic and functional MR whereas MR deteriorated in rheumatic etiology at 6 months echographic follow-up. The decision to repair or replace the mitral valve at the time of AVR remains difficult, but preoperative echocardiographic analysis of the mitral valve morphology gives the surgeon the most important prognostic factor for the change in MI severity: the etiology of MI.**

Mild to moderate **mitral incompetence** (MI) often found with severe **aortic stenosis and** has been reported to be present in up to 2/3 patients requiring **aortic** valve replacement (AVR) (1).MR in patients with **aortic stenosis** is often functional in nature although organic **mitral** disease may coexist. Remodeling observed after AVR may impact the outcome of MR postoperatively (2). The natural history **and** early clinical impact of mild to moderate MI in patients with severe **aortic stenosis** submitted to AVR remains unsettled. In addition, the clinical outcome of persistent MR after AVR is uninvestigated. On the other h**and**, concomitant replacement of the **aortic and mitral** valves is associated with increased morbidity **and** mortality compared to an isolated AVR (2). When the MR is severe, a double-valve operation with mitral valve repair or replacement is indicated (3). In most patients, MI is less severe and surgical decision making is influenced by an expectation that there

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will be a reduction in MR with relief of the gradient across the aortic valve. functional mitral regurgitation appears to have a better prognosis than structural regurgitation after AVR. Mitral valve surgery could be avoided if it were possible to reliably predict that MI would improve after AVR. In contrast, combined valve surgery would be indicated for patients with significant or progressive MR after isolated AVR (4).

The purpose of this study was to investigate the change in moderate or moderate-severe MI after isolated AVR for **aortic stenosis** to decide the need of mitral valve surgery in patients candidate for AVR.

Methods

Between January 2005 and january 2008, 50 patients with isolated aortic stenosis with moderate or moderate-to-severe MI on preoperative echocardiography were included in this study. Exclusion criteria were severe **aortic** regurgitation, moderate or severe mitral **stenosis**, prior mitral valve surgery.

Data were reviewed for preoperative and operative characteristic. Clinical history directs the attention to the cause of MI (history of rheumatic fever, history of myocardial infarction, etc.) Two-dimensional and M-mode echocardiography were used to detect the underlying cause of MI. When no morphologic abnormality was found, the MI was classified as functional. All patients had postoperative clinical assessment, echocardiograph study six months after aortic valve surgery.

Statistical Analysis

The data are summarized as means ± standard deviation or numbers and percentages. The Student t test was used to compare continuous variables.

Results

The study group consisted of 50 patients (18 women, 32 men, aged 52 ± 11 years) who underwent AVR for aortic stenosis and had moderate or moderate-to-severe mitral regurgitation on preoperative echocardiography, Table 1 lists the preoperative clinical and echocardiographic characteristics. Preoperatively, the majority of patients were in New York Heart Association (NYHA) class II or III (45 patients, 90%). Left ventricular ejection fraction was 52% ± 13%. Morphologic changes of the mitral apparatus (either ischemic or rheumatic) were found in 40 patients (80%) and 10 patients with functional MI. All patients were subjected to mechanical aortic valve replacement using aortic cannulae and bicaval cannulation and left atrial vent to drain the heart and to give an indicator about left atrial pressure with antegrade blood cardioplegia (via aortic root or direct osteal coronary cannulation) associated CABG in 10 patients with mean cross clamp time 68±12 minutes, ICU stay 28±12 hours, inotropic support in 20patients and IABP counter pulsation in 4 patients. There was no mortality related to this study. six months Postoperatively there was a significant change in mean gradient across the mechanical aortic valve. The degree of MI decreased in 18 of 50 patients, remained unchanged in 24 of 50 patients, and worsened in 8 of 50 patients. Improvement was more frequent in the ischemic MI group, 7 of 10 and in the functional MI group, 8 of 10 than in the rheumatic group, 3 of 30.Left ventricular end diastolic diameter reduced postoperatively without statistcal significance (57±3 vs 52±2)

Table (2) 6- month postoperative clinical and echographic study MI = mitral incompetence, NYHA = New York Heart Association, LAD = Left atrial diameter, LVEF = Left ventricle ejection fraction, GAV= Gradient across aortic valve, LVEDD = Left ventricular end diastolic diameter.

Discussion

The mitral valve should be repaired or replaced during the same operation in patients with severe **aortic stenosis** undergoing AVR is controversial when considering patients with moderate or moderate-to-severe MI. Because the concurrent replacement of both valves is associated with higher postoperative mortality (5% to 12.5%) and morbidity (1), mitral valve surgery could be avoided if it is possible to reliably predict in which circumstances MR would improve after AVR (3). In contrast, combined valve surgery would be indicated for patients with unchanged but significant or progressive MR after isolated AVR. Thus, it is crucial to predict which are the preoperative clinical and echocardiographic factors influencing the improvement or deterioration of MI in patients undergoing AVR In patients with severe **aortic stenosis(4)**. Concomitant MI either may be caused by morphologic changes of the mitral valve or may be secondary to **aortic stenosis** and increased afterload and left ventricular dysfunction or a combination of both. The degree of MR depends on the regurgitant orifice and the systolic pressure gradient between the left ventricle and left atrium. The former may be affected by ventricular remodeling after AVR; the latter may be affected by

	All patients with MI n= 50	Rheumatic n=30	Ischemic n=10	Functional n=10
Age (years)	52 ± 11	51±2.3	53±3	52±4.2
sex/male	32	19	7	6
hypertension	24	10	8	6
Diabetes	22	10	7	5
NYHA	I = 1	0	1	0
	II = 15	10	2	3
	III = 30	18	6	6
	IV = 4	2	1	1
LVEF(%)	52±13	52±14	56±13.8	58±12
LAD mm	45±6	46±5.2	44.3±7.5	44±6.6
LVEDD mm	57±3	58±6.3	53±5.5	55±4
GAV	75±5.7	76±4	74±2.4	72±6

Table (1) Preoperative characteristic MI = mitral incompetence, NYHA = New York Heart Association, LAD = Left atrial diameter, LVEF = Left ventricle ejection fraction, GAV= Gradient across aortic valve, LVEDD = Left ventricular end diastolic diameter.

	All patients with MI n= 50	Rheumatic n=30	Ischemic n=10	Functional n=10
NYHA	I = 8	1	5	2
	II = 14	6	3	5
	III =25	21	1	3
	IV =3	2	1	0
LVEF %	51±8	50±6	53±13	52±11
LAD mm	44±6	44±5	41.3±6	42±5.2
LVEDD mm	52±2	53±5.2	51±5	50±4.3
GAV mmgh	25±3	26±2.5	21±3	22±6

Table (2) 6- month postoperative clinical and echographic study MI = mitral incompetence, NYHA = New York Heart Association, LAD = Left atrial diameter, LVEF = Left ventricle ejection fraction, GAV= Gradient across aortic valve, LVEDD = Left ventricular end diastolic diameter.

replacing a stenotic **aortic** valve, thereby lowering the left ventricular systolic pressure. Given the morphologic and physiologic modification after AVR, the degree of MI might improve.

In this study, there was no mortality related to this procedure that is matching with the study of **Absil and associates** where the Presence of preoperative moderate functional MR (grades 2–3) in patients undergoing isolated AVR for **aortic stenosis** regresses in the majority of patients postoperatively **and** has no significant impact on perioperative morbidity or mortality, nor mid-term survival. The change in left ventricular dimension after aortic valve replacement affected the significant change in the distribution of MI severity (before and after AVR toward improvement: 36% of patients improved by 1 or 2 degree of MI at six month). This finding is consistent with other reports, Tunick and associates [5] studied MI evolution at a mean of 58 days after AVR. Half of the patients had structural valve lesions, and of the 44 patients studied, 11 had moderate MI. In those 11 patients, 10 showed an improvement of MI after AVR [5]. More recently, Brasch and associates [6] studied 27 patients, 16 of them having grade 2 or 3 MI, and 9 (44%) of those experienced an improvement of MI. Larger left ventricular mass was the only significant prognostic of MI improvement when considering the whole group at mean follow-up of 2.2 months [6]. Bareirro and coworkers [7] reported 80% improvement in the functional group and 50% but of the 70 patients studied,only 37 had a postoperative echocardio graphy. Vanden and associates studied 80 patients and The degree of MR decreased in 29 (36%), remained unchanged in 44 of (55%), and worsened in 7 (9%) 1 year after AVR Improvement was more frequent in the ischemic MI group and in the functional MI group, than in the rheumatoid group or the myxomatous group(4). In conclusion, our patients undergoing isolated AVR for **aortic stenosis** with significant MI before surgery showed that MI improved in ischemic and functional MR whereas MR deteriorated in rheumatic etiology at 6 months echographic follow-up. The decision to repair or replace the mitral valve at the time of AVR remains difficult, but preoperative echocardiographic analysis of the mitral valve morphology gives the surgeon the most important prognostic factor for the change in MI severity: the etiology of MI. Functional or ischemic MR will likely improve after isolated AVR, whereas rheumatic or degenerative MR will most likely remain stable or even deteriorate.

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Mitral valve surgery through right thoracotomy versus median sternotomy: comparative study

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Background: **The right thoracotomy approach was recently updated as an alternative to repeated sternotomy for redo mitral valve operations and more recently used as lesser invasive approaches for mitral valve surgery. our aim was to evaluate the technique of mitral valve surgery through right thoracotomy approach in females and comparing its results with median sternotomy approach.**

Methods: **The study included forty five female patients operated for mitral valve disease, and approached through right antrolateral thoracotomy. During the same period Sample of Forty five female patients operated for mitral valve disease and approached through median sternotomy was selected as control group.**

Results: **Both patient groups were comparable as regard age, type of mitral valve pathology, left ventricular (RV) dimension and functions, and the associated lesions. There was no operative or postoperative mortality in both patient groups. Total operative time was significantly prolonged in sternotomy group than thoracotomy group (246±34minutes versus 180±24 minutes, P <0.05). However, cardiopulmonary bypass time and aortic clamping time were comparable between the two patient groups (96±44 minutes and 34±26 minutes in sternotomy group and 89±54 minutes and 34±23 minutes in thoracotomy group, P >0.05). No significant difference between the two groups as regard the technique of mitral valve procedure. Both operative and postoperative blood loss was significant increased in sternotomy group than thoracotomy group (1840±620 ml versus 864±582 ml, P<0.05). Also the need for blood transfusion was higher in sternotomy group than thoracotomy group (1250±650 ml versus 320±250 ml, P<0.05). ICU stay was comparable between the two patient groups (1.41±0.7 days in sternotomy group versus 1.32±0.4 days in thoracotomy group, P>0.05). However, total hospital stay was prolonged in sternotomy group than thoracotomy group (7.2±3.1 days versus 5.7±1.4 days, P<0.05). Postoperative pain score was high in sternotomy group than thoracotomy group during hospital stay (4.3±2.1 versus 2.3±1.1, p<0.05) and the requirement for postoperative pain control medications was significantly more in sternotomy group than thoracotomy group. Postoperative complications were comparable between the two patient groups (26.7% in sternotomy group versus 24.4% in thoracotomy group). Mean length of skin incision was significantly long in sternotomy group (15.9±3.8cm), than in thoracotomy group (7.5±2.1 cm). Cosmetic satisfaction from the skin appearance was appreciated for thoracotomy than sternotomy.**

Conclusion: **Mitral valve replacement, through right antrolateral thoracotomy has the advantages of decreased blood loss, decreased postoperative pain, and decreased need for analgesic, also shorter hospital**

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stay with better cosmetic results than standard full sternotomy incision.

Median sternotomy is the conventional approach for correction of cardiac defects, it is routinely performed with minimal morbidity and mortality at most centers but it is invasive and often yields poor cosmetic result. (1,2,3).

Right antrolateral thoracotomy was utilized initially for redo mitral valve surgery, to avoid re-sternotomy with its own complications, and now widely used for closure of ASD by several author (2,3,4) as it give good exposure to the intra-thoracic structures, also has better cosmetic result in females as the scar almost invisible in the breast fold.

Aim of this study is to evaluate the technique of mitral valve surgery through right thoracotomy approach in females and comparing its results with median sternotomy approach.

Methods:

This is prospective study conducted in National heart Institute, Shibeen El-Kom teaching Hospital & Zagazige University Hospital in the period from August 2006 and June 2008 We excluded

1- CAD patients .
2- Heart failure patients

Echocardiography was done to all patients by (Hewlett Packard Sonos 5500 machine) 2- dimensional & M-mode were done to asses morphology of Mitral valve morphology and asses its lesion also to calculate left ventricular internal dimension ,EF by Tiecholies method, to measure Mean pulmonary artery pressure(MPAP),tricuspid regurge (TR) and calculate right ventricular systolic pressure(RVSP) by Doppler Flow.

Selective Coronary Angiography was done by a femoral approach with Judkin technique to assess coronary arteries(Levin & Gardiner, 1992).

Significant Lesion Was Defined As more than 70 % diameter stenosis in a major epicardial coronary artery and more than 50% diameter stenosis of left main CA (Mishra et al.,2002).

Forty five female patients were operated for mitral valve disease, and approached through right antrolateral thoracotomy. During the same period Sample of Forty five female patients operated for mitral valve disease and approached through median sternotomy was selected as comparison group.

All the patients were prepared for surgery as per our protocol with full laboratory assessment, plain chest X ray, echocardiographic assessment, and coronary angiography if age above 40 years.

Anesthesia:

the patients were operated under general anesthesia with single lumen endotracheal tube for patients submitted to median sternotomy and double lumen endotracheal tube in patients submitted for thoracotomy, invasive arterial line, and central venous line and swan Ganz catheter for monitoring. The trans-esophageal echocardiography probe was inserted for evaluation of deairing and assessment of surgical correction in cases of mitral valve repair. Defibrillator pads are properly placed across the chest wall. Surgical technique:

Sternotomy group:

Standard midline incision was done with skin incision extended from the sternal notch to the tip of xyphoid process, midline sternotomy was done utilizing the standard vertical saw. Standard cannulation of aorta and both vena cava cannulation were done after heparinization.

Thoracotomy group:

The patient was positioned supine and a pillow was placed under the right scapulae and shoulder to elevate the right chest about 30 degrees. The patient was painted with iodine solution and draped exposing the anterior and right lateral chest wall and both groin areas. Skin incision was performed around the breast fold (Picture 1, show skin incision of right thoracotomy), and the subcutaneous fat and the mammary gland tissue were dissected from the fascia up to the fourth rib. The pectoralis major was cut from the sternal edge to the anterior axillary line. The thorax was entered through the bed of the fourth rib. The pericardium was opened longitudinally anterior to the phrenic nerve. Thymus tissue was dissected cranially and excised if large. An adequate exposure was achieved by traction on pericardial stay sutures. The right side of the aorta is easily visualized, and selected for cannulation after passing tape around the aorta. Both venae cava were cannulated from the right atrium, for venous drainage with passing snare around both cava. Right superior pulmonary vein was cannulated for venting.

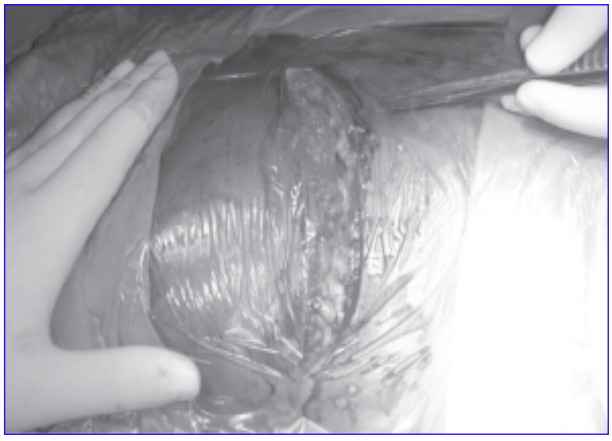

Fig (1): Skin incision of right thoracotomy.

Normothermic cardiopulmonary bypass was utilized in both patient groups, and after snaring of both vena cava. Application of aortic clamp was facilitated with traction on the aortic tap, myocardial protection is achieved with warm blood potassium infused antegrade in the aortic root by the perfusionest. Potassium chloride 30 milliequvelant was infused over three minutes initially and maintenance dose of 10 milliequvelant potassium chloride infused over three minutes every 20 minutes.

Left atrium was opened after dissection of inter-atrial (Waterstone) groove and mitral valve either replaced or repair according to the valve pathology (Picture 2, show operative view of mitral valve through right thoracotomy), then the left atrium was closed. After deairing of the left side and regain cardiac rhythm, caval snares were reapplied and the right atrium was opened and tricuspid De-Vega suture was done for correction of tricuspid regurgitation if present.

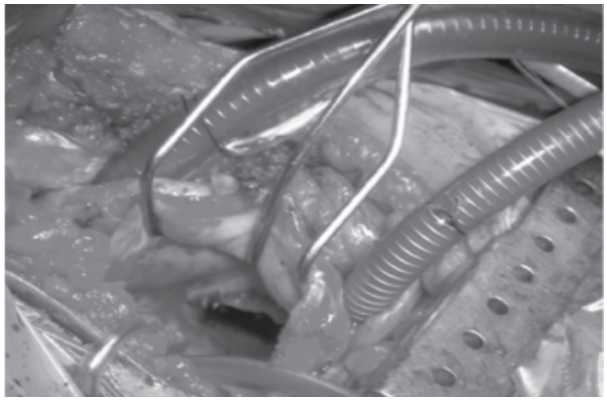

Fig (2): Mitral valve exposure through right thoracotomy incision.

Two pericardial drains were inserted for sternotomy patients. While, in thoracotomy patients one pericardial and one pleural drain were inserted. The pericardium was closed in all patients partially over the aorta (Picture 3, show right thoracotomy wound after skin closure).

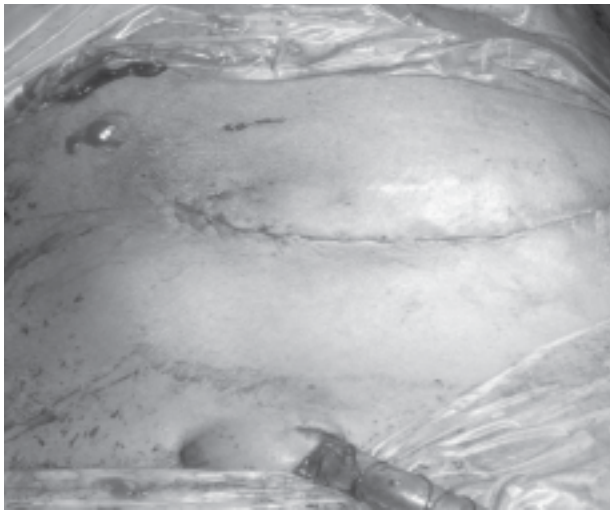

Fig (3): Right thoracotomy incision after skin closure.

Statistical analysis: Statistical analysis was carried out with the use of SPSS software version 12 (SPSS Inc, Chicago, IL). The data were collected as mean ± standard deviation; student t-test was utilized for comparing quantitative values, chi- square test, fisher exact test for qualitative values and ANOVA test for repeated values. P value is considered non -significant if >0.05, significant if <0.05, and highly significant if <0.01.

Results:

There were no significant differences between the two patient groups, as regarded patient>s age {group (A) mean age 38.4±16.3 years, and group (B) mean age 36.1±14.8 years}.

There were no-significance differences between the two patient groups as regard the preoperative mitral valve pathology. Within patients of the group (A), there were 21 patients with pure mitral regurgitation (46.7%), ten patients with pure mitral stenosis (22.2%), 12 patients with combined stenosis and regurgitation (26.7%), and two patients with cleft anterior mitral valve leaflet (4.4%). However, in group (B), there were 19 patients with pure mitral regurgitation (42.2 %), 13 patients with pure mitral stenosis (28.9%), 12 patients with combined mitral stenosis and regurgitation (26.7 %), and one patient with cleft anterior mitral valve leaflet (2.2%). Tricuspid valve regurgitation (moderate to severe degree) in need

for repair are reported in 33 patients in group A (73.3%) and in 31 patients in group B (68.9%). (Table-1)

Pathology	Sternotomy group		Thoracotomy group		P-value
	Number	%	Number	%	
MR	21	46.7	19	42.2	>0.05
MS	10	22.2	13	28.9	>0.05
MR and MS	12	26.7	12	26.7	>0.05
Cleft AMVL and ASD	2	4.4	1	2.2	>0.05
Tricuspid regurgitation	33	73.3	31	68.9	>0.05

Table (1): Preoperative diagnosis in the two patient groups: MR= Mitral regurgitation, MS= Mitral stenosis,ASD= Atrial septal defect, AMV= Anterior mitral valve leaflet.

There was no significant difference between the two patient groups as regarded the preoperative echocardiographic parameters. (Table-2)

Echocardiographic parameter	Sternotomy Group	Thoracotomy group	P-value
EDD(mm)	61.4±2.1	59.1±3.6	>0.05
ESD(mm)	42.7±1.8	39.9±2.4	>0.05
MPAP(mmHg)	59.8±14.6	64.7±11.2	>0.05
RV diameter (mm)	30.20±2.86	30.50±3.18	>0.05
RV pressure (mmHg)	42.7±3.72	42.9±5.13	>0.05
EF %	64.31±4.24	64.20±4.27	>0.05

Table (2): Pre-operative Echocardiographic data in the two patient groups: EDD=End diastolic dimension, ESD=End systolic dimension, PAP=Pulmonary artery pressure, RV=right ventricle, EF= ejection fraction

There was no operative or postoperative mortality in both patient groups. Total operative time was significantly prolonged in sternotomy group than thoracotomy group (246+34minutes versus 180±24 minutes, P <0.05). However, cardiopulmonary bypass time was comparable between the two patient groups (96±44 minutes in sternotomy group and 89±54 minutes in thoracotomy group, P >0.05), also aortic clamping time, show no significant differences between the two patient groups (34±26 minutes in sternotomy group versus 34±23minutes in thoracotomy group), (P>0.05).Table- 3.

Variables	Sternotomy group	Thoracotomy group	P-value
TOR time (minute)	180±24	246±34	<0.05
CPB time (minute)	96±44	89±54	>0.05
AC time (minute)	34±26	34±23	>0.05
Skin incision	15.9±3.8	7.5±2.1	<0.05
blood loss (ml)	1840620	864±582	<0.05
Blood transfusion (ml)	1250+650	320±250	<0.05
ICU stay (day)	1.41±0.7	1.32±0.4	>0.05
Hospital stay (day)	7.2+3.1	5.7±1.4	<0.05
Pain score	4.3+2.1	2.3+1.1	<0.05

Table (3): Operative and postoperative data of the two patient groups: TOR time= Total operative time, CPB= Cardiopulmonary bypass, AC= Aortic clamp, ICU= Intensive care unit

No significant difference between the two groups as regard the technique of mitral valve procedure. In group A, mitral valve replacement was done for 36 patients (80%), and mitral valve repair was done for 9 patients (20%). In group B, mitral valve replacement was done in 34 patients (75.6%), and mitral valve repair was done in 11 patients (24.4%).

Blood loss both operative and postoperative was significant increased in sternotomy group than thoracotomy group (1840±620 ml versus 864±582 ml, P<0.05). Also the need for blood transfusion was higher in sternotomy group than thoracotomy group (1250±650 ml versus 320±250 ml, P<0.05).

ICU stay was comparable between the two patient groups (1.41±0.7 days in sternotomy group versus 1.32±0.4 days in thoracotomy group, P>0.05). However, total hospital stay was prolonged in sternotomy group than thoracotomy group (7.2±3.1 days versus 5.7±1.4 days, P<0.05).

Postoperative pain score was high in sternotomy group than thoracotomy group during hospital stay (4.3±2.1 versus 2.3±1.1, p<0.05) and the requirement for postoperative pain control medications was significantly more in sternotomy group than thoracotomy group.

Postoperative complications were reported in 12 patients (26.7%) in sternotomy group. Two patients (4.4%) were explored for bleeding, 6 patients (13.3%) had postoperative atelectasis, one patient (2.2%) had post-pericardiotomy syndrome, and three patients (6.7%) had superficial wound infection.

Postoperative complications were reported in 11 patients (24.4%) in thoracotomy group. One patient (2.2%) had postoperative bleeding required exploration and ligation of the internal mammary artery. Five patients (11.1%) had postoperative atelectasis of right lung responded to conservative management. Five patients (11.1%) had superficial wound infection.

Mean length of skin incision was significantly long in sternotomy group (15.9±3.8cm), than in thoracotomy group (7.5±2.1 cm)

Postoperative echocardiography follow up was done three months after discharge, showed no significant differences between the two patient groups .

Discussion:

The right thoracotomy approach was recently updated as an alternative to repeated sternotomy for redo mitral valve operations[4, 5, 6] and more recently lesser invasive approaches for mitral valve surgery and many other cardiac operations had been of great concern (6,7,8).

In this study we reported our result with first time mitral valve surgery through right antro-lateral thoracotomy and comparing the result with that of median sternotomy.

Cohn (6) and Doll (7) utilized right sub-mammary mini-incision with femoral artery cannulation and considered direct aortic cannulation to be hazardous. Moreover, Mulder et al (10) preferred 5 cm skin incision mini-thoracotomy and groin incision 3 cm for femoral artery and vein cannulation with central SVC cannulation. But they reported complications of femoral artery in 2 % require patch enlargement of the artery, and iliac vein lesion require stenting in 4% of their patients, also groin wound infections were reported in 6 % of their patients.

In our study we preferred central cannulation of aorta and both vena cava, in the expenses of enlarging the skin incision to avoid groin incision for femoral cannulation. Also, Giamberti (10), Bichell (11), and Abdel-Rahman (2), preferred one thoracotomy incision with central cannulation than adding a groin incision for femoral vessels cannulation. Moreover, we found insertion of tape around the aorta with slight traction by assistant during the insertion of aortic cannula is efficient to make insertion of aortic cannula easily performed and we reported no difficulty in insertion of aortic cannula. Also, both Debritz(3) and Giamberti(10) reported no difficulties in insertion of aortic cannula through right antrolateral thoracotomy in their groups of patients. Also, the summation of both thoracotomy incision and groin incision was not differing from lone thoracotomy incision.

Helps(12) reported phrenic nerve damage in 31% of their patients after right antrolateral thoracotomy for atrial septal defect closure. They define several possible causes for their results included (direct injury, electrocautery used near a nerve, extensive thymus dissection, placement of pericardial stay sutures and traction, internal jugular vein cannulation, and topical cooling).

We did not report any patient with phrenic nerve impairment postoperative, this may be due to avoidance of topical cooling in our patients as we used normothermic cardiopulmonary bypass, also our patients were older age than the previous study. Moreover, many other studies (2,3,9,11) did not report any patient with phrenic nerve injury with the use of hypothermic cardiopulmonary bypass and topical cooling during ASD closure.

Therefore, the anterolateral approach can be used safely by appreciating the course of the nerve, pulling adequately on the pericardial traction sutures, and avoiding topical cooling.

In our study, we reported significant prolongation of the total operative time in sternotomy group than thoracotomy group (246±34 minutes versus 180±24 minutes, $P < 0.05$). However, both cardiopulmonary bypass and aortic clamping times were comparable between the two groups. This difference in total operative time only reflects the prolongation of times required for opening and cannulation through sternotomy incision.

In agreement with our results both, Cohn (10) and Doll (7) reported significant prolonged total operative time, however both reported also prolongation of both cardiopulmonary bypass time and aortic clamping time, in thoracotomy than sternotomy. This may be due to their selection of thoracotomy and groin incision, which consume more time, also, working through a small

thoracotomy field may slow the procedure.

Intra-operative and postoperative blood loss (1840±620 ml versus 864±582 ml, P<0.05), and the requirements for blood transfusion (1250±650 ml versus 320±250 ml, P<0.05) were significantly more in sternotomy patients than thoracotomy patients. In agreement with our results Loulmet (13) and Tribble (5) reported more blood loss and need for transfusion in first time and repeated median sternotomy than thoracotomy during mitral valve surgery. However, most of the published literatures (2,3,7,11) reported no significant differences in blood loss or the need for transfusion between thoracotomy and sternotomy during closure of atrial septal defect (ASD) (14) . Actually the simplicity of the procedure of closure of atrial septal defect and the short time on cardiopulmonary bypass minimizes the incidence of blood loss and the requirement for transfusion.

ICU stay was comparable between the two patient groups (1.41±0.7 days in sternotomy group versus 1.32±0.4 days in thoracotomy group, P>0.05). However, total hospital stay was prolonged in sternotomy group than thoracotomy group (7.2±3.1 days versus 5.7±1.4 days, P<0.05). Also, Cosgrove (1) Praeger (4) and Loulmet (15) reported prolonged hospital stay in sternotomy patients than thoracotomy patients.

Postoperative pain score was high in sternotomy group than thoracotomy group during hospital stay (4.3+2.1 versus 2.3+1.1, p<0.05) and the requirement for post-operative pain control medications was significantly more in sternotomy group than thoracotomy group.

Lohchab (16) agreed with our result that there is high significant decreased in MPAP after mitral valve surgeruy.

young (13) Find that there is significant decrease in LVEDD, LVESD, &There is significant increase in LVEF after mitral valve replacement and this was approved by our result also.

The cosmetic healing after using both sternotomy and anterolateral thoracotomy were excellent in our series. Wound dehiscence was completely absent and superficial wound infection was infrequent in the two patient groups. The length of skin incision was significantly shorter in thoracotomy patients than sternotomy patients. Also, patient satisfaction by the wound appearance was highly appreciating the thoracotomy incision than sternotomy.

Conclusion:

Right antrolateral thoracotomy is applicable and safe procedure and can be considered as alternative to the median sternotomy in mitral valve surgery with better cosmetic result and short hospital stay.

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The Pulsatile Cardiopulmonary Bypass, Is It Necessary? A Comparative Randomized Prospective Study During Mitral Valve Replacement for Regurgitant Lesion

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Background: **The controversy over the benefits of pulsatile perfusion (PP) and nonpulsatile perfusion during cardiopulmonary bypass (CPB) has been ongoing for more than three decades. So, the aim of this work is to compare between pulsatile and non pulsatile cardiopulmonary bypass regarding vital signs, effect on vital organ and any morbidity or mortality.**

Methods: **Between May 2005 and August 2007, fifty patients who were undergoing mitral valve replacement for severe mitral incompetence in Mansoura University Hospitals, using cardiopulmonary bypass were randomized for using two types of flow, pulsatile flow (PF group) and non pulsatile flow (NPF group). . In pulsatile group, the arterial line was short to make the pulsatile wave maximum. The trigger mode of pulsatile flow was chosen as it is simple and does not need extraconnections to the patient as in synchronized mode. In NPF group continuous flow was used and the pump output was calculated.**

Results: **Data five minutes after start of CPB (T1) showed no significant difference between both groups .**

Data five minutes after aortic cross clamp (T2) showed no significant difference between both groups Data five minutes before off aortic cross clamp (T3) which is the actual representative stage between both groups showed no significant difference between both groups .

On the other hand, there was significant difference between both groups regarding SVR (P = 0.01), and VO2 (P = 0.02) and highly significant difference between both groups regarding venous O2 sat (P = 0.08) and A-VO2 cont. difference (P = 0.001) as this was the stage representing the actual difference between both groups.

Data five minutes before off bypass (T4) showed no significant difference between both groups .

On the other hand there was significant difference between both groups regarding urine output at the end of CPB (P = 0.004). Postoperative data showed shorter brain recovery time in the pulsatile flow group with no significant difference (P = 0.72) and also no significant difference between both groups regarding hospital stay (P = 0.27). However, there was significant difference between both groups regarding extubation time and ICU stay (P = 0.01, and 0.01 respectively).

Postoperative laboratory data showed no significant difference between both groups There was highly significant difference between both groups regarding RBCs count (P = 0.001).

Comparison between pre and postoperative laboratory data in the NPF group showed no significant difference regarding platelet count, prothrombin concentration and time (P values were 0.10, 0.13 and

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0.08 respectively), significant difference regarding Hb%, and RBCs (P values were 0.02 and 0.04 respectively), and highly significant difference regarding WBCs count (P value was 0.001).
Comparison between pre and postoperative laboratory data in the PF group showed no significant difference regarding HB%, RBCs and WBCs respectively (P values were 0.10, 0.57 and 0.05 respectively), significant difference regarding prothrombin time (P was 0.02), and highly significant difference regarding platelet count, prothrombin concentration, and INR (P values were 0.001, 0.001, and 0.001 respectively).
All patients survived the perioperative and postoperative periods in our study.
Conclusion: **From the previous information, we can conclude that pulsatile flow is a physiological flow and has many benefits over nonpulsatile flow. It improved microcirculatory perfusion, tissue oxygenation, and decreased systemic vascular resistance. It increased renal tissue perfusion and urine output. It increased venous oxygen saturation, arteriovenous oxygen content difference and decreased whole body oxygen consumption (VO2) compared with non pulsatile which is a stressful perfusion that increases catecholamine secretion and VO2. Pulsatile perfusion decreased ICU extubation time and ICU stay. However, there is numerical decrease in RBCs and platelet count that did not need correction.**

The use of artificial circulation to maintain organ system function has made advanced cardiac surgery possible. The perfusion provided by some roller pumps or centrifugal pumps is nonpulsatile perfusion (NP) and therefore nonphysiologic. The use of pulsatile perfusion (PP) has been thought to improve microcirculatory flow, myocardial perfusion, oxygenation, and indices of contractility. It has also been demonstrated to reduce the commonly seen rise in systemic vascular resistance during cardiopulmonary bypass (CPB) by means of maintaining a normal level of plasma angiotensin, aldosterone, and catecholamines. Additionally, PP was found to decrease the retention of fluid into the lungs. On the other hand, several clinical studies have been unable to detect a benefit associated with PP [1].

There is no evidence documenting the adverse effects of pulsatility during pediatric or adult patient CPB. Pro-nonpulsatile investigators can claim only that there is no difference between PP and NP in terms of vital organ recovery. However, some papers has reporting that PP is better than NP during CPB [2].

The pulsatile blood flow has a lower peripheral vascular resistance than nonpulsatile blood flow; consequently, it maintains a better microcirculation, increases tissue metabolism, and is associated with lower edema formation. Thus it is more compatible with the requirements of the peripheral tissue metabolism (3).

So, the aim of this work is to compare between pulsatile and non pulsatile cardiopulmonary bypass regarding blood gases, whole body oxygen consumption, laboratory tests, vital signs, effect on vital organ, brain recovery time, extubation, ICU and hospital stay and any morbidity or mortality to detect that PP is necessary or not.

Methods

This is a prospective study which was done between May 2005 and August 2007. Fifty patients underwent mitral valve replacement in Mansoura University Hospitals, using cardiopulmonary bypass. They were randomized for using two types of flow, pulsatile and non pulsatile.

Excluded from this study were patients operated on active infective endocarditis, thrombosed prosthetic valves, combined valve procedures, combined MVR and CBAG, MVR for isolated mitral stenosis, MVR with chronic renal failure, liver cirrhosis and COPD.

All patients in this study were evaluated preoperatively by detailed medical history and clinical examination done to all patients with special attention to the following points: Age, sex, symptoms of congestive heart failure and risk factors for cardiac disease which include hypertension and diabetes mellitus.

The respiratory system of each patient was carefully assessed by history and physical examination. Preoperative preparation included encouraging patients who smoke to stop. Chronic productive cough improved by a period of intensive respiratory therapy.
Chest x-ray, resting twelve lead electrocardiogram, echocardiographic study and laboratory investigations were done including complete blood picture, liver and kidney functions, serum electrolytes, and the coagulation profile.
The anesthetic technique used in both groups was the same.

The operative procedures were performed by the same group of surgeons using the same operative technique. Heparin was given in a dose of 300 I.U/kg with additional doses of 3000 I.U in order to maintain the activated clotting time (ACT) over 480 seconds throughout cardiopulmonary bypass.

In the nonpulsatile group standard CPB was used and Stöckert roller pump (Instrument GmbH-IBX-ICE Germany) and Sarns roller pump model 7000 (INC/3M USA) were used to deliver non pulsatile flow. In pulsatile flow group Stöckert roller pump (Instrument GmbH-IBX-ICE Germany was used to deliver pulsatile flow.

In NPF group continuous flow was used and the pump output was calculated from the formula: pump output = BSA x CI (2.4 L/min) where BSA = body surface area and CI = cardiac index.

The BSA was calculated from special chart using body weight and height.

The heart was ejecting in this group in the first few minutes of bypass and also after successful defibrillation till the end of bypass, so the actual difference between both groups was in the period of ischaemic arrest.In the pulsatile group, the arterial line was short to make the pulsatile wave maximum. The trigger mode of pulsatile flow was chosen as it is simple and does not need extraconnections to the patient as in synchronized mode.

The heart rate was adjusted to be the same as the prebypass heart rate and the pulsatile waveform was adjusted to be similar in height and width to the prebypass pressure waveform in order to minimize haemodynamic changes and to give a pump output equal to the calculated cardiac output (CO) depending on BSA.

The following regimen was used in the pulsatile group:

1- At the onset of CPB: NPF was used until left ventricular ejection ceased or putting the aortic clamp, and pulsatility was provided by the spontaneous cardiac contraction.
2- PF was used during the whole period of aortic cross clamp.
3- NPF was used from the beginning of left ventricular ejection till the end of bypass, and pulsatility was provided by the spontaneous cardiac contractility.

After completion of the surgical procedure de-airing was done, the cross clamp was removed and after successful defibrillation of the heart and adequate reperfusion time and raising rectal temperature to 35ºC or more, weaning process from CPB started in a gradual manner three quarter flow, then half flow then quarter flow adjusted according to adequate patient haemodynamic response then off bypass. Hemodynamic data, blood gases, rectal temperature, and pump flow were calculated during 4 times of bypass (1) Five minutes after the start of bypass T1. (2) Five minutes after aortic cross clamp T2. (3) Five minutes before cross clamp off T3. (4) Five minutes before off bypass T4. The total amount of urine during CPB was calculated.

Statistical Analysis

Data were analyzed using SPSS (Statistical Package for Social Sciences) version 10. Qualitative data were presented as number and percent. Comparison between groups were done by Chi-Square test. Quantitative data were tested for normality by Kolmogrov-Smirnov test. Normally distributed data were presented as mean ± SD. Paired t-test was used for comparison within groups. Student t-test was used to compare between two groups. $P < 0.05$ was considered to be statistically significant, and $P < 0.01$ was considered to be statistically highly significant.

Results:

A total of fifty patients were included in this prospective study and were divided into two groups. There were no statistically significant differences in either preoperative or operative para meters between the two groups regarding age, body surface area, weight, cross-clamp, CPB times and perfusion flow rates. Demographic and other data from preoperative and postoperative periods are shown in the following tables.

	NPF group		PF group		P value
Age	33.48 ± 13.79		29.96 ± 13.01		0.35
	No	%	No	%	
Male	4	16%	9	36%	0.10
Female	21	84%	16	64%	
Total	25	100%	25	100%	

Table (1): Demographic data in both groups.

	No	Mean	SD	P value
NPF group	25	1.55	0.35	0.06
PF group	25	1.71	0.21	

Table (2): BSA in both groups. BSA = Body surface area

	NPF (n = 25)		PF (n = 25)		P value
	Mean	SD	Mean	SD	
Hb	11.95	1.22	11.19	1.53	0.05
RBCs	4.43	0.84	4.15	0.48	0.16
WBCs	7.75	1.96	7.31	3.76	0.60
Platelet count	183.24	69.85	184.68	57.51	0.93

Table (3): Preoperative laboratory data in both groups. Hb = Haemoglobin, RBCs = Red blood cells, WBCs = White blood cells.

	NPF (n = 25)		PF (n = 25)		P value
	Mean	SD	Mean	SD	
Pump flow (L/min)	3.73	0.84	4.10	0.05	0.06
Pump time (min)	97.64	38.10	81.0	18.67	0.05
Cross clamp time (min)	58.92	16.24	51.64	13.05	0.08

Table (4): Full flow pump time and cross clamp time in both groups.

	No	Mean	SD	P value
NPF group	25	1168.0	200.45	0.004
PF group	25	1316.0	133.64	

Table (5): Urine output during CPB in both groups (ml). There was highly significant difference between groups regarding the amount of urine during CPB.

T1	**NPF (n = 25) (mean ± SD)**	**PF (n = 25) (mean ± SD)**	P value
Pump flow (L/min)	3.35 ± 0.48	3.31 ± 0.25	0.67
Temp (°C)	31.74 ± 1.52	31.48 ± 1.33	0.52
Systolic blood pressure (mmHg)	60.76 ± 7.36	57.60 ± 6.63	0.11
Diastolic blood pressure (mmHg)	33.80 ± 9.05	32.40 ± 9.26	0.59
Mean arterial blood pressure (mmHg)	42.79 ± 7.36	40.80 ± 7.28	0.34
Systemic vascular resistance SVR (dyne/se/m^{-5})	838.78 ± 209.26	774.65 ± 235.92	0.31

Table (6): Pump flow, temperature, and hemodynamic data in both groups during (T1).

T1	Arterial			Venous		
	NPF	PF	P value	NPF	PF	P value
PaCO2 (mmHg)	34.30 ± 11.36	38.56 ± 5.79	0.10	41.33 ± 13.35	37.54 ± 9.05	0.24
O2 sat%	99.07 ± 1.45	98.76 ± 14.2	0.45	58.76 ± 19.2	63.92 ± 10.63	0.24
pH	7.44 ± 0.08	7.47 ± 0.07	0.15	7.46 ± 0.13	7.41 ± 0.08	0.11
O2 cont. gm%	16.81 ± 1.76	15.78 ± 2.11	0.06	9.59 ± 3.12	9.82 ± 2.24	0.76
	NPF			PF		P value
A-VO2 cont. diff. Gm%	7.22 ± 3.05			5.96 ± 1.69		0.07
VO2 (ml/min/m2)	141.9 ± 36.9			127.4 ± 23.7		0.10

Table (7): Arterial and venous blood gases, A-VO2 cont. difference and VO2 in both groups during (T1).

T2	NPF (n = 25) (mean ± SD)	PF (n = 25) (mean ± SD)	P value
Pump flow (L/min)	3.45 ± 0.36	3.47 ± 0.44	0.86
Temp. (°C)	32.08 ± 1.75	32.08 ± 1.41	1.0
Systolic blood pressure (mmHg)	59.04 ± 5.50	58.20 ± 4.30	0.55
Diastolic blood pressure (mmHg)	33.80 ± 8.69	30.80 ± 7.59	0.20
Mean arterial blood pressure (mmHg)	42.21 ± 7.12	39.93 ± 5.66	0.21
Systemic vascular resistance SVR (dyne/se/m-5)	987.66 ± 180.13	941.88 ± 220.37	0.42

Table (8): Pump flow, temperature, and hemodynamic data in both groups during (T2).

T2	Arterial			Venous		
	NPF	PF	P value	NPF	PF	P value
$PaCO_2$ (mmHg)	32.38 ± 10.37	36.18 ± 6.59	0.13	38.2 ± 16.61	35.88 ± 10.38	0.55
O_2 sat%	99.22 ± 0.87	99.04 ± 0.49	0.38	63.14 ± 11.24	65.23 ± 9.30	0.47
pH	7.44 ± 0.9	7.40 ± 0.08	0.07	7.44 ± 0.11	7.39 ± 0.09	0.07
O_2 cont. gm%	16.83 ± 1.71	15.83 ± 2.07	0.06	10.21 ± 1.73	9.99 ± 2.07	0.68
	NPF			PF		P value
A-VO_2 cont. diff. Gm%	6.62 ± 2.06			5.83 ± 1.57		0.13
VO_2 (ml/min/m^2)	153.13 ± 53.62			130.41 ± 18.02		0.05

Table (9): Arterial and venous blood gases, A-VO2 cont. difference and VO2 in both groups during (T2).

T3	NPF (n = 25) (mean ± SD)	PF (n = 25) (mean ± SD)	P value
Pump flow (L/min)	3.63 ± 0.40	3.75 ± 0.41	0.27
Temp. (°C)	34.11 ± 2.54	34.84 ± 1.65	0.23
Systolic blood pressure (mmHg)	60.28 ± 9.19	64.40 ± 6.97	0.08
Diastolic blood pressure (mmHg)	40.64 ± 11.25	35.80 ± 5.14	0.05
Mean arterial blood pressure (mmHg)	47.19 ± 9.23	45.33 ± 5.25	0.38
Systemic vascular resistance SVR (dyne/se/m-5)	1157.86 ± 295.95	981.75 ± 177.64	0.01

Table (10): Pump flow, temperature, and hemodynamic data in both groups during (T3). There was significant difference between both groups regarding SVR (P = 0.01).

T3	Arterial			Venous		
	NPF	PF	P value	NPF	PF	P value
PaCO2 (mmHg)	36.89 ± 10.01	38.04 ± 4.46	0.60	40.98 ± 11.20	38.58 ± 9.95	0.42
O2 sat%	98.98 ± 1.05	98.51 ± 1.40	0.18	58.94 ± 4.69	63.26 ± 6.31	0.008
pH	7.45 ± 0.07	7.39 ± 0.14	0.07	7.41 ± 0.07	7.41 ± 0.07	0.69
O2 cont. gm%	16.86 ± 1.77	15.78 ± 2.04	0.05	9.61 ± 1.23	9.68 ± 1.61	0.85
	NPF			PF		P value
A-VO2 cont. diff. Gm%	7.26 ± 1.17			6.10 ± 1.21		0.001
VO2 (ml/min/m2)	189.02 ± 106.41			136.73 ± 38.60		0.02

Table (11): Arterial and venous blood gases, A-VO2 cont. difference and VO2 in both groups during (T3). There was highly significant difference between both groups regarding venous oxygen saturation and A-VO1 cont. diff. and there was significant difference between both groups regarding VO2.

T4	NPF (n = 25) (mean ± SD)	PF (n = 25) (mean ± SD)	P value
Pump flow (L/min)	3.54 ± 0.29	3.76 ± 0.47	0.05
Temp. (°C)	35.61 ± 1.56	36.20 ± 0.76	0.09
Systolic blood pressure (mmHg)	93.8 ± 7.68	95.0 ± 9.90	0.63
Diastolic blood pressure (mmHg)	65.4 ± 5.94	65.2 ± 8.72	0.92
Mean arterial blood pressure (mmHg)	74.87 ± 6.33	75.13 ± 8.94	0.90
Systemic vascular resistance SVR (dyne/se/m-5)	1606 ± 193.77	1520.2 ± 295.69	0.22

Table (12): Pump flow, temperature, and hemodynamic data in both groups during (T4).

T4	Arterial			Venous		
	NPF	PF	P value	NPF	PF	P value
PaCO2 (mmHg)	51.48 ± 6.23	39.04 ± 4.65	0.42	41.44 ± 11.11	39.28 ± 7.53	0.42
O2 sat%	97.20 ± 10.67	98.49 ± 1.02	0.55	62.21 ± 9.21	62.69 ± 6.80	0.83
pH	7.43 ± 0.08	7.39 ± 0.09	0.07	7.44 ± 0.10	7.39 ± 0.15	0.11
O2 cont. gm%	16.44 ± 2.44	15.77 ± 2.10	0.30	10.08 ± 1.44	9.61 ± 1.70	0.29
	NPF			PF		P value
A-VO2 cont. diff. Gm%	6.36 ± 2.41			6.16 ± 1.32		0.72
VO2 (ml/min/m2)	154.03 ± 73.02			139.87 ± 48.78		0.42

Table (13): Arterial and venous blood gases, A-VO2 cont. difference and VO2 in both groups during (T4).

	NPF (n = 25) (mean ± SD)	PF (n = 25) (mean ± SD)	P value
Brain recovery time(min)	204 ± 58.84	210.8 ± 77.06	0.72
Extubation time(min)	433.60 ± 123.23	358 ± 95.61	0.01

Table (14): Brain recovery and extubation time in both groups.

	NPF (n = 25) (mean ± SD)	PF (n = 25) (mean ± SD)	P value
ICU stay (days)	4.56 ± 1.76	3.48 ± 1.12	0.01
Hospital stay (days)	5.40 ± 1.55	5.88 ± 1.54	0.27

Table (15): ICU and hospital stay in both groups.
There was significant difference between both groups regarding ICU stay.

	NPF (n = 25)		PF (n = 25)		P value
	Mean	SD	Mean	SD	
Hb	11.31	1.29	10.35	2.31	0.07
RBCs	4.88	0.62	4.23	0.69	0.001
WBCs	9.67	3.24	9.67	4.84	0.99
Platelet count	152.52	46.59	127.34	48.64	0.06

Table (16): Postoperative laboratory data in both groups.
There was highly significant difference between both groups regarding RBCs count. All patients survived the perioperative and postoperative periods in our study.

Discussion

The number of patients in different studies varies. Kono and associates (4) in their study reported 23 cases, Orime and associates (5) reported 18 cases and Sezi and associates (6) reported 24 cases. So the number of patients in our study was sufficient for comparison between pulsatile and nonpulsatile types of flow.

In the study done by Kono (4) and Sezi and their associates (6), the patients had IHD only while in the series of Khalaf and Mageed (7) patients had aortic and mitral valve disease. In Ozatik and associates' study (8) the patients had IHD, MVD, AVD and double valve disease. In our study all patients had rheumatic heart disease. Also we have in our study only one pathology which is severe mitral incompetence and we choose this type of pathology to exclude the difference that may be present with different pathologies. In Khalaf's study (9), he found that VO2 in patients with rheumatic heart disease was 110.30 ml/m2/min, in congenital cyanotic heart disease, it was 174.10 ml/m2/min, in congenital non cyanotic heart disease, it was 104.25 ml/min and in patients with ischemic heart disease, it was 158.80 ml/m2/min. While in the available literatures, no one restricted his study to one type of pathology, so our study is a leading one in this respect.

In our study, the mean age of patients in the NPF group was 33.48 ± 13.79 years while in the PF group, it was 29.96 ± 13.01 years with no statistical significant difference (P = 0.35).

Our patients mean age matched with the results of Khalaf and Mageed (7), where the mean age in pulsatile group was 24 ± 13 years while in the non pulsatile group it was 25 ± 11 years and this may be due to chosing the two series of patients with rheumatic valve lesions 7).

In series of Murkin and associates (10) the mean age of patients in PF group was 60.9 ± 8.7 years while in NPF group of patients it was 61.2 ± 7.8 years with no significant difference. This high range of age was due to the fact that all patients were scheduled for CABG. In series of Alkan and associates (11), the mean age in the PF group ranged from 2 days to 15 years while in NPF, age ranged from 2 days to 16 years as their patients had congenital heart disease.

Female gender was predominant in our study (74%) while male gender institued (26%) because rheumatic incompetence is more common in female gender and this differs from series of Zamparelli and associates (12) where in their series male gender was 100% because it was done on ishcaemic patients.

In the study done by Khalaf and Mageed (7), female gender was 42% and male gender was 58%. This was because this study was done on mixed aortic and mitral valve disease.

Body surface area affects whole body oxygen consumption. The mean BSA in the NPF group was 1.55 ± 0.35 m2 while it was 1.71 ± 0.21 m2 in the PF group with no significant difference (P = 0.06). This means that the difference in BSA in both groups did not affect VO2.

In series of Khalaf and Mageed (7), BSA in NPF group was 1.6 ± 0.4 m2 while in PF group, it was 1.6 ± 0.37 m2 with no significant difference. In Orime study (5) BSA of PF group was 1.63 ± 0.14 m2 while in NP group it was 1.64 ± 0.19 m2 with no significant difference.

The heart lung machine has a deleterious effects on both formed (cellular) and nonformed (non-cellular) elements of blood.

The mean preoperative hemoglobin content in the NPF group was 11.59 ± 1.22 gm% while it was 11.19 ± 1.53 gm% in the PF group with no statistically significant difference (P = 0.05). Postoperative data included a drop in the values of both groups as a result of the deleterious effect of CPB to be 11.31 ± 1.29 gm% in the NPF group and 10.35 ± 2.31 gm% in PF group with no statistically significant difference (P = 0.07) which means that pulsatile flow has no additional hazards on haemoglobin content. These results match with the results of Alkan and associates (11) in which preoperative HCT value in the NPF group was 38.56 ± 30.3 while it was 38.51 ± 2.93 in PF group with no significant difference. Also these preoperative HCT values decreased to 29.44 ± 3.44 versus 28.67 ± 46 in NPF group and PF group respectively and this means that PF flow has no additional hazards on Hb content. However, our results do not cope with those of Zumbro and associates (13) who demonstrated that plasma HB level was significantly higher in the PF group compared with NPF group (80 mg/dl ± 40 versus 56 mg/dl ± 29 respectively) (P < 0.001).

As regard RBCs count there was no statistical difference between preoperative and postoperative count

in both the NPF group and the PF group (P = 0.16), but the postoperative difference was difficult to explain because the majority of patients received blood transfusion during bypass, after bypass, and in the intensive care unit according to need but not in a strict scheduled manner.

The preoperative WBCs count in the NPF group was 7.75 x 103/UL ± 1.96 compared with the postoperative value which was 9.67 x 103/UL ± 3.23 with highly significant difference (P = 0.001). On the other hand, the preoperative WBCs count in the PF group was 7.31 x 103/UL ± 3.76 compared with the postoperative value which was 9.67 x 103/UL ± 4.84 with no significant difference (P = 0.05). This means that the NPF stimulates the inflammatory response in a much higher degree compared to the PF.

Also, Our results cope with Ozatik and associates (8) study, where WBCs count in NPF group rose from 5800 ± 1270 x 103 µL at the start of operation up to 7200 ± 4711 x 103 µL at the end of operation while in the PF group it decreased from 6200 ± 1690 x 103 µL at the start of operation to 6000 ± 4465 x 103 µL at the end of operation with significant statistical difference and this means that NP perfusion induces more inflammatory effect during CPB.

The mean preoperative platelet count in the NPF group was 183.24 ± 69.85 x 103 µL while it was 184.68 ± 57.51 x 103 µL in the PF group with no statistical difference (P = 0.93). Postoperative data included drop in the values of both groups as a result of deleterious effect of CPB to be 152.52 ± 26.59 x 103 µL in NPF group and 127.34 ± 48.64 x 103 µL in PF group with no statistical difference (P = 0.06). We can conclude that pulsatile flow compared with non pulsatile flow does not add more destructive effect on platelets.

The same deleterious effect on the platelets was reported in Ozatik and associates (8) where in NPF group preoperative platelet count decreased from 328.3 ± 37.92 x 103 µL to 146 ± 68.04 x 103 µL postoperatively with no significant difference and in PF group, it decreased from 325 ± 48.5 x 103 µL to 141 ± 54.6 x 103 µL without significant difference.

Some parameters during CPB as perfusion flow rates, pump time and ischemic time have no significant difference between the NPF and the PF groups in our study and this abolish their effects on whole body oxygen consumption (P = 0.06, 0.05, 0.08 respectively).

As regard the mean pump time in our study, it was 97.64 ± 38.10 min. in the NPF group while it was 81.0 ± 18.67 min. in PF group with no statistical difference (P = 0.05). This means that both groups were subjected to the same deleterious effects of CPB as regard duration of bypass. This copes with the results of Hamulu and associates (14), in which pump time was 83.3 ± 40.7 min. for NPF group while it was 89.5 ± 8.50 min. for PF group with no significant differences.

As regard, the cross clamp time in the NPF group in our study, it was 58.92 ± 16.24 min. while it was 51.64 ± 13.65 min. in the PF group with no statistical difference (P = 0.08). This means that the heart in both groups was affected to the same extent by ischemic insult done by cross clamping and so this effect will be negligible on the other postoperative data such as brain recovery and extubation time and also this copes with results of Orime and associates (5) in which cross clamp time in NPF was 95.4 ± 22.0 min. while in the PF group it was 81.4 ± 19.1 min. with no significant difference.

The urine output during CPB in the NPF group was 1168 ± 200.45 ml while it was 1316 ± 133.634 ml in the PF group with highly statistical significant difference between both groups (P = 0.004). This means that the PF has better effect on tissue perfusion and the kidney with more renal blood flow compared to the NPF.

Our results cope with those of Undar and associates (15) and Alkan and associates (16) where they found increased urine output with PF.

While in the series of Murkin and associates (10) there were no difference in urinary output between NPF group patients and PF group patients (378 ± 358 ml versus 367 ± 346 ml) respectively.

As regard the mean perfusion flow rate in our study, it was 3.73 ± 0.84 L/min in the NPF group and it was 4.1 ± 0.5 L/min in the PF group with no statistical difference between the two groups (P = 0.06). This means that the difference in both groups regarding perfusion flow rate did not affect whole body oxygen consumption (VO2).

Body temperature affects the metabolic rate and VO2. In our study there was no significant difference between body temperature in both groups during the four times for blood sampling. The P values were 0.52, 1.0, 0.23 and 0.09 in the first, second, third and fourth

samples respectively. This means that the difference in body temperature was not affecting VO2 in both groups. All researches in this field comparing between the effect of NPF and PF must have no significant difference in the body temperature of the two groups to abolish the effect of temperature on VO2. For example, in series of Nagawaka and associates (17) the temperature was 26.3 ± 2.1 ºC in NPF group, while in PF group temperature was 26.4 ± 1.6 ºC with no significant difference.

As regard arterial oxygen saturation in both groups, there was no statistical significant difference between NPF and PF groups during all consecutive sampling times (P = 0.45, 0.38, 0.18 and 0.55 respectively). This means that the arterial oxygenation was sufficient and excellent in both groups throughout bypass during all times of sampling.

As regard venous oxygen saturation, there was no significant difference between both groups during the first sampling five minutes after bypass (T1) (P = 0.24). Also there was no significant difference between both groups during the second sampling five minutes after aortic cross clamping (T2) (P = 0.47).

On the other hand, there was highly significant difference between NPF and PF groups (P = 0.001) as regards venous oxygen saturation during the third sampling five minutes before release of aortic cross clamp (T3) as it is the true time reflecting the difference between both groups, as it is the longest period for either non pulsatile and pulsatile flows. These values clearly reflect the highest oxygen extraction in the NPF group and this also explained the highest values of VO2 in this group during this time.

On the fourth sample, five minutes before off bypass (T4), there was no significant difference (P = 0.83) between both groups regarding venous oxygen saturation.

Arteriovenous oxygen content (A-VO2 cont.) difference or oxygen extraction is a major factor affecting VO2. At the beginning of CPB in the first sample taken it was 7.22 gm% in the NPF group and 5.96 gm% in the PF group with no significant difference (P = 0.07) between both groups which means that this difference did not affect the difference of VO2 in both groups.

Five minutes after cross clamping of the aorta, the A-VO2 cont. difference was 6.62 gm% in the NPF group and 5.83 gm% in the PF group with no statistical difference (P = 0.13).

In the third sample five minutes before release of the aortic cross clamp, the A-VO2 cont. difference was 7.26 gm% in the NPF group and 6.1 gm% in the PF group with highly significant difference between both groups (P = 0.001). This period is the most important period showing the actual difference between both groups because during this period the heart is arrested and the flow is purely non pulsatile in the NPF group and purely pulsatile in the pulsatile flow group. The value of this A-VO2 cont. difference is evident when we compensate in the Fick's equation to calculate VO2 where there was significant difference between both groups (P = 0.02) with higher values in NPF group compared with PF group.

At the end of CPB five minutes before getting off bypass the A-VO2 cont. difference was 6.36 gm% in the NPF group and 6.16 gm% in the PF group with no significant difference (P = 0.72). This value is very important because at that time in both groups, we used only the non pulsatile flow mode to avoid mismatch between the pulsatile flow given by the pump and the pulsatile flow given by the spontaneous contraction of the heart as in the PF group, we used the trigger mode of pulsatility and not the synchronized mode.

As regard whole body oxygen consumption, there was higher values in the NPF group in the samples taken five minutes after start of CPB than in the PF group with no significant difference (P = 0.10).

In the second sample, five minutes after aortic cross clamp, VO2 was higher also in the NPF group than in the PF group with no statistical difference (P = 0.05).

In the third sample five minutes before removal of aortic cross clamp, VO2 was significantly higher in the NPF group than the PF group (P = 0.02). This sample is the most important sample between both groups which means that NPF significantly increases VO2 compared with PF, as the equation of VO2 is:

VO2 = X (A-V) O2 cont. difference

And as there was no significant difference between both groups regarding the age (P = 0.35), BSA (P = 0.06), and perfusion flow rate (P = 0.06), this means that all these factors were not producing significant difference

between both groups regarding VO2.

And when we compare between both groups regarding body temperature, during different samples it was found that there was no significant difference between both groups regarding body temperatures in all samples (P = 0.52, 1.0, 0.23, and 0.09 in the different successive four samples). So it is clear that the difference in the temperature between both groups did not produce significant difference in VO2 between both groups.

But when we compared between A-VO2 cont. difference during the four successive samples, it was found that there was no significant difference between both groups in the first, second and fourth samples respectively (P = 0.10, 0.13 and 0.72 respectively) while there was highly significant difference between both groups (P = 0.001) during the third sample which is the most important sample which was reflected in VO2 formula by significant difference between both groups, 189.0 versus 136.7 ml/min/m2 in NPF versus PF groups respectively (P 0.02). The only difference in this respect was explained only by the type of flow which denotes higher VO2 in NPF group compared with the PF group and this copes with the results of Khalaf and Mageed (7), who found that values of VO2 were 70.3 ± 49.8 (ml/min/m2) in NPF group and 68 ± 43 (ml/min/m2) in PF group with significant difference (P = 0.01).

On the contrary, Shepard and Kirklin (18) found increased VO2 in pulsatile perfusion. Edmunds (19) documented that pulsatile flow has theoretically benefits including transmission of more energy to the microcirculation which reduces critical capillary closing pressure, augments lymph flow and improves tissue perfusion and hence it may increase oxygen consumption.

Our explanation for this contradiction is that NPF is a non physiologic type of flow and so it increases sympathetic stimulation of the body with redistribution of blood flow, with increased blood flow to vital organs as brain and decreased blood flow to less vital organs. Also, there is increased secretion of epinephrine and norepinephrine with vasoconstriction and increase SVR. The net result of the stress response is increased VO2.

So it is clear that the values of VO2 and A-VO2 cont. difference move hand in hand with each other with no significant difference between both groups in all except the third sample; five minutes before off cross-clamp which is the true time representing the difference between both groups.

As regard the hemodynamic data in our study there was no significant difference in systolic, diastolic and mean pressures during all sampling periods T1, T2, T3, T4.

Our results cope with the results of Khalaf and Mageed (7) between both groups during the same data.

As regard systemic vascular resistance (SVR), there was higher values in the NPF group (838.28 dyne/sec/m–5) compared with the PF group (774.85 dyne/sec/m–5) with no significant values (P = 0.31) during the first sample taken five minutes after start of CPB. Also, there was higher values in the SVR in the NPF group (987.66 dyne/sec/m–5) compared with the PF group (941.88 dyne/sec/m–5) with no statistical significance (P = 0.42) during the second sampling five minutes after aortic cross clamping. On the other hand, there was significant difference (P = 0.01) in the SVR between both groups during the third sampling five minutes before off cross clamping with higher values in the NPF group (1157.80 dyne/sec/m–5) compared with PF group (981.75 dyne/sec/m–5) and this time is the actual time representing the difference between both groups.

Our explanation to this higher value of SVR in NPF group compared to PF group is higher levels of catecholamines due to higher stress situation during continuous flow as compared to the pulsatile flow which is more physiologic.

These higher values of SVR are still higher in the NPF group (1606.95 dyne/sec/m–5) than the PF group (1520.27 dyne/sec/m–5) but with no significant difference (P = 0.22) during the fourth sampling five minutes before off bypass. So, it is clear that the SVR is higher during all stages of CPB in the NPF group than in the PF group, with no significant difference in all except the third sampling five minutes before cross clamping

Most researchers found that SVR is higher in NPF group of patients. Some studies found this elevation with statistically significant difference as in study of Levin and associates (20).

In the clinical study of Minami and associates

(21), they reported that peripheral vascular resistance with pulsatile perfusion decreased to 85% of that with nonpulsatile perfusion. This pulsatile flow attenuated the catecholamine stress, reduced the fluid overload, and decreased the postoperative recovery period. These decreases in PVR during pulsatile perfusion are therefore considered to be physiologically favorable.

Others found that SVR increased with non pulsatile perfusion but without significant difference as study of Hamulu and associates (14). Minami and associates (22) compared pulsatile with nonpulsatile perfusion 5 minutes after institution of CPB. They found lower levels of elevation of epinephrine (from 168 ± 40 to 444 ± 100 pg/ml vs 176 ± 56 to 611 ± 108 pg/ml) and lower levels of elevation of norepinephrine (from 162 ± 44 to 267 ± 23 vs 231 ± 48 to 518 ± 100 pg/ml) in pulsatile perfusion. Also higher levels were found with nonpulsatile perfusion at the end of CPB.

Taylor and colleagues (23) reported that pulsatile cardiopulmonary bypass prevented a rise in either the SVR or the plasma concentration of angiotensin II.

As regards brain recovery time, there was no statistically significant difference between both groups where it was (204.0 ± 58.84 versus 270.8 ± 77.06 min.) in NPF versus PF groups respectively (P = 0.07). This didn't cope with Khalaf and Mageed (7) study in which brain recovery time with NPF group was 208 ± 146 min. while with PF group, it was 31 ± 14 min. with highly significant difference (P < 0.001).

The mean extubation time was 433.60 ± 123.23 min. in the NPF group compared with 358.1 ± 95.61 min. in the PF group with significant difference (P = 0.01) which means earlier extubation time in the PF group. As the extubation criteria are strict ones and are dependent on the mental, cardiac, and respiratory functions, it is clear that these functions were better in the PF group compared to the NPF group with significant difference.

Minami and associates (22) documented longer postoperative tracheal intubation time with non pulsatile flow group (4.6 ± 1.2 hours versus 2.7 ± 0.8 hours) (P = 0.001).

Also, Khalaf and Mageed (7) found in their study shorter periods of ventilatory time with pulsatile group patients with highly statistically significant difference (330 ± 120 min. versus 560 ± 249 min) (P < 0.001).

Also, in the study of Alkan and associates (11) they found shorter extubation time with pulsatile group (10.26 ± 1.04 hours) versus (18.64 ± 1.99 hours) NPF group with statistically significant different (0.02) and this matches with our results.

As regard the ICU stay, there was higher values in the NPF group compared to PF group with significant difference (P = 0.01). The criteria for ICU stay are strict and the mean ICU stay in the PF group was 3.48 days compared to the NPF group which was 4.56 days. This means that the postoperative outcome of patients in the PF group was better than those in the NPF group and this also copes with Alkan and associates (11) who reported shorter ICU stay with pulsatile versus non pulsatile flow group (2.75 ± 1.19 vs 1.53 ± 0.07 days) (P = 0.012).

As regard the hospital stay in which no strict criteria were followed up, there was no statistical difference between both groups; 9.96 ± 1.97 days in NPF group versus 9.36 ± 2.0 days in PF group (P = 0.29). This does not cope with Ozatik and associates (8) study in which shorter hospital stay was found in PF group than NPF group, but without significant difference (7.1 ± 7.6 days vs 7.2 ± 7.1 days). In the study of Alkan and associates (11) hospital stay was 11.16 ± 0.58 days for NPF group while it was 6.71 ± 0.19 days for PF group with highly significant difference (P < 0.001).

Conclusion:

We conclude that pulsatile flow carries more benefits than non pulsatile flow regarding increased intraoperative urine output, lower systemic vascular resistance, increased venous oxygen saturation, decreased arteriovenous oxygen content difference, decreased whole body oxygen consumption, shorter extubation time and ICU stay. The numerical depletion in RBCs and platelet count did not need correction. So we recommend the use of pulsatile cardiopulmonary bypass.

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Effect of ventricular volume reduction on the Atrioventricular valve regurgitation in patients with single ventricle after bidirectional Glenn operation

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Background: **Several studies have shown that the ventricular volume decreases after bidirectional Glenn operation In this retrospective study we try to see the effect of the volume load reduction after bidirectional Glenn operation (BDG) on the atrioventricular valve regurgitation (AVVR) in patients with single ventricle without doing concomitant atrioventricular valve repair.**

Methods: **We reviewed our patients who underwent the BDG between March 2004 and January 2008 in many hospitals with more concentration on those patients with moderate or severe AVVR. The degree of AVVR was evaluated by trans-thoracic echocardiography study. During this study period there were 32 patients with significant moderate to severe AVVR who had underwent BDG. Moderate to severe AVVR was seen more significantly in patients with a common atrioventricular canal.**

Results: **showed that from those 32 cases with moderate to severe AVVR, 11 cases (34.38%) had surgical interventions to repair the regurgitated AVV at the same setting of BDG. There was no hospital death . The remaining 21 (65.62%) cases who did not undergo additional surgical interventions at BDG, significant improvement in AVVR (mild or none) was noted in 9 cases(28.13%) at early and late (6 to 12 months) follow-up, the other 12 cases(37.5%) did not show significant improvement in their echocardiography study, inspite of their clinical improvement.**

Conclusions: **We concluded that AVVR improves in some patients after BDG especially in those patients with moderate AVVR, but those patients with severe AVVR may improved if there is no additional pathology to annular dilatation. Also, The presence of significant AVVR before BDG may affect ICU and hospital stay, but without significant effect on hospital survival.**

Several studies have shown that the ventricular volume decreases after bidirectional Glenn operation, and This ventricular volume reduction is accompanied by a reduction in the dimension of the atrioventricular annulus with consequent improvement in atrioventricular valve function, especially those patients that have significant annular dilation and leaflet non-coaptatin[1,2,3] . Other studies have suggested that such decrease in ventricular volume has no much effect on AVVR, especially in those patients with severe AVVR . The aim of this study is to reach to a clear conclusion about the effect of BDG operation on AVVR in those patients with single ventricle by analyzing our experience to detect whether significant AVVR improves after BDG without concomitant surgical repair of AVVR or surgical repair must considered[4,5].

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Methods :

Our 32 cases were collected in the period between March, 2004 and January, 2008, and we retrospectively reviewed the preoperative, early postoperative and then 6 months postoperative clinical, radiological, ECG and echocardiographic data of all the 32 patients. Informations were obtained from the patient files. Atrioventricular valve morphology of the systemic ventricle was classified as tricuspid, mitral, common atrioventricular canal, or two atrioventricular valves. Out of those 32 cases, 19 were males (59.37%) and 13 were females (40.63%) with age range from 4 months to 5.4 years and mean of 9.2 months.

A complete echocardiographic study was routinely performed before BDG to assess preoperative LVEDV, LVESV and LVEDD and LVESD, EF, FS and The degree of AVVR, and the same examination done early and late (6 to 12 months) postoperative. All of these Echocardiographic examinations including M.mode, two-dimensional and color Doppler study were reviewed. Cases graded according to the degree of AVVR into two groups, group A (mild to moderate AVVR) and group B (moderate to severe AVVR). To identify the primary mechanism of AVVR, preoperative echocardiographic studies as well as operative reports were reviewed. Echocardiographic data were analyzed in correlation with other investigation data (e.g. catheterization data if present), as well as clinical examination.

Results

According to the ventricular morphology, There were 23 patients (71.87%) with dominant left ventricles and 9 patients (28.13%) with dominant right ventricles (fig.1) . Primary diagnosis is distributed in Table 1.

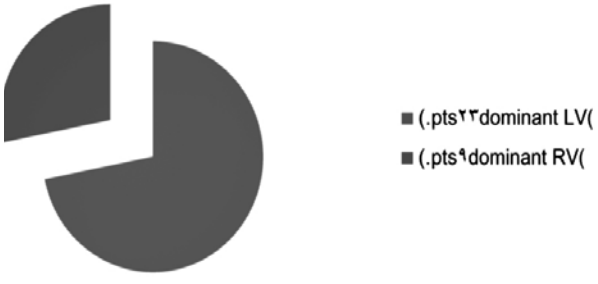

fig.1:dominant vetricular morphology

Primary diagnosis	N
Tricuspid atresia	15
Unbalanced AVSD	8
HLHS	5
Others	4

Table 1 : Distribution of primary diagnosis

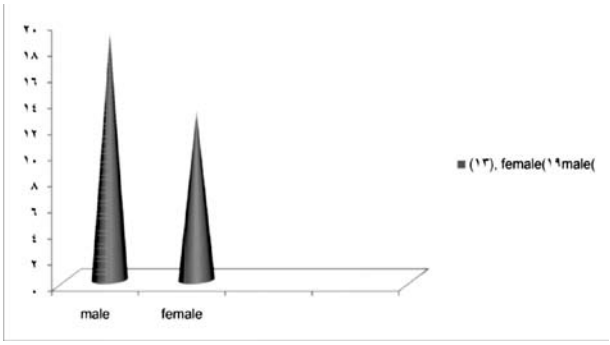

Fig.2: Male to Female ratio

Preoperative echocardiographic studies were reviewed to detect the morphology of the AVV and the pathology in cases with AVVR and the data were analyzed for evaluation and the cases were divided into two groups based on the degree of AVVR prior to the Glenn operation, group A (mild to moderate AVVR) and group B (moderate to severe AVVR). The types of atrioventricular valves in each of the two groups are shown in table 2. 6 cases (45.55%) of the valves repaired were common atrioventricular valves.

Group	Valve type	n	AVVR
Group A (17 cases)	Absent right AVV	11	0
	Absent left AVV	3	1
	Common AVV	2	1
	Double inlet RV	1	1
Group B (15 cases)	Absent right AVV	4	2
	Absent left AVV	2	0
	Common AVV	6	5
	Others	3	1

Table 2: AVV types and distribution between the two groups

From table 2, we concluded that there is 17 patients in group A (mild to moderate AVVR) and 15 patients in group B (moderate to severe AVVR). 6 cases from 8 cases had common AVV underwent valve repair either to close the cleft or to overcome the deficiency in tissue leaflets by partial annuloplasty . The two cases with absent left AVV did not need any surgical intervention to repair the significant regurge as the only pathology was moderate annular dilatation which supposed to be due to volume overload, One case with double inlet RV needed surgical intervention to close the small and severely deformed left AVV. The other three cases underwent AVV repair needed only annuloplasty due to severe annular dilatation. From statistical analysis moderate or severe AVVR was significantly more common in patients with common atrioventricular valve morphology, There was no significant difference in the prevalence of significant AVVR among patients with mitral, tricuspid, or two atrioventricular valves.

Bidirectional Glenn anastomosis was performed at a median age of 9.2 months (range from 4 months to 5.4 years), bilateral BDG was done in 4 cases due to presence of persistent left superior vena cava. All cases done on-pump, 11 cases underwent AVV repair and the remaining 21 cases did not undergone any surgical intervention to re pair the AVVR. There was no hospital mortality, but 5 cases needed long ICU stay, 4 of them needed nitric oxide inhalation due to reactive pulmonary hypertension. The fifth one actually behaved very well in the first postoperative day and extubated in the second postoperative day but one days after, patient started to misbehave, first desaturated and re-intubated, saturation did not improve inspite of maximum ventilatory support, next hemodynamics started to deteriorate, chest x-ray showed opacity on the upper left lung zone, cardiac catheterization was done and showed anomalous drainage of upper left pulmonary vein, patient went back to operating room to take down the Glenn shunt and central shunt was done

The follow-up echocardiographic data showed that the degree of AVVR improved in all patients of group A. One of the 11 patients who underwent valve operation at the time of BDG showed moderate to severe left AVVR due to residual cleft in the anterior leaflets which controlled medically and repaired at time of completion of Fontan operation. Two patients from group B who did not undergo AVV repair needed surgical intervention during completion of Fontan operation. Therefore, there were 18 patients with significant AVVR who underwent BDG without additional interventions showed significant improvement in atrioventricular valve function and in all of those 18 patients had the cause of AVVR was only annular dilatation. Three patients required later AVV repair, actually one of those three patients underwent failed valvoplasty during BDG. No patients required valve replacement at a later date.

Discussion :

According to Seliem et, al.[6]the ventricular volume decreases significantly and the right ventricular end-diastolic volume decreases by 33% after BDG and this ventricular volume reduction result in a decrease in atrioventricular valve annular diameter, which might improve atrioventricular valve function after BDG. Our study as well as many other series supported this view; however, such studies have been limited by small patient number. On the other hand, Reyes and colleagues[7] reported that atrioventricular valve function did not significantly improve after BDG in their patients group with hypoplastic left heart syndrome that had moderate or severe AVVR preoperatively. Some of the present series demonstrated that just over one-fifth of subjects with hemodynamically significant AVVR demonstrate improvement in valve function after BDG [8,9].

The mechanism of AVVR is an important factor in determining which patients are likely to demonstrate improved atrioventricular valve function after BDG. Although the statistical analysis limitation due to small number of patients, the significant improvement occurs most commonly in patients with normal atrioventricular valve structure in which the jet of AVVR is central due to leaflet non-cooptation as a result of annular dilatation. Imai and colleagues did not rely on the previous mechanism and used a circular annuloplasty even in those patients with mild AVVR. According to William and associates [10]Patients with structural abnormalities of the valve rarely demonstrate improvement after BDG and none of the cases with dysplastic valve leaflets or restricted movement of valve leaflets demonstrated significant improvement in AVVR after BDG if valvuloplasty was not undertaken concomitantly.

Inspite of patients who had repair of the atrioventricular valve required more days on mechanical ventilation as well as in the intensive care unit; the total length of hospital stay was not prolonged. In their analysis to subset of patients with moderate to severe AVVR , William and associates were unable to elicit

any significant differences in the duration of ventilation, length of ICU and hospital stays, as well as in the incidence of late complications. Ahmad Sallehuddin reported also, that the incidence of late complications and the overall survival were not different in patients with repair of the atrioventricular valve as compared to their counterparts without repair.

In our study, there was no mortality during hospital stay or during period of follow up (6 to 12 months), so we could not judge the risk of AVVR on mortality, of course limited number of patients and limited time of follow up affected our results. Imai and colleagues[11]reported a 12-year mortality of 27% for patients with significant AVVR versus 9% for patients with no or trivial AVVR. Recent reports that have failed to identify AVVR as a risk factor for patients after bidirectional Glenn operation. In his experience, Ahmad Sallehuddin suggests that the concomitant repair of the atrioventricular did not significantly alter the mortality rate.

No valve replacement recorded in our group of patient, but Mosca and colleagues reported one patient went on to require valve replacement. .

Conclusions :

Patients with trivial and mild AVVR do not get obvious benefit from surgical intervention for valvoplasty during BDG operation.. Valve repair in patients with moderate to severe AVVR improved the regurgitation. Mechanism of AVVR and the potential for improvement after BDG must be considered before any surgical decision for valvoplasty as we noticed in this study that significant AVVR can improve in some patients undergoing the BDG without concomitant valvuloplasty. From our results significance of AVVR is not a major risk factor of early or intermediate-term mortality after BDG, but more studies is needed to focus on its long term effect

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Intra Aortic Balloon Pump Improves The Early Outcome Post Left Ventricular Systolic Restoration

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Background: **Ischemic cardiomyopathy with left ventricular aneurysms are treated surgically with coronary artery bypass grafting and the Dor technique for left ventricular restoration.(1) As we see a lot of Septuagenarians, octogenarians and Nonagenerians, we are involved in the management of those patients with ischemic cardiomyopathy with left ventricular aneurysms. Intra-aortic balloon pump with marked reduction in preoperative cardiac function may improve the outcome after left ventricular restoration. (2)**

Methods: **A retrospective analysis was performed on 86 patients who had left ventricular restoration in King Fahd Armed Forces Hospital; Jeddah; KSA. Intra-aortic balloon pump was used for the patients with a preoperative ejection fraction (EF) < 25%.**

The demographic data of the patients characteristics, intra-operative, post-operative data, Intensive care unit and hospital length of stay, complications and early mortality were analysed in both groups; those with IABP (Group 1) and those without IABP(Group 2).

Results: **The study included 86 patients; (all were males), of whom 24 had preoperative EF less than 25% and needed intra-operative IABP before Left Ventricular Restoration (LVSR) and continued in the early postoperative ICU stay. Overall 30 days mortality was 1.16% with only one death occurring in the IABP group (1/24) and no deaths occurring in non IABP group. The Mean length of stay was 8.4 ± 9.5 days for all patients. Postoperative NYHA was 1.8 Vs 1.3 in groups (1) and (2). Hospital Re admission was significantly higher in group (1).**

Conclusions: **Very Low ejection fraction is a risk factor but not a contraindication to left ventricular restoration. IABP improves the early outcome and yields acceptable results post LVSR. LVSR is a safe procedure and can be done with acceptable results.**

Coronary artery disease causes congestive heart failure in two thirds of the cases. Dor and colleagues demonstrated that left ventricular restoration is an effective surgical treatment for dyskinetic aneurysmal disease and akinetic dilated ventricles, resulting in improvements in both systolic function and New York Heart Association (NYHA) functional class. Wide spread acceptance of this procedure has been slowed by many surgeons' reluctance to exclude normal appearing akinetic segments of the ventricle; therefore, coronary artery bypass grafting (CABG) alone is performed. (1)

Intra-aortic balloon pump with even marked reduction in preoperative cardiac function (ejection fraction <25%) may improve the outcome after left ventricular restoration. (2)

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We therefore analysed 86 of our patients who underwent left ventricular restoration to determine if IABP will affect the early postoperative outcomes.

Methods:

This is a retrospective study that included extensive experience of King Fahd Armed Forces Hospital; Jeddah in the management of the patients with ischemic cardio-myopathy who underwent left ventricular restoration in about 10 years. We included those patients with

1. Ant - Sept MI > 2 month .
2. EF < 35 %.
3. Symptoms of angina or heart failure.
4. LVESVI > 60 mls/m2 (if measured)
5. Favorable anatomy as per Cardiac Magnetic Resonance and angiography.

We excluded those patients with

1. Recent acute MI < 4 - 6 Weeks.
2. RV Failure.
3. History of prior coronary artery surgery.
4. Severe Pulmonary Hypertension > 60mmHg.

Cardiac MRI is available in Jeddah and was Performed in 25% of cases preoperatively to assess the anatomy, geometry and LV volumes. Viability Study & Myocardial contrast studies. Eighty six patients (all are males) were our candidates and they were retrospectively divided into two groups;

Group (1); with IABP (n = 24) with (EF < .25) and

Group (2); without IABP (n = 62) (EF ≥.25).

Both groups received nearly the same inotropic support both pre, intra and postoperatively. The charts of those patients were reviewed and the data were presented as in the tables (1-2-3).

	IABP(24)	IABP(62)	
Age	59.1	56.4	
Male Sex	24	62	
Mean NYHA	3.33	1.99	S.
+DM	75%	61.2	S.
+Renal Dysfunction	41.6%	29%	S.
+Valve Disease	58%	38%	S.
Mean Pre Op. EF	19.4%	29.3%	

Table (1); The preoperative Data.

	IABP(24)	IABP(62)	
Grafts	2/patient	2.6/patient	NS
Isolated LVSR	4(16.66%)	10 (16.12%)	NS
LVSR +CABG	10(41.66%)	36(58.06%)	S
LVSR +CABG+MVP	10 (41.66%)	10(16.12%)	S.
LVSR+CABG+MVP+TVP	0(0 %)	6(9.67%)	S.
Inotropic Support days	3	3	
30 Days Mortality	1 (4.16%)	0	
Mean hosp stay days	12	10	NS
Mean ICU stay Days	10	6	S.
Clamp In Min.	74	102	S.
CBP In Min.	100	130	S.
One Re Admission (No.)	3(12.25%)	2(3.22%)	S.
> 1 Re Admission	2(8.33%)	0	S.

Table(2);The intra-operative and early post-operative data.

	IABP(24)	NO IABP(62)
Respiratory Failure	2 (8.33%)	5 (8.06%)
Renal Failure;	3 (12.25%)	9 (14.5%)
Creatinine>1.5	2	7
Requiring Dialysis	1	2
Reoperation	2 (8.33%)	5 (8.06%)
Stroke	3(12.25%)	7(11.29%)
Sepsis	3(12.25%)	6 (9.67%)
Urinary Tract Infection	4(16.66%)	9(14.5%)
Pneumonia	3(12.25%)	7(11.29%)
Sternal Wound Infection	2(8.33%)	6 (9.67%)

Table(3); Some of the early postoperative complications.

Routine trans-oesophageal echocardiography was used before cardiopulmonary bypass to evaluate the left ventricular function and the valves functions and anatomy and the position of the IABP.

Routine median sternotomy was our approach. Intra-Aortic Ballon pump is usually inserted through the Seldinger technique and very rarely through the open technique. Its position is confirmed by the TEE and or the CXR. Cardiopulmonary and warm cardioplegia were our tools. The cross clamp was then applied and the heart arrested with warm blood antegrade cardioplegia every 20 minutes as usual. CABG was performed as necessary. Left Ventricular Restoration (Dor procedure) and the valve procedures were performed before the proximal anastomoses. The left ventricle is opened near the apex at least 1 cm lateral to the septum. We extended the ventriculotomy parallel to the left anterior descending artery. inspection and may be palpation of the ventricle was done to delineate the scarred and viable myocardium, with scar appearing white. A Prolene suture is placed along the margin of the scar in circumferential or purse string fashion as described by Dor. Ensure that the previous stitch was placed no deeper into the ventricle than the base of the papillary muscles. Put a purse string to anchor the endoventricular patch and reduce ventricular volume. A Dacron patch is then sewn to the ridge created by the purse-string suture with Prolene in a running fashion. Fold the ventriculotomy over the patch and close it with 2-0 Prolene. Be sure that there is no distortion of the patch . Good hemostasis is done as our routine. Patients were then weaned off cardiopulmonary bypass with ionotropic agents and or intra-aortic balloon pump (IABP). We usually re-assess the contractility, valves functions and ventricular size through the transesophageal echocardiography. Our patients are transferred to the ICU; mechanically ventilated and on inotopes as required and or IABP. Our patients are discharged home usually on angiotensin-converting enzyme inhibitors, diuretics, and ß-blockade. Follow-up was performed by the referring cardiologist and the surgeon whenever indicated. Follow-up was done through out patients clinic visits and or the telephone contact. Our mean follow up is more than 5.5 years. Simple statistical analysis was done with significance when the P value is <0.05.

RESULTS:

Our study included 86 cases of left ventricular restoration done in King Fahd Armed forces Hospital: Jeddah in 10 years. The mean age was 59.1 years (range, 36 to 92 years). Mean NYHA functional class was 3.3 (range between 1 to 4) in group 1 and 1.99 in group 2. (range, 1 to 4) with a significantly worse NYHA class in group 1. The mean preoperative ejection fractions measured with echocardiogram were 23.4% (range 10 to 35%). The preoperative ESVI was 89 in group 1 and 93 in group 2. Co-morbidity included diabetes mellitus, renal dysfunction and concomitant mitral and or tricuspid valve diseases. Diabetes mellitus was present in 75% in group 1 and in 66.6% in group 2. Renal dysfunction was reported in 41.6% Vs 29%. Mitral valve diseases were in 58% Vs 38%. CABGs were done in 83.3% in group 1 Vs 83.9% in group 2. There is no significant difference in the number of bypass grafts between the two groups 2/paient Vs 2.6/ patient. Concomitant mitral repair was done 41.6% in group 1 Vs 25.8% in group 2. Tricuspid valve repair was needed in 6 cases in group 2 and never needed in group 1. The aortic cross clamp time was significantly higher in group 2 (92 min. Vs 74 min.) and so is the CBP 120 min. Vs 100 min.). One patient of the group (1) died with no deaths in non IABP group. Overall 5 -year survival was 76%. Five-year survival in group (1) was 72.6% versus 78.5 % in group (2). Mean length of stay was 8.4 ± 9.5 days for all patients and was not significantly different between the two groups (12 Vs 10 days). Postoperative NYHA was 1.8 Vs 1.3 with % of improvement of 46% Vs 35%. Readmission was significantly higher in group (1); 41.6 % Vs 6.4%.

DISCUSSION:

King Fahd Armed Forces Hospital Jeddah was pressurized by many factors such as competition, being a tertiary centre, increasing flow of cases and politics to accept older and older patients. In the beginning, there was a fear of the outcome, however, we were encouraged by the unexpected good results. As the age of the population increases with time due to greater preventive medicine measures and better medical therapies for chronic diseases, these procedures are being performed in an ever-aging population. Perceptions of elderly patients, their families, and their physicians that these patients may have lower functional reserve and more co-morbid conditions, which are more likely to lead to complications or death, than younger patients have made cardiologists and cardiac surgeons hesitant to offer elderly patients life saving or symptom-resolving cardiac surgery . Because of advances in cardiopulmonary bypass technique, myocardial protection and improved perioperative care, cardiac surgery can safely be performed in elderly patient with minimal increase in mortality, however, at a price of increased morbidity. The number of patients older than 70 years are increasing all over the world. (3)

Of the 3115 cardiac surgical operations at the King Fahd Armed Forces hospital between January 2OO2 and December 2OO8, 352 operations (11,3%) were in patients >70 years old. 316 (89.7%) Were septuagenerians, 35 (9.9%) were octogenerians and 1 (0.3%) was anengenerian.

Heart failure is characterized by progressive chamber dilation and deterioration of pump function that is driven by the increased hemodynamic and neurohormonal stresses present in this condition. Structural, cellular, extracellular, molecular, biochemical, and metabolic mechanisms compose what is called Ventricular remodeling which is not just a manifestation of disease, but is an important mechanism of disease. Remodelling follows the Laplace's law (pressure ∝ wall tension/ radius). Angiotensin-converting enzyme inhibitors, ß-blockers, cardiac resynchronization therapy, and passive ventricular constraint are beneficial as they may be able to inhibit or reverse remodel the heart.(4-5)

The elliptical normal shape of the heart becomes spherical after anterior septal infarction. LSVR restores the Size and shape toward a more normal elliptical configuration by placing a patch to exclude the scar and returning non scarred remote muscle back to its conical form. (6)

Intraaortic balloon pump (IABP) counterpulsation provides an essential circulatory support for numerous patients experiencing hemodynamic instability especially after acute myocardial infarction, in those with cardiogenic shock, in those with severe left ventricular dysfunction, during angioplasty and those who have undergone myocardial revascularization. The potential clinical applications of IABP to include its use as preoperative therapy for high-risk patients undergoing coronary artery bypass grafting (CABG) has been extended. (7-8)

Preoperative IABP therapy significantly improves the cardiac function before a procedure, thus allowing CABG to be performed on a less-ischemic myocardium, which may be the main explanation for improved postoperative cardiac function. This was reflected in reduced hospital mortality and morbidity; shortening of both ICU and hospital stay. (7-9)

Our study includes a relatively good no. of cases (86 cases) in about 10 years. Regarding the preoperative patient characteristics, Group (1); IABP group was a higher risk and it included a significantly higher co morbidity as DM, renal dysfunction, concomitant valve diseases, lower EF and higher NYHA class.(Table 1). Lower EF was the indication of IABP. Regarding the intraoperative findings in table (2), there was no significant difference regarding the no. of grafts needed nor the % of isolated LVSR. Although the incidence of LVSR+CABG was higher in group (2), the combination of LVSR +CABG+MVP was significantly higher in group (1). The aortic clamp and CPB times were significantly longer in group (2) may be due to relatively more need to more grafts and more tricuspid valve repairs. The postoperative inotropic support was the same in both groups. Analysing the postoperative outcome in table (3); we found that group (1) had a significantly more readmission and sepsis. It had a non significantly longer hospital and ICU stay, higher rate of re-operation, Urinary Tract Infection and sternal wound infections. However, they had a lower rate of renal failure and lower stroke. We used the IABP as an intra and early postoperative support for 48 hours. So, more or less IABP in such higher risk patients achieved an acceptable mortality(<2%), comparable ICU and hospital stay, EF and NYHA improvements that should be reflected on a better quality of life, comparable complications and 5 years survival with group (2). So, IABP in such higher risk group improves the early and even the 5 years survival. While Ramnarine et.al.,2005 used IABP as follows; group A; No IABP support in 7461 patients (96.92%) , group B; Preoperative IABP support in high-risk patients in 27 patients (0.35%), group C; Preoperative IABP support in haemodynamically compromised patients in 25 patients (0.35%), group D;Intra-operative IABP support in 120 patients (1.54%) and group E; Post-operative IABP support in 65 patients (0.84%) (10)

The EF increased in both groups from 19.4% to 30.3% in group (1) and from 29.3% to 39.7% in group (2). This means a 56.2% improvement in group (1) and 35.5% in group (2). This may be due to the fact that left ventricular restoration reshapes and decreases the dilated ventricle volumes, thus decreasing the wall sress and myocardial oxygen consumption. It increases the wall compliance and the angle of systolic fiber contractions and all these improve the EF.(22) In The series of Di Donato et.al.,2009, the EF increased from 0.32 ± 0.07 to 0.45 ± 0.10 in type I, from 0.30 ± 0.09 to 0.41 ± 0.10 in type II and from 0.27 ± 0.08 to 0.34 ± 0.07 in type III. (11)

The currently accepted indications for IABP use have expanded to include ongoing unstable angina refractory

to medical therapy, acute myocardial ischemia/infarction associated with percutaneous transluminal angioplasty (PTCA), perioperative low cardiac output syndrome, cardiogenic shock after myocardial infarction, congestive heart failure, Bridge to heart transplant, ischemic ventricular septal defect, acute mitral valve insufficiency and pPoorly controlled perioperative ventricular arrhythmias. (12-13)

The in-hospital mortality of Ramnarine et.al.,2005 was very high in group D and E ; 43.6% versus 4.16% in our study, postoperative MI of 45.8% versus 4.16%, stroke of 7.7% Vs 12.25% in our study, Post-operative renal failure of about 27% Vs 12.25%, Deep sternal wound infection of 6.8% Vs 8.33% and Re-exploration for bleeding in 13.9% Vs 12.25%in our group (1) (10)

Preoperative ejection fraction ≤.30, LVESVI ≥80 mL/m2, concomitant mitral repair, advanced NYHA functional class, and age ≥75 years were the risk factors of death at any time postoperatively in the study of Adams et.al., 2006. This was consistent with our early mortality in group (1). (2)

IABP assist significantly increases graft flow and also diastolic components of flow. The degree of increase is greater in the in-situ Left Internal Mammary Artery (LIMA) supplying the left anterior descending artery than in Aorto-Coronary grafts anastomosed to other coronary arteries. IABP increases the diastolic component more in A-C grafts than in in-situ LIMAs, probably because of different flow characteristics of the two grafts (14).

IABP significantly increases the global graft flow in various types of conduits, such as saphenous vein grafts, radial artery, gastroepiploic artery, and internal thoracic arteries. It also increases the diastolic components. Differences in flow between different graft materials may certainly be a reflection of the inherent characteristics of each material used, but it is also related to the peripheral resistance. The peripheral resistance is increased when the distal grafted vessel is stenosed or occluded as in infracted myocardium. IABP has a significant positive effect of preoperative, proactive IABC in high-risk patients undergoing myocardial revascularization compared with the controls. The preoperative IABP increases preoperative cardiac index, thus resulting in myocardial revascularization on a less ischemic heart, This may result in a decreased resistance in the outflow vascular bed, which in itself may result in an increased graft flow (15)

Kantrowitz et.al.,1986, showed a 65% survival in 15 year study of 733 patients who needed IABP, while Sirbu et.al.,2000., showed a 72% survival in a 10 year study. (16-17).

Our overall 5-year survival was 76%. Five-year survival in group (1) was 72.6% versus 78.5 % in group(2). These results are consistent with other published reports especially those of Creswell et.al.,1992 who showed a 5 year survival of 71% and Goldberger et.al.,1986 who showed a 2 year survival of 63% and better than those of Strum et.al 1980who showed a 7 year survival of 45% and Macoviak et.al., 1979 who showed a survival of 36%in 4 years. (18-19-20-21)

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Intermittent Antegrade Warm versus Cold Blood Cardioplegia during elective revascularization of coronary patients with Low Ejection Fraction

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Background: **Myocardial preservation during on-pump revascularization of low Ejection Fraction coronary patients is crucial. However, the ideal way of intraoperative protection of these patients is still controversial Our Objective wase Comparing Intermittent Antegrade Warm Blood Cardioplegia (IAWBC) to an established cardioplegic strategy which is Intermittent Antegrade Cold Blood Cardioplegia (IACBC) in this group of patients in elective on-pump coronary surgery with respect to myocardial ischaemia and outcome.**

Methods: **In a randomized trial , from October 2005 to April 2009 in Ain Shams University Hospitals, Egypt and Saud Al- Babtain Cardiac Centre (SBCC), KSA. IAWBC (33°C) (n=50) was compared to IACBC (4°C) (n=50), regarding the myocardial ischaemia and functional outcome using creatine kinase MB isoenzyme (CK-MB) and cardiac troponin-I (cTNI) measurements to assess ischemia and echo-cardiographic (TEE and TTE) measurements including Ejection Fraction (EF.) & Segmental Wall Motion Scoring Index(SWMSI) to assess the recovery of cardiac contractility .**

Results: **Preoperative parameters were comparable in both groups (IAWBC vs IACBC) ; There was no differences regarding mortality (2%versus 6%), incidence of perioperative myocardial infarction (2% both), low cardiac output (2% versus 4%), length of ICU stay (2.0±2.4 versus 2.2±3.0 days). The necessity of defibrillation after cardiac arrest was significantly less frequent (22% versus 58%, P<0.001) and of lower intensity (5.4±10.8 versus 11.8±20.6 Joules, P<0.001) in the IAWBC but significant difference in the incidence of postoperative atrial fibrillation (34% versus 18% P P<0.001) was noted. However, There was a statistically significant difference regarding Dosage need of epinephrine at the end of operation (0.086±0.04 versus 0.172±0.03 µ/kg/min, P<0.001), the need for intra-aortic balloon pump(IABP)(8%versus 16% P<0.001). Also,patients of the IACBC group required significantly more frequent re-thoracotomy due to bleeding within the early postoperative course. Ischaemia markers were significantly lower in the IAWBC group.CK-MB levels were higher in the IACBC group at day 0 (0.26±0.19 versus 0.20±0.15µmol/l, P=0.003) and day 1 (0.30±0.25 versus 0.23±0.11µmol/l, P=0.007) and day 2 (0.20±0.12versus 0.13±0.09 µmol/l, P=0.003). Also, cTNI levels were higher in the IACBC group at day 0 (1.73±0.94versus 0.66±0.32µmol/l, P=0.001) and day 1 (2.01±0.99 versus 0.95±0.59µmol/l, P=0.001) and day 2 (0.98±0.52versus 0.60±0.18 µmol/l, P=0.007) and day 3 (0.33±0.13versus 0.20±0.06 µmol/l, P=0.004) .At postoperative day 7th , levels of both enzymes were of non statistical significance. Statistically highly significant improvement in the mean EF. and SWMSI Immediately after weaning off bypass by TEE in the IAWBC**

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group (0 Day), but not in the IACBC group.(25.7±12.9 Pre- versus 42.3±6.15 Post P<0.001)&(2.73±0.14 Pre versus 2.23± 0.12Post P<0.001). IACBC showed statistically insignificant improvement (0 Day) by TEE (26.2±15.8 versus 32.4±7.18 P=0.08) & (2.71±0.12 versus 2.56± 0.16 P= 0.07) but statistically significant improvement started (3rd Day).

Conclusion: **IAWBC is a more safe and simple method in elective on-pump coronary artery bypass surgery in low EF.patients. Significantly lower ischemic markers and cardiac contractility parameters suggest an improved myocardial protection compared to IACBC.**

The number of patients with advanced left ventricular dysfunction who undergo coronary artery bypass graft**in**g (CABG) has **in**creased **in** the past few years[1] . Although the recovery of impaired **myocardial** function has been shown to occur after CABG, contractile left ventricular dysfunction rema**in**s a negative determ**in**ant of postoperative outcome[2]. Impaired left ventricular function, which has been shown to be an **in**dependent predictor of operative mortality **in** patients who undergo CABG[3], can also lead to low cardiac output and a high postoperative mortality rate [4]. Many patients with impaired left ventricular function require **in**otropic or mechanical support for hours to days after surgery [4]. **In** the last decade, an improvement **in** surgical techniques and perioperative management has led to a better postoperative course and decreased postoperative mortality and morbidity rates **in** this high-risk group of patients [5.6].

Termination of ischemia by the resumption of coronary perfusion, although necessary for myocardial recovery, can result in a paradoxic extension of ischemic damage, the so-called ischemia-reperfusion injury. A large body of evidence indicates that this injury is mediated by oxygen-derived free radicals, which are maximally produced at the onset of myocardial reperfusion and induce biomembrane peroxidation. Free radical generation and oxidative stress are evident in the ischemic reperfused human myocardium; accordingly, antioxidant administration has been reported to result in a dramatic improvement in postoperative outcome. Intermittent antegrade warm blood hyperkalaemic cardioplegia (IAWBC) has been recently proposed as an improved method of myocardial protection and decreased tissue oxidant burden leading to prevention of myocardial oxidative stress [7]. However, certain high-risk subgroups of patients remain at increased risk for complications and death despite progressive advances in perioperative care and myocardial protection . Low EF.patients are high risk group

Methods:

In a prospective, randomized trial , from October 2005 to October 2009 in Ain Shams University Hospitals,Egypt and Saud Al Babtain Cardiac Centre(SBCC), KSA.100 patients with reduced left ventricular ejection fraction were randomized and studied. The inclusion criteria were the presence of left ventricular dysfunction (ejection fraction [EF] 0.35), isolated CABG, and no acute myocardial infarction during the month that preceded the operation. Exclusion criteria were prior cardiogenic shock, emergency surgery, preoperative implantation of an intraaortic balloon pump, combined valve procedures, or a left ventricular aneurysmectomy. Patients were randomized into the two study groups of IAWBC or IACBC, respectively. This study was approved by the Medico-Ethical Review Committee, and an informed consent was signed by every patient before enrollment.

Surgical Technique:

In all patients studied, anesthesia was induced with Fentanyl (5-10mcg/kg) propofol (2.0 to 2.5mg/Kg) and muscle relaxation with atracurium (0.5 mg/Kg). Ventilation was controlled with oxygen in air (50%). Anesthesia was maintained with continuous infusion of propofol (1-2mg/Kg/h) and fentanyl(1-2mcg/kg/h)and atracurium 0.5mg/kg/h.

Before sternotomy, A TEE multiplane probe was placed in the oesophagus for evaluating the heart preoperatively. (PHILIPS ;SONOS 5500, Hewlett-Packard).

After median sternotomy,and pericardiotomy, and while the patient was briefly disconnected from the ventilator (to obtain end expiratory images) to minimize global cardiac movement; the left ventricle was imaged along the three standard longitudinal and short axis views seen before which can show all the 16 segments of the LV.

A complete data about the global LV function were obtained in the all patients including Systolic function (ESV,EDV,EF "Simpson Method" and SWMSI)

In order to quantitatively assess the regional wall motion in the ischaemic and reperfused areas, the percentage increase in segmental wall thickening and endocardial motion during systole was used in the

same transesophageal echo image off line tracing of the endocardium and epicardium, wall thickness was measured at the center of the segment on the end-systolic and end-diastolic images, and percentage increase in segmental wall thickening during systole was calculated. Intraobserver and interobserver variability was minimized using the different new qualitative and quantitative indices available(acquastic quantification and harmonic imaging. A segmental wall motion score index (SWMSI) was calculated for each time point by dividing the sum of the 16 segmental wall motion scores by 16. SWMSI of 1 therefore corresponds to completely normal wall motion whereas SWMSI of greater than 1 indicates abnormal wall motion in one or more segments. TEE Evaluation of LV function included:

(1) Pre-CABG(s):After median sternotomy, retraction of the sternum and pericardiotomy
(2) Post-CABG(s): After assurance of haemodynamic stability, as the preCABG state (the same loading effects), and before removal of the sternal retractor.

(1) Global systolic function:
** EF using simpson method
** Segmental Wall Motion Score Index(SWMSI).
Using the most commonly used scoring system intraoperatively.

Score	Wall motion	Wall Thickening
1	Normal /Hyperkinesia	30%-50%
2	Mild hypokinesia	10%-30%
3	Severe hypokinesia	<10%
4	Akinesia	Absent
5	Dyskinesia	Wall thinning, Bulging

Smith J.S., Cahlan M.K. and Benefiel D.J. 1985. [8].

There was no difference regarding the surgical technique. All operations were performed on cardiopulmonary bypass (CPB) through a median sternotomy. During CPB at a mild systemic hypothermia of 33–34°C the flow was maintained at 2.5 l/min per m2 and the arterial pressure between 50 and 60 mmHg. Using solitary as well as sequential grafts distal anastomoses were performed during a single aortic cross-clamp time. Proximal anastomoses were constructed within the reperfusion interval using tangential clamping of the ascending aorta. The left internal thoracic artery (ITA) was used in all patients. Independent from the cardioplegia strategy and arterial grafts were preferred for patients younger then 65 years. Mostly one radial artery and seldom the right ITA were used as graft material in these patients.

Application of cardioplegia:

In all patients cardioplegia was applied via the aortic root immediately after aortic cross-clamping.

In the IAWBC-group oxygenated blood was infused at 33–34°C into the aortic root by means of 1/4-inch tubing and a roller pump taken directly from the oxygenator. The tubing is connected to a Syringe pump that deliver potassium(K) In the concentration of 2 mEq./ ml. After the first infusion of cardioplegia (600 ml of blood and 10-14 mEq. K (5-7ml) In 2 min),till the heart arrests. Reinfusions are administered every 15 min. of ischaemia (400 ml of blood and 4 mEq. K (2ml.) in 2 min. MgSO4 was added to each dose,1gm in the 1st dose then half the dose in each maintainance dose. Flow rates of these infusions were adjusted according to the protocol of Calafiore et al. [7].

Patients of the IACBC-group received Buckberg-solution cooled at 4°C by a separate heat exchanger for a time of 4 min[9]. usually prepared by combining autologous blood obtained from the extracorporeal circuit while the patient is on cardiopulmonary bypass with the crystalloid solution. The ratio of blood to crystalloid varies among centers, we use the most common ratio being 4:1. (flow 200 ml/min and in hypertrophied hearts increase to 300 ml/min). As in the IAWBC-group an additional second or third shot of cardioplegia was administered each 20–25 min for a duration of 2 min (flow 200 ml/min). The solution is consisting of citrate-phosphate-dextrose (CPD), tris-hydroxymethyl-aminomethane (tham) or bicarbonate (buffers), and potassium chloride. The CPD is used to lower the ionic calcium, the buffer is used to maintain an alkaline pH of approximately 7.8, and the final concentration of potassium is used to arrest the heart (approximately 16 mmol/L).

Ischemia.markers : Quality of myocardial protection was assessed by ischemia markers cTNI and creatine kinase MB isoenzyme (CK-MB). For evaluation of postoperative enzyme kinetics patients suffered from a myocardial infarction within the peri-operative course were excluded to avoid interferences with incidence and enzyme release.

The CK-MB activities were analyzed by the SYNCHRON® Test (Beckman Coulter GmbH, Unterschleissheim, Germany). The cTNI-concentrations were measured by the Access® Accu TnI Troponin I Assay (Beckman Coulter GmbH, Unterschleissheim, Germany).

Definitions and data collection:

Operative mortality was considered as death within the hospital stay. A diagnosis of postoperative myocardial infarction was made according to the following criteria: new Q-waves in two or more contiguous electrocardiographic leads, poor R-wave progression, new left bundle-branch block, and unstable ventricular rhythm. Values of the myocardial-specific cTNI were considered significant reaching a level of more then 10 ng/ml at 24 h postoperatively, according to a previous publication[10]. Cardiac enzymes and electrocardiogram were evaluated immediately after admission to ICU and at the 1st, 2nd, 3rd and 7th postoperative day.

Statistical-analysis : Statistical analyzes were performed using the SPSS for Windows 10.0 software system (SPSS Inc., Chicago, IL). Variables were expressed as mean±one standard deviation. Univariate analysis of variance (ANOVA) as well as ANOVA with repeated measurements were used for the comparison of the groups. Significance was assumed, if the P-value was less than 0.05. Correlation of ischemia markers cTNI and CK-MB with the cumulative amount of defibrillation energy and preoperative creatine was estimated by the method of Pearson.

Results:

Preoperative and demographic data: were comparable in both groups (Table 1).

Intra-operative analysis: There was significant differences in-between the groups regarding cumulative amount of cardioplegia solution as well as time until isoelectrical arrest of the heart. Hearts of the IACBC-group needed more cardioplegia solution and more time until isoelectrical cardiac arrest compared to the hearts of the IAWBC-group, however, no statistical difference in the two groups regarding the recurrence of electrical activity during the procedure. The necessity of defibrillation after cardiac arrest was significantly less frequent (22 versus 58%, P<0.001) and of lower intensity (5.4±10.8 versus 11.8±20.6 J, P<0.001) in the IAWBC group in spite of same potassium levels (4.5±0.6 versus 4.6±0.6 mmol/l, P=0.451). There was a statistically significant difference regarding hemodynamic stability and Dosage need of epinephrine at the end of operation (µg/kg/min) (0.086±0.04 in AWBC group versus 0.172±0.03 , P 0.000) and also the need for perioperative insertion of intra-aortic balloon pump(IABP) was significantly less in the IAWBC group(8 versus 16% P 0.001).Time at cardiopulmonary bypass , cross-clamp time and reperfusion time were insignificantly shorter in the IAWBC-group caused by the procedure needing shorter application time of cardioplegia compared to the IACBC-group. No difference in the no. of anastomoses in both groups.(Table 2).

Post-operative analysis: Results demonstrated no differences in-between the groups regarding mortality (2versus 3%), incidence of perioperative myocardial infarction (2.0% both), low cardiac output (2 versus 4%), length of ICU stay (2.0±2.4 versus 2.2±3.0 days).

But significant difference in the incidence of postoperative atrial fibrillation (34 versus 18% P 0.000) was noted. However, patients of the IACBC group required significantly more frequent re-thoracotomy due to bleeding within the early postoperative course (Table 3).

	IAWBC (n=50)	IACBC (n=50)	P-value
Age (years)	61.1±8.7	59. 2±9.6	0.135 (NS)
Gender (male/female)	35:15	37:13	0.943 (NS)
Body mass index	26.7±3.5	26.8±3.7	0.239 (NS)
Preoperative LVEF (%)	25.7±12.9	26.2±15.8	0.576 (NS)
Preoperative SWMSI	2.73±0.14	2.71±0.12	0.428 (NS)
History of myocardial infarction	31	32	0.642 (NS)
Preoperative creatinine (mmol/L)	93.2±88.0	103.1±100.25	0. 309 (NS)

Table 1. Preoperative and demographic parameters :

	IAWBC (n=50)	IACBC (n=50)	P-value	
Time on cardio-pulmonary bypass (min)	87.6±30.2	91.8±29.2	0.235	(NS)
Aortic cross-clamp time (min)	57.0±12.3	53.2±16.4	0.121	(NS)
Reperfusion time (min)	32.0±17.6	35.2±17.8	0.573	(NS)
Cumulative time of cardioplegia application (min)	5.7±4.4	6.8±2.3	<0.001	
Cumulative amount of cardioplegia (ml)	1560±738	2020±732	<0.001	
Time until cardiac arrest (sec.)	46.2±27.3	83.1±12.4	<0.001	
Number of patients with electrical activity during aortic cross-clamp time (%)	14	13	0.24	(NS)
Number of distal anastomoses	3.2±0.9	3.2±01.0	0.843	(NS)
Necessity of defibrillation (%)	22	58	<0.001	
Cumulative energy of defibrillation (Joules)	5.4±10.8	11.8±20.6	<0.001	
Dosage of epinephrine at the end of operation (μ/kg/min)	0.086±0.04	0.172±0.03	<0.001	
Need for IABP (%)	8	16	<0.001	

Table 2. Intraoperative data :

	IAWBC (n=50)	IACBC (n=50)	P-value	
30-day-mortality (%)	2	6	0.832	(NS)
Perioperative acute myocardial infarction (%)	2	2	0.920	(NS)
Low Cardiac Output (LCOP)	2	4	0.413	(NS)
Stroke (%)	4	6	0.231	(NS)
Re-thoracotomy due to bleeding (%)	0	6	<0.001	
Postoperative atrial fibrillation (%)	34	18	<0.001	
Postoperative ventilation time (h)	8.3±17.4	12.3±53.2	0.092	(NS)
Time at intensive care unit (days)	2.0±2.4	2.2±3.0	0.071	(NS)

Table 3. Clinical outcome :

Postoperatively the ischaemia markers were significantly lower in the IAWBC group , within the period of study using ANOVA with repeated measurements (Patients with perioperative myocardial infarction in both groups(2patients in both) were excluded .CK-MB levels were higher in the IACBC group at day 0 (0.26±0.19 versus 0.20±0.15µmol/l, P=0.003) and day 1 (0.30±0.25 versus 0.23±0.11µmol/l, P=0.007) and day 2 (0.20±0.12versus 0.13±0.09 µmol/l, P=0.003). At postoperative days 3 and 7 levels of CK-MB levels were of non statistical significance in both groups (0.11±0.07 versus 0.12±0.07µmol/l, P=0.23) and (0.08±0.04 versus 0.09±0.03 µmol/l, P=0.813) respectively (Fig. 1A). Also, cTNI levels were higher in the IACBC group at day 0 (1.73±0.94versus 0.66±0.32µmol/l, P=0.001) and day 1 (2.01±0.99 versus 0.95±0.59µmol/l, P=0.001) and day 2 (0.98±0.52versus 0.60±0.18 µmol/l, P=0.007) and on day 3 (0.33±0.13versus 0.20±0.06 µmol/l, P=0.004) .At postoperative day, 7 levels of CK-MB levels were of non statistical significance in both groups (0.11±0.05versus 0.08±0.04µmol/l, P=0.416) (Fig. 1B). There was no correlation of ischemia markers with the total amount of defibrillation energy (correlation of Pearson between -0.035 and 0.112) nor with the preoperative kidney function (correlation of Pearson between -0.082 and 0.010).

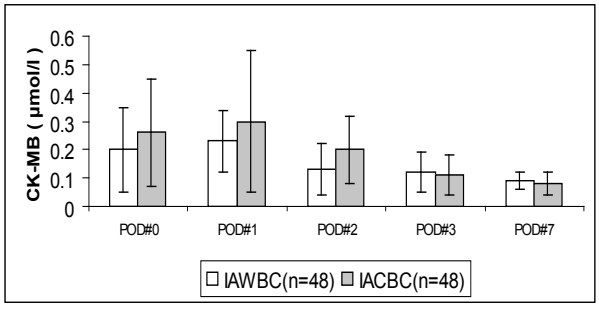

Fig.1A: ANOVA with repeated measurements revealed a significant difference in-between the two groups regarding the level of CK-MB (µmol/l).

Patients with acute myocardial infarction were excluded. We had recorded statistically highly significant improvement in the mean EF. and SWMSI Immediately after weaning off bypass by TEE in the IAWBC group (0 D),but not in the IACBC group.(25.7±12.9 Pre-versus 42.3±6.15 Post P<0.001)&(2.73±0.14 Pre versus 2.23± 0.12Post P<0.001). IACBC showed statistically insignificant improvement (0 D) by TEE (26.2±15.8 versus 32.4±7.18 P =0.08) & (2.71±0.12 versus 2.56± 0.16 P= 0.07) but statistically significant improvement started (3rd D) till the time of discharge(7th.D).

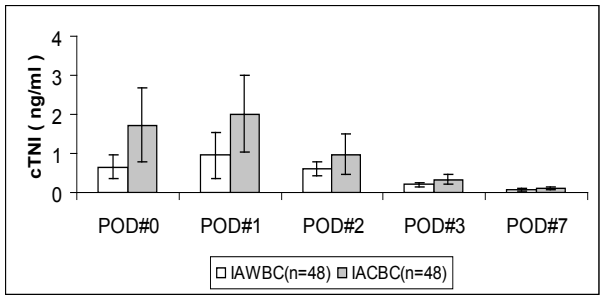

Fig.1B: ANOVA with repeated measurements revealed a significant difference in-between the two groups regarding the level of cTNI (ng/ml).

Ejection Fraction (EF.):(Fig.2A)

0 Post Operative Day (POD#0Pre ----} POD#0Post.):

IAWBC: EF:range from 20 – 35% mean 25.7±12.9---} 35 – 45 % mean 42.3±6.15

IACBC : EF:range from (20-35%)mean 26.2±15.8-----} 25- 35% mean 32.4±7.18

3rd Post Operative Day (POD#3):

IAWBC: EF:range from 35–45 % mean 42.3±6.15------} 37- 48% mean 44.1±8.12

IACBC:EF: range from 25- 35% mean 32.4±7.18-------}28-40% mean 38.3±9.22

7th. Post Operative Day (POD#7) :

IAWBC: EF: range from 37 – 48 % mean 44.1±8.12-----} 38 – 45mean 44.3±10.16

IACBC: EF: range from 28-40% mean 38.3±9.22--------}35-42% mean 40 ±12.34

Segmental Wall Motion Score Index (SWMSI): Fig.2B)

0 Post Operative Day (POD#0Pre ----} POD#0Post.):

IAWBC: SWMSI: range from 2.93- 2.50mean 2.73±0.14---}2.38 - 2.13 mean 2.23± 0.12

IACBC:SWMSI: range from 2.81–2.50mean 2.71±0.12----}2.81- 2.25 mean 2.56± 0.16

3rd Post Operative Day (POD#3):

IAWBC:SWMSI:range from 2.38 -2.13mean 2.23± 0.12) ----}2.25 – 2.13mean 2.19±0.13

IACBC:SWMSI:range from 2.81-2.25 mean 2.56(± 0.16)----}2.69- 2.25 mean 2.63±0.19

7th. Post Operative Day (POD#7) :

IAWBC:SWMSI:range from 2.25 – 2.13 mean2.19±0.13-----}2.25 -2.13mean 2.18±0.11

IACBC:SWMSI:range from 2.69- 2.25 mean 2.63±0.19-----}2.38 – 2.25 mean2.13±0.15

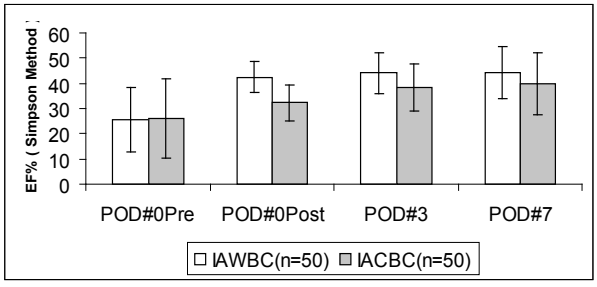

Fig.2A: ANOVA with repeated measurements revealed a significant difference in-between the two groups regarding EF.%:

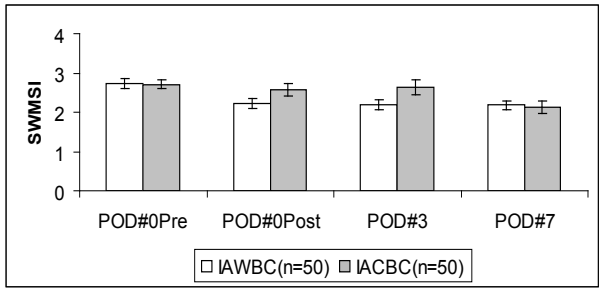

Fig.2B: ANOVA with repeated measurements revealed a significant difference in-between the two groups regarding SWMSI:

Discussion:

The warm blood cardioplegia was established into the clinical use by the warm heart surgery investigators group [11,12] basing on the observations of Buckberg and co-workers who found that the arrested, normothermic heart requires 75–80% less oxygen than does the normal working heart. [13].However, the continuous blood flow is a limitation of safety in coronary surgery. Calafiore and associates reported a very simple technique of intermittent antegrade warm blood cardioplegia in 1995 in a historical comparative study[7]. The beneficial outcome of this kind of cardioplegia was described by a lot of cardiac surgeons regarding cardiac metabolism [14,15,16,17]. Only few prospective randomized trials are available comparing the IAWBC with established cardioplegic strategies [15,18].Aim of our study was the comparison of IAWBC to our standardized cardioplegia protocol with intermittent antegrade cold blood cardioplegia according to Buckberg [19]. To avoid interferences with systemic perfusion temperature or other perfusion conditions both study groups received the identical peri-operative protocol with the exception of cardioplegia solution and cardioplegia temperature. The IAWBC technique of Calafiore was modified by lowering the cardioplegia temperature to the systemic perfusion temperature of 33–34°C and by magnesium supplementation according to Caputo and colleagues [20]. The magnesium supplementation was necessary because of a high rate of failed electromechanical arrest after application of cardioplegia at the time of preparation of this study. Also Pelletier and colleagues described a failure rate of 13% to achieve sustained electromechanical arrest by use of warm blood cardioplegia [21]. Using the magnesium supplementation this phenomenon did not appear in our experience. In a recent study the beneficial effect of magnesium as a supplement to warm blood cardioplegia on incidence of peri-operative arrhythmias was described. However, the decrease of atrial fibrillation observed by Yeatman and colleagues could not confirmed in our analysis [16]. The results of our study demonstrate no differences of mortality and peri-operative infarction but the need for intra-aortic balloon pump was significantly higher. However, patients of the IAWBC group needed less frequent defibrillation due to ventricular arrhythmias during reperfusion. The lower rate of ventricular arrhythmias was also observed by other investigators [7,21]. Additionally, Calafiore et al. [7] found a lower mortality, a less frequent use of intra-aortic balloon pump (IABP) and a lower incidence of inotropic support for weaning from cardiopulmonary bypass in his historical comparison. As the patients of Calafiore our patients of the IAWBC group could weaned from ventilation earlier than patients with IACBC but in our study it was statistically insignificant. The ischemia markers cTNI as well as CK-MB were significantly lower in the IAWBC group within the first postoperative days. These results confirm the observations of most other investigators [12,13,15]. They are corresponding to the data of Pelletier and colleagues who compared IAWBC and IACBC too. These authors also found a not different clinical outcome, however, a lower rate of ventricular arrhythmias and lower ischemic markers in patients with IAWBC. The cause of impaired myocardial protection using hypothermia is assumed in a prolonged disturbance of cardiac metabolism. Especially all adenosine triphosphate-dependent reactions are impaired, with a resulting negative influence on membrane stability, energy production, enzyme function, aerobic glucose utilization, adenosine triphosphate generation and utilization, cyclic adenosine monophosphate production, and osmotic homeostasis [7,22]. Biagioli et al. demonstrated a significant increase of oxidative stress measured by the glutathion redox status in cold blood cardioplegia [17]. Mehlhorn and colleagues found an activation of constitutive nitric oxide synthase (cNOS or NOS-III) and an increased cGMP content after hypothermic blood cardioplegia compared to warm blood cardioplegia[23].They concluded that

increased NO release secondary to NOS-III activation may have contributed to ischemia-reperfusion injury with decreased left ventricular function. Additionally, in our patients the time until isoelectrical cardiac arrest was significantly shorter in the IAWBC group compared to the IACBC group. The fast cardiac arrest might preserve the adenosine triphosphate content of the myocardium in the early ischemic period and influence the cell damage. Intermittent antegrade warm blood cardioplegia according to Calafiore et al.[7] is a technically very simple method. In contrast to cold blood cardioplegia no additional heat exchanger is necessary and the used drugs are available without preoperative mixture by a pharmacist resulting in lower costs for cardioplegia of less then the half. The Warm Heart Trial (WHT) was a randomized trial of 1732 patients in 1994 comparing cold versus warm cardioplegia that demonstrated significant decreases in low-output syndrome (9.3% vs 6.1%, P = .01) and enzymatically identified myocardial infarction (MI, 17.3% vs 12.3%, P < .01), In a recent study on 6064 patients undergoing isolated coronary artery bypass grafting, warm or tepid blood cardioplegia showed associated better early and late event-free survivals than is cold cardioplegia [24]. The left ventricular stroke work index measured at the end of a study comparing intermittent warm blood cardioplegia group (A) with another intermittent antegrade cold blood cardioplegia (B). Group A indicated a better functional recovery. Intermittent antegrade warm blood cardioplegia protects the myocardium from ischemia-reperfusion injury better than intermittent antegrade cold blood cardioplegia; this phenomenon may be partly due to the decreased tissue oxidant burden mediated by intermittent warm blood cardioplegia[25] . Because normothermic blood cardioplegia results in less severe myocardial ischemia-reperfusion injury and free radicals and oxidative stress are involved in the heart damage associated with ischemia and reperfusion, we hypothesized that normothermic blood cardioplegia might decrease myocardial oxidant load during ischemia and reperfusion and this may lead to early recovery of the ischaemic myocardium as occurred in our patients of study on the other hand, in a study to evaluate the early hemodynamic and metabolic features of Revascularization of severe hibernating myocardium in the beating heart, Pasini E, et al; investigated the effects of coronary artery bypass grafting (CABG) without cardiopulmonary bypass (CPB) in selected patients with severe hibernating myocardium. They selected twelve patients (EF = 25% +/- 0.7%) with reversible ventricular dysfunction (from 2.0 +/- 0.06 to 1.6 +/- 0.05 left ventricular score index by echo-dobutamine, P < 0.01) in the territory of the left anterior descending artery (LAD) have been studied. Revascularization was achieved by anastomosing the left internal mammary artery to the LAD. The ischemic time of LAD was 9.0 +/- 0.4 minutes. They found that Left ventricular function increased 6 hours and 48 hours after revascularization (left ventricular stroke work index from 32 +/-1.8 to 42 +/- 1.5 and 40 +/- 0.6 gxm/m2, respectively: p = 0.0001) [26] Regarding this opinion, specially if these results were on a larger population, the immediate effect of revascularization on the severly hibernating myocardium may not be the only factor that cause this immediate improvement in performance, a period of arrest with a good more physiological cardioplegia (like the intermittent antegrade warm blood cardioplegia) may be another important factor.

Lorusso R, et al., prospectively evaluated patients undergoing CABG with severe LV dysfunction and hibernating yocardium(HM) to elucidate postoperative prognosis. They enrolled 120 consecutive patients undergoing CABG with severe LV dysfunction and HM as assessed by dobutamine echocardiography and by rest-redistribution radionuclide (Thallium-201) study. Mean preoperative LVEF was 28% +/- 9 (range 10-40%). Intermittent antegrade worm blood cardioplegia was used. All patients underwent echocardiographic study to assess LV recovery of function intraoperatively, prior to hospital discharge, at 3 months, at 1 year, and yearly during the follow-up. LVEF significantly improved perioperatively (from 28+/- 9% to 40+/-2%, P<0.01). Increase in LVEF, however, was gradually offset over the time (EF of 33+/- 9%, 32+/- 8%, and 30+/- 9% at 3 months, and 12 months, and 8 years after surgery, respectively). Furthermore, patients who experienced limited LV functional recovery perioperatively had a more remarkable decline of LVEF thereafter, and suffered from recurrence of heart failure symptoms [27]. Simon P. et al,. had studied the immediate effect of coronary artery bypass grafting on regional myocardial function in severely dysfunctional segments (percent fractional area change less than 20%). Severely dysfunctional segments were found to be significantly improved immediately after bypass (14.7% +/- 0.9% before bypass to 27.7% +/- 2.1% after bypass, p less than 0.0001). This improvement was maintained 30 minutes after bypass (22.8% +/- 1.5%, p less than 0.001). They conclude that coronary revascularization exhibits an immediate beneficial effect on chronically underperfused myocardium having severely depressed baseline function [28]

Our results seem to be highly comparable with these authors regarding the immediate effect of revascularization on the EF. and SWMSI when using this system of intermittent antegrade warm blood cardioplegia. Based on our results and results of the others who used the same protocol of cardioplegia, it is not mandatory; as many surgeons believed before; that IABP (Intra Aortic Ballon Pumb) must be used prophylactic before the start of the operation and continued postoperatively till weaning of the patient. We have not us IABP in our study group was neither prophylactically nor in the early postoperative period , All of the patients needed it were in the ICU for stabilization and not to use very high doses of intropic support for these weak hearts . There was a significant difference in the need for it between the two groups of study. Accordingly, IABP must be available and ready for usage only when indicated. We are in agree with Caputo M. et al. in that the effect of warm blood cardioplegia on perioperative changes in myocardial performance is an open question[20].In our opinion the success of our protocol of cardioplegia is related to its role in counteracting the most accepted two causes of postoperative myocardial stunning mentioned by Gao WD;et al.;As the two chief explanations for stunning are:

1- An increased cytosolic calcium .

2-Formation of free radicals upon re-perfusion [29].So, MgSo4 and IAWBC can minimize stunning state early postoperatively.

Limitations of the study:

The most serious limitation of conventional assessment of segmental systolic wall motion is that it relies on subjective qualitative (or semiquantitative at best) visual interpretation instead of quantitative measurements. Better standarization of image acquisition and reading criteriae and the use of a more detailed 16 segment model have been proposed for improving interreader agreement, but will not eliminate all limitations of an essentially qualitative analysis [30].In our study, we have evaluated all of our patients offline to minimize this problem as much as possible.

Conclusion:

IAWBC is a safe and cost-effective method in elective on-pump coronary artery bypass surgery. Mortality and incidence of perioperative myocardial infarction demonstrated no differences in-between IAWBC group and IACBC group. However, significant lower incidence of ventricular arrhythmias and significantly lower ischemic markers due to reduced myocardial cell damage suggest an improved myocardial protection compared to cold blood cardioplegia in these patients.

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Intraoperative Loading Dose of Amiodarone as Prophylaxis against Atrial Fibrillation after Valvular Heart Surgery

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BACKGROUND: **Atrial fibrillation is the most common complication after valve repair or replacement surgery .Several studies showed that preoperative oral amiodarone is effective in reducing this arrhythmia, but it needs either admission of the patient for several days before surgery or frequent visits to the hospital our objective wase To determine if an Intraoperative loading dose of amiodarone is effective in reducing atrial fibrillation after valvular heart surgery**

METHODS: **Prospective, controlled study of 94 patients listed for valvular heart surgery. The patients received either Amiodarone 3 mg/kg IV or similar volume of normal saline as a placebo as infusion over 30 minutes after insertion of peripheral line .The incidence of significant atrial fibrillation during the first week after surgery was the main outcome measured.**

RESULTS: **Atrial fibrillation occurred in fewer patients in amiodarone group (13 /46, 28 %) compared with patients in placebo group (19/48, 39 %) (Hazard ratio 0.84, Confidence interval 0.55-1.26, p value 0.035) More patients in the amiodarone group converted to sinus rhythm after cross clamp removal (27/46 , 58.6%) compared with the patients who received placebo patients (21 /48 , 43.7% %) (Hazard ration0.72, Confidence interval 0.52-1.32, p value 0.039).There was no difference in hospital mortality, major post operative morbidity, ICU stay or hospital stay.**

CONCLUSION: **Intraoperative IV loading dose of amiodarone is effective in reducing post valvular heart surgery atrial fibrillations**

Postoperative atrial fibrillation occurs in up to 40 percent of patients undergoing cardiac surgery [1] [2] [3]. this arrhythmia remains an important cause of patient discomfort or anxiety, hemodynamic deterioration, stroke, exposure to the risks of tachyarrhythmia treatments, prolongation of hospital stay, and expenses after heart surgery [4][5][6]. Atrial fibrillation is facilitated by atrial manipulation (trauma, stretch, and or ischemia), epicardial inflammation, hypoxia, acidosis, electrolyte disturbances, and electrophysiological changes that accompany sympathetic nervous system discharge [7] as these factors are common in valvular surgery; atrial tachyarrhythmia is the most common postoperative complication after valvular cardiac surgery.

Amiodarone is a class III anti-arrhythmic drug that is effective for treatment of atrial fibrillation and can be begun safely in patients with structural heart disease. [8][9][10][11] Several studies had evaluated the effects of preoperative oral amiodarone on atrial fibrillation after cardiac surgery [12] [13] [14]; because of oral amiodarone needs frequent visit to the hospital and intense monitoring of side effects, at the same time , the onset of action of the antiarrythmic effects of intravenous amiodarone is rapid [15][16] we postulated that a loading dose of

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IV amiodarone in the operative room may reduce the risk of development of post operative atrial fibrillation .

The purpose of this study was to assess the use of intraoperative loading dose of amiodarone as prophylaxis against atrial fibrillation after valvular heart surgery.

METHODS:

This study included, adult patients of either sex more than 18 years old, scheduled for elective valve surgery requiring cardiopulmonary bypass without concomitant procedures, and have normal sinus rhythm. After approval from the institutional committee, all patients had informed consent. All patients had base line electrocardiogram .Patients were excluded if they were allergic to amiodarone; had used amiodarone within four months of enrollment; had a history of amiodarone toxicity; required the use of anti-arrhythmic therapy (other than beta-receptor antagonists, calcium-channel antagonists, or digitalis); had chronic obstructive lung disease, had untreated thyroid disease; had serum aspartate aminotransferase or alanine aminotransferase concentrations four times the upper limit of normal; were pregnant; had a resting heart rate of less than 50 beats per minute; or had uncontrolled heart failure or in NYHA class VI. Ninety four patients were randomly assigned in a double-blind fashion to either a loading dose of amoidarone (3 mg /kg) or a similar volume of normal saline as a placebo.

Primary end points:

The primary end point of this study was occurrence of atrial fibrillation during the first week after surgery .For the purpose of the study atrial fibrillation was defined as any episode of new onset atrial fibrillation of more than 5 minutes duration, whether affecting the patient hemodynamics or not, and regardless of the need for medication

Secondary end points:

The ventricular response rate of atrial fibrillation that did occur, the postoperative day of an atrial fibrillation occurrence, the number of atrial fibrillation episodes, the duration of the longest episode, the total duration of fibrillation (number of hours of atrial fibrillation during the first 6 postoperative days), and length of postoperative hospital stay. Morbidity and adverse events potentially attributable to amiodarone were also recorded.

Anesthesia technique:

All the patients were premedicated with intramuscular injection of morphine 0.1 mg.kg and promethazine 0.5 mg/kg 45 minutes before induction.

In the operative theatre, electrocardiogram (ECG). Pulse oximetry (spo2)and non invasive blood pressure monitoring lines were commenced .After establishing intravenous cannual and arterial line , general anesthesia was induced by administration of the following drugs intravenously :2ug/kg of fentanyl,0.02 mg/kg of midazolam , 5 mg/kg of thiopentone and 0.9 mg/kg of pancuronium .Trachea was intubated with endotracheal tube of approriote size .Anesthesia was maintained with incremental doses of fentanyl , midazolam , isoflurane and pancruniuom .The right internal jugular vein was cannulated with double or triple lumen central venous catheter .

Operative technique:

Heparin was given in a dose of 300 unit /kg to achieve activated clotting time of 480 seconds or more .A median sternotomy was performed in all the patients. Standard cardiopulmonary bypass was established via ascending aortic cannulation and a single two-stage venous cannulation of the right atrium in aortic valve replacement cases and bicaval cannulation in cases required opening of the right atrium or mitral valve surgery. Myocardial protection was achieved by antegrade or retrograde or both intermittent cold crystalloid cardioplegia every 20 min. Weaning from bypass is done after appropriate rewarming and metabolic stability.

Initial rhythm was noted after release of cross clamp and internal paddles defibrillation is done using 10-40 joules for atrial fibrillation, ventricular fibrillation or ventricular tachycardia. Pacing is used if the patient has atrioventricular block. Inotropic support was used when ever need in the form of dopamine, dobuatmine, or adrenaline. After reversal of Heparin with protamine, the patient decannulated and surgical hemosyatsis is done following by closure and transfer to intensive care unit.

Postoperative management :

All patients were returned to the cardiac surgical intensive care unit. Identical postoperative management was done in all patients. This included hemodynamic parameters (heart rate, invasive blood pressure and central venous pressure), temperature, and fluid balances, which were recorded every hour. Mean arterial blood pressure was kept between 60-90 mm Hg and the heart rate between 60-100 beats/minute. All patients were kept within the normal range electrolytes which were replaced as needed. Weaning from mechanical ventilation was

started as soon as hemodynamic and ventilatory stability was achieved and the patient was awake and able to maintain a patent airway. All patients had continuous display of the electrocardiogram in the intensive care unit and continuous monitoring in the step-down unit until the fifth postoperative day.

Twelve-lead electrocardiography was done daily starting from the day of operation to the 5th postoperative day, then at discharge and on demand to document any rhythm disturbance. No specific protocol for atria fibrillation treatment was specified and the treatment was done as directed by the attendant physician.

Study protocol:

The patients who consented were randomly assigned in a double-blind fashion in 1:1 ratio to receive intraoperative loading dose of amiodarone or matching placebo. In the amiodarone group, amiodarone 3 mg/kg total dose diluted in 100 ml of normal saline was started prior to skin incision and administrated through the venous line over a period of 30 minutes. In the control group, the same volume of normal saline was infused in a similar fashion .If bradycardia heart rate less than 60 / minute or hypotension defined as systolic blood pressure less than 90 mmHg was noted the infusion was temporarily discontinued, preload was optimized to treat hypotension Inotropic support was initiated if required to achieve hemodynamic stability and continue the infusion or otherwise the case is excluded from the study. The surgical team and anesthesia team were not aware of patients allocations to either group.

Statistical Analysis:

Data were analyzed on the basis of the intention-to-treat principle. Continuous variables were expressed as means ±SD. Continuous variables were compared by means of Student's t-test, and categorical variables were compared by Chi square test. A P value of less than 0.05 was considered to indicate statistical significance. Statistical analysis was done using SPSS soft ware (SPSS Inc. 233 south waker drive, 11th floor, Chicago, IL, USA)

RESULTS:

Study population:

Between July 2008 and July 2009, Ninety seven patients were enrolled and randomized in this study, 3 patients were excluded due to failure to give the studied drug in 2 patients and another patient was exclude as this patient (from the placebo group)died second postoperative day from low out put leaving 94 patients who completed the study, of those 46 received amiodarone and 48 received normal saline as placebo.

Preoperative patients characteristics:

The characteristics of the patients are summarized in table no. 1

There was no statistically significant difference between the two groups in terms of gender, age, ejection fraction, diabetes mellitus, chronic obstructive pulmonary disease, hypertension and preoperative medications.

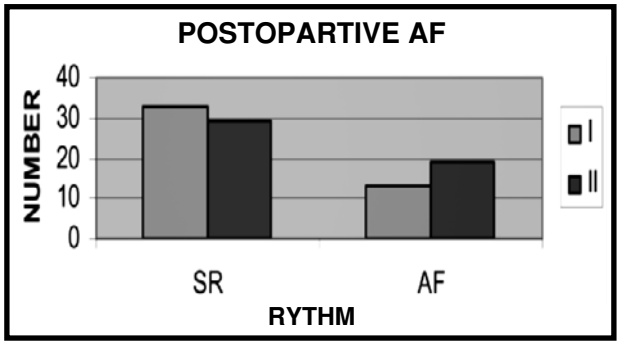
Operative characteristics:

Other than fewer defibrillations per patient to restore sinus rhythm after release of the aortic cross-clamp in the amiodarone group, there were no significant differences in surgical data between the amiodarone and placebo groups. More patients in the amiodarone group converted to sinus rhythm after cross clamp removal (27/46 = 58.6%) compared with the patients who received placebo patients (21 /48 = 43.7% %) (Hazard ration0.72, Confidence interval 0.52-1.32, p value 0.039). Table no 2

In the amiodarone group, the initial rhythm after the release of aortic cross clamp was noted to be AF 5 in 10.8 % (n =5) and ventricular tachycardia/fibrillation in 30.4 % (no=14) all were converted to normal sinus rhythm . In the control group, the rhythm soon after the release of aortic cross clamp was AF in 14.5% (n =7) and ventricular tachycardia/fibrillation in 39.5 % (no= 19) all were converted to normal sinus rhythm .One patients in the control group need pacemaker to restore the rhythm initially.

Postoperative Atrial Fibrillation

The percentages of patients remaining free of atrial fibrillation in the amiodarone and placebo groups are shown in figure no. 1.



	Amiodarone	Placebo	P value
Number :	46	48	0.84
Age mean + SD	36.36+10.68	37.33+10.79	0.59
Gender :Male/Female No.	25/21	23/25	0.51
Body weight :(Mean + SD)	75.12+12.51	77.50+12.83	0.71
Body surface area m2 (Mean + SD)	1.82+0.21	1.85+0.21	0.99
Preoperative NYHA class (Mean + SD)			
Class : NO.	2.21+0.72	2.22+0.75	
I	8(17.39%)	9(18.75)	0.79
II	20(43.47%)	19(39.58%)	
III	18(39.1%)	20(41.66%)	
Preoperative Ejection Fraction (Mean + SD_	59.93+7.11	59.27+7.23	0.60
Co morbidities: NO.			
Hypertension:	5 (10.86%)	9(18.75%)	0.53
Diabetes Mellitus	4 (8.69%)	8 (16.66%)	0.50
Smoking	10 (21.37%)	11(22.91%)	0.79
COPD	1(2.17%)	2 (4.61%)	0.55
Cerebrovascular diseases	3 (6.52%)	2(4.61%)	0.64
Preoperative medications No.:			
Digitalis	33 (71.73%)	34 (70.83%)	0.82
Beta-Blockers	17 (36.95%)	19(39.58%)	0.95
Diuretics	29 (36.04%)	30 (62.50%)	0.87
ACE/ARBS	9 (19.56%)	9 (18.75%)	1.00

TABLE NO 1 : PREOPERATIVE CHARACHTERISTICS:

	Amiodarone	Placebo	P value
Type of operation ::			
MVR:	21 (45.65%)	22(45.83%)	0.91
AVR:	7 (15.21%)	7(15.83%)	1.00
DVR	8 (17.39)	9(18.75%)	0.85
MVREAPIR:	5 (10.86%)	4(8.33%)	0.91
MVR+TVREPAIR	3(6.52%)	4(8.33%)	0.91
DVR+TVREPAIR	2 (4.43%)	1(2.08%)	0.67
Cardiopulmonary bypass time (minutes)	80.9+24.67	81.56+ 23.81	0.88
Cross clamp time (minutes)	62.1+ 20.80	63.41+19.81	0.91
Rhythm after cross clamp removal :No.:			
VT/VF	14 (29.16%)	19 (39.58%)	
AF	5 (10.86%)	7 (14.85%)	0.039
SR	27 (25.17%)	21 (43.75%)	
JR	0	1(2.08%)	

Number of patients required inotropic support cardioversion No. (%)	19(41.30%)	26(54.13%)	0.33
Amount of required energy for cardioversion: (Joules)	26.31+12.56	29.23+12.93	0.74
Number of patients required inotropic support: No. (%)	15(32.60%)	16(33.33%)	0.82
Need for pacing wires	0	1(2.08%)	0.91

TABLE NO.2: OPERATIVE CHARACHTERISTICS:

ABBREVIATIONS:

ACE/ARBS: angiotensin converting enzyme inhibitors/ angiotensin receptor blockers
AF: Atrial fibrillation
AVR: Aortic valve replacement
CABG: Coronary artery bypass grafting
DVR: Double valve (mitral &aorta) replacement
ECG: Electrocardiogram
ICU: Intensive Care Unit
IV: Intravenous
JR: Junctional rhythm
MV: Mitral valve
MVR: Mitral valve replacement
SPO2: Oxygen saturation
SR: sinus rhythm
TV: Tricuspid valve
VF: Ventricular Fibrillation
VT/VF: Ventricular tachycardia/fibrillation
VT: Ventricular Tachycardia

	Amiodarone	Placebo	P value
Number of patients who had AF	13(28.26%)	19(39.58%)	0.038
N Number of patients who needed treatment for AF	7(53.84%)	11(57.89%)	0.037
Number of Episodes of AF / patient	1.72+0.78	1.78+0.63	0.61
Duration of AF /Patient (minutes)	240 ± 193.38	254.73±110.37	0.45
Ventricular rate /minute	159.23+11.24	162.89+ 9.75	0.61
Ventilator time (hours)	7.69+2.70	7.60+2.20	0.56
ICU stay (days)	2.43+ 0.54	2.5+ 0.50	0.35
Hospital length of stay (days)	10.93+2.55	11.27+3.00	0.75
Major complications (Total) :No.(%)	9 (19.56%)	10 (20.08%)	0.78
Bleeding:	2	3	0.57
Wound infection	2	3	0.64
Stroke	1	1	1.00
Ventricular tachycardia	1	1	1.00
Prolonged ventilation	1	1	0.55
Chest infection	2	2	1.00

TABLE NO.3: POSTOPERATIVE DATA:

The incidence of atrial fibrillation was 28 percent (13 out of 46 patients) in the amiodarone group and 39 percent (19 out of 48 patients) in the placebo group (Hazard ration 0.84, Confidence interval 0.55-1.26, and p value 0.035)

Atrial fibrillation occurred a mean of 3.15+ 0.86 days after surgery in the patients assigned to amiodarone and 2.85 ± 0.77 days after surgery in the patients assigned to placebo (P = 0.26).The maximal ventricular rate during atrial fibrillation was insignificantly lower in the amiodarone group than in the placebo group (159.23+ 11.24 vs. 162.89+ 9.75 beats per minute, P =0.55); however, there was no significant difference between the groups in the total duration of atrial fibrillation (240 ± 193.38vs.254.73± 110.375minutes,(P = 0.79).

Symptoms attributable to atrial fibrillation were reported by 6 out of 13 patients who developed AF (46.1 percent) in the amiodarone group and 11 out of 19 patients who developed AF (57.8 percent) in the placebo group (P = 0.039).

Atrial fibrillation was initially managed by an antiarrhythmic medication in 7 patients (53.3 percent) assigned to amiodarone and in 11 patients (57.3 percent) assigned to placebo (P = 0.038). Spontaneous conversion without antiarrhythmic medication occurred in 6 patients receiving amiodarone (46.7 percent) and in 8 receiving placebo (42.1 percent, P = 0.69). Table no. 3

Length of Hospital Stay:

The patients in the amiodarone group were in ICU for none significantly fewer days than those in the placebo group 2.43+ 0.54 vs.2.5+ 0.50 days, (P = 0.89). Total hospital stay was 10.93+2.55 days in cases received amiodarone versus 11.27+3.00 days in placebo group. In the amiodarone group, the mean length of stay for the patients with atrial fibrillation was 12.07+2.81 days while in the placebo group, the patients with episodes of atrial fibrillation were hospitalized for insignificantly more days 12.36+3.45days (P =0.09). Table no. 3.

Morbidity and Mortality in the Hospital :

There was no significant difference in the incidence of complications between the amiodarone and placebo groups. Major post operative complications occurred in 9 patients in the amiodarone group (19.56 percent) and in 10 patients in the placebo group (20.08 percent), (P = 0.89) Table no 3.

None of our patients showed bradycardia, hypotension, hepatotoxicity, pulmonary toxicity, QT interval prolongation, and requirement for temporary pacing with amiodarone during patient hospitalization. No mortality was recorded in this series of patients.

DISCUSSION:

AF after cardiac surgery, albeit self-limiting in most cases, is known to be a potential risk of hemodynamic compromise, systemic thromboembolism, and even stroke. Even when uncomplicated, post-cardiac surgery AF requires additional medical treatment, a prolonged hospital stay, and concomitant extra costs. [17]

Amiodarone has often been utilized for the prophylactic treatment of AF with conflicting results. Several meta-analyses have shown amiodarone to be effective in reducing the incidence of AF and its complications after CABG alone or after combined CABG and valvular surgery (18). Some researchers have demonstrated the side effects of amiodarone including nausea, bradycardia, hypotension, QT interval prolongation, pulmonary toxicity, hepatotoxicity, postoperative acute respiratory distress syndrome, and requirement for temporary pacing [19].

Amiodarone is a Vaughan–Williams class III drug, which also has alpha- and beta-adrenergic blocking with Sodium-, calcium-, and potassium channel blocking properties that might attenuate sympathetic over stimulation seen in patients undergoing cardiac surgery[8][20][21]. Short-term amiodarone administration also blocks sodium channels (making the threshold voltage for activation more positive), thereby reducing automaticity (ectopic triggers) and prolonging conduction velocity (length of the tachycardia cycle) [22] [23]. Amiodarone may also reduce automaticity by decreasing the recruitment of voltage-dependent inward current (the "pacemaker current") during spontaneous depolarization, reducing the slope of phase 4 of the action potential [24]

A conflicting results of Preoperative oral amiodarone prophylaxis in patients undergoing cardiac surgery ,some trial found that Preoperative oral amiodarone significantly reduces the incidence of postoperative atrial fibrillation and the duration and cost of hospitalization [12][13] while others did not [25][26]. The use of prophylactic oral amiodarone for at least one week before elective heart surgery reduced the incidence of postoperative atrial fibrillation by approximately 50 percent, significantly reduced the length and total cost of hospitalization, and

reduced the number of symptomatic episodes of atrial fibrillation occurring after discharge (14). Daoud et al [12] performed a placebo controlled study of low dose oral amiodarone started a week before the surgery and continued until patient discharged home and they found significant reduction of atrial fibrillation incidence in patients received oral amiodarone compared with placebo . The PAPABEAR trial demonstrates that a 13-day perioperative course of oral amiodarone is an effective, possibly safe, well-tolerated [14].

Preoperative oral amiodarone need either admission of the patients for more days before the surgery or frequent visit to the hospital for dosing and monitoring of amiodarone effects. We studied the effects of single intravenous loading dose of amiodarone on post operative atrial fibrillation.

In our study, Significant cases showed electrical stability after release of aortic cross clamp most of the patients who received amiodarone showed sinus rhythm or needed small amount of energy for conversion this result was in agreement Selveraj et al [16] who studied patients with rheumatic valvular replacement and was in atrial fibrillation rhythm and received amiodarone before cardiopulmonary bypass most were converted to sinus rhythm after release of cross clamp.

The incidence of post operative atrial fibrillation was found significantly less when single loading dose of amiodarone was used in this study .In agreement with us ,Hohnloser et al. [27] performed a placebo-controlled study of intravenous amiodarone as prophylaxis against atrial fibrillation occurring after heart surgery in The amiodarone infusion began after the completion of the surgical procedure and significantly reduced the incidence of atrial fibrillation. However, in Hohnloser et al. [27] study electrocardiographic monitoring was performed only during the first 48 hours after surgery, and amiodarone was discontinued in 18 percent of patients because of side effects.

Lee et al [28] in his study pf preoperative amiodarone for CABG patients found that Perioperative low-dose intravenous amiodarone significantly reduces the incidence, ventricular rate, and duration of atrial fibrillation after coronary artery bypass grafting. Furthermore, low-dose intravenous amiodarone is well tolerated and does not increase the risk of Intraoperative or postoperative complications. Although our study showed also the same results but the current study is different as we did not use maintenance dose of amiodarone.

Complications of Therapy:

The loading dose amiodarone regimen used in this study did not result in important cardiac or non cardiac side effects. Non cardiac toxic effects of amiodarone include dose-related and non–dose-related effects were reported in many studies (29) (30). Cardiac toxicity due to amiodarone is uncommon. The incidence of amiodarone-induced ventricular proarrhythmia is low, even in the setting of structural heart disease [31][32] .Furthermore, amiodarone has little or no negative inotropic effect, rarely exacerbates heart failure, and can reduce congestive symptoms. Also, because it is well tolerated in patients with poor left ventricular function and unlikely to exacerbate preexisting medical conditions, prophylactic low-dose oral amiodarone can be used for patients who are not candidates for beta-blockade.

CONCLUSION:

Amiodarone prophylaxis appears to be effective in the prevention of new-onset postoperative AF. It also reduces the ventricular response after valvular heart surgery.

Amiodarone also poses more electrical stability of the heart after cross clamp removal. It is well tolerated and did not increase postoperative complications.

Limitations of the Study:

Small number of patients non measurement of amiodarone level in the blood and lack of holter monitoring are the limitation of this study

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Mitral valve procedure in dilated cardiomyopathy: Repair or Replacement

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Background: **Mitral valve (MV) surgery for dilated cardiomyopathy (DCM) was proposed at the beginning of the 1990s, and its effectiveness has been confirmed by many studies. The aim of this retrospective study was to evaluate long-term survival and the functional results of our experience with MV surgery for DCM.**

Methods: **Retrospective study on 91 DCM patients(64 ischemic, 27 idiopathic)in the Department of cardiology and cardiac surgery, G.D Annunzio University, Chieti, Italy operated upon in the period from January 1990 to October 2002. Patients with organic MV disease, severe right ventricle dilatation with impaired function, or severe renal or hepatic failure were excluded from the study. MV annuloplasty was performed in 64 patients, and 27 patients underwent a MV replacement according to our protocol stated in previous reports that depends on the Mitral Valve Coaptation Depth (MVCD).**

Results: **The 30-day mortality rate was 4.4% (4 patients).The probability of being alive at 5 years was 78.4 ± 4.3% and was higher in patients who underwent MV repair (81.4 ± 4.5%) than in patients who underwent replacement operation (66.7 ± 9.1%), even if the P value was not statistically significant. After a mean follow-up period of 27 ±30 months, the New York Heart Association (NYHA) class decreased from 3.5 ± 0.7 to 2.1 ± 0.6 in the 69 survivors (P < .001). The probability of being alive 5 years after surgery with an improvement of least 1 NYHA class was 65.9 ± 5.0% and was higher in patients with MV repair (76.6 ± 6.0%) than in patients who underwent valve replacement (51.9 ± 9.6%), even if the P value was not statistically significant. Fifty patients were carefully followed with serial evaluations in our echocardiographic laboratory. Volumes did not change, nor did stroke volume or ejection fraction.**

Conclusions: **Long-term results in our patients are satisfying for both repair and replacement groups.Although better outcome could be achieved by repair but it was statistically insignificant.**

Mitral valve (MV) surgery for dilated cardiomyopathy (DCM) was proposed at the beginning of the 1990s [Bolling1995], and different reports [Calafiore 1999, Bishay 2000, Buffolo 2000, Calafiore 2001, Radovanovic 2002] have confirmed the effectiveness of this procedure. The appearance of functional mitral regurgitation (FMR) complicates the natural history of DCM and has a negative impact on survival [Romeo 1989, Blondheim 1991, Junker 1993]. Restoring the MV competence has a direct effect on reducing left ventricle (LV) overload, which in turn has an effect on LV end-diastolic

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pressure and on stroke volume, which becomes prevalently antegrade, resulting in a positive net effect on cardiac output. Reducing the LV volumes and increasing the ejection fraction (EF) are not purposes of the procedure.We review our experience with MV surgery for treating DCM to evaluate long-term survival and functional results.

Methods:

As there is no clear definition of DCM in the literature, DCM has been defined in our previous reports, We included in this series, for surgical purposes, all the patients that fit the following criteria:

1. ejection fraction equal or less than 35%
2. end diastolic volume (at the echocardiography) higher than 110 ml/m2
3. enlargement of the base of the heart (maximum mitral diameter, at the echocardiography, higher than 22 mm/m2) with functional mitral regurgitation For the above reason, mitral valve surgery (repair or replacement) wase performed in every patient From January 1990 to October 2002, MV surgery for DCM was performed in 91 patients. These patients had ischemic (n = 64) or idiopathic (n = 27) DCM .

No patients had organic MV disease, and right ventricular function was normal or moderately impaired. Severe right ventricular dilation with poor contractility, as well as severe renal or hepatic failure, was a formal surgical contraindication. MV surgery was indicated if FMR was severe (4/4) or moderate to severe (3/4); however, we do recommend surgery in cases of a moderate FMR (2/4). The definition of moderate FMR is often echocardiographic, and its influence on cardiac output depends on the LV function and on the stroke volume. The lower the EF and the stroke volume are, the higher will be the impact of moderate FMR on cardiac output. Moreover, the MR in DCM, being functional, can change from time to time. For this reason, the result of the echocardiographic evaluation is the key point for the surgical indication, because the echocardiographic MV anatomy does not change, whereas FMR can. Echocardiographic evaluation has to consider the MV annulus, which is enlarged in DCM, and the degree of displacement of the papillary muscles. This latter aspect can be easily inferred from the depth of the coaptation of the mitral leaflets into the LV (MV coaptation depth [MVCD])

[Calafiore 2001]. This value can easily be obtained by measuring the distance between the plane of the annulus and the coaptation point of the MV leaflets (Figure 1).

In the normal MV, the MVCD does not exceed 6 mm (mean ±SD, 4.1± 1.6 mm) [Calafiore 2001]. The greater the MVCD is, the more displaced will be the papillary muscles. This value can be a determinant of surgical indication, because a larger MVCD increases the possibility that FMR will severely increase under stress conditions, independently from its basal value. Surgery is indicated in the presence of an enlarged annulus, a deep MVCD, and a 2/4 basal FMR. Table 1 shows the

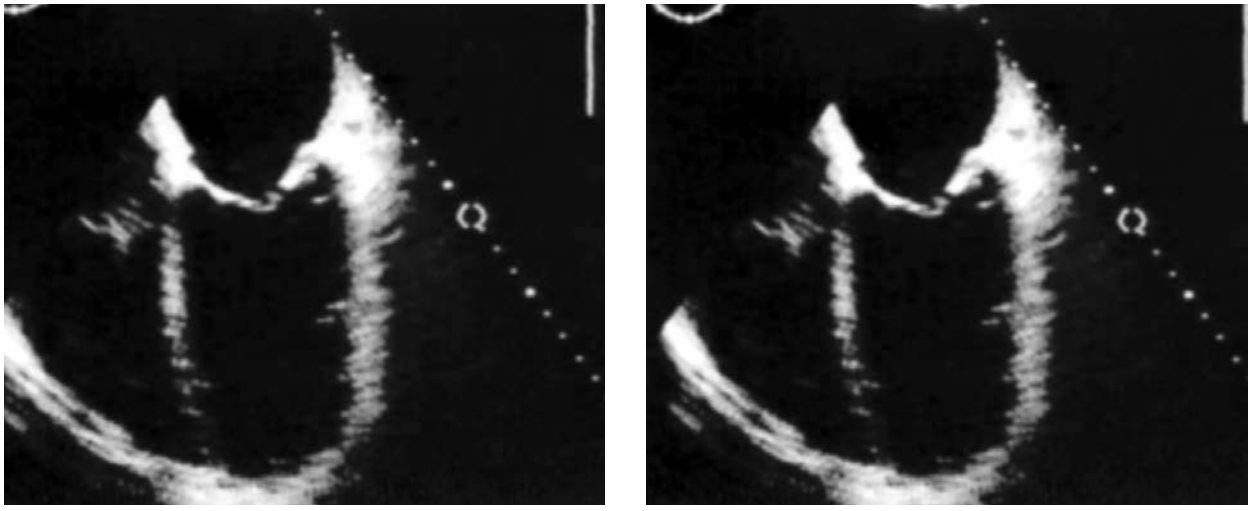


Fig.1: Normal values : Mitral annulus (17±4) mm/m² & Coaptation depth (4.1±1.6) mm/m² (Calafiore 2001)

clinical and hemodynamic preoperative data, and Table 2 presents the echocardiographic data.

Data	No.
Age, y	65.1 ± 9.3
Female sex, n	15 (16.5%)
NYHA class	3.2 ± 0.6
NYHA class III-IV, n	83 (91.2%)
Etiology, n	
Ischemic	64 (70.3%)
Idiopathic	27 (29.7%)
Mean PAP, mm Hg	34 ± 14
Cardiac index, L · min–1 · m–2	2.05 ±0.84

Table 1. Preoperative Clinical and Hemodynamic Data (n = 91)*
Data are presented as the mean ±SD where appropriate. NYHA indicates
New York Heart Association; PAP, pulmonary artery pressure.

Data	No.
End-diastolic volume, mL/m2	146 ± 52
End-systolic volume, mL/m2	102 ±43
Stroke volume, mL/m2	40 ±14
Ejection fraction, %	27 ±7
Mitral annulus, mm/m2	22.0 ±3.2
Coaptation depth, mm	10.4 ±1.7
Mitral regurgitation	3.3 ±0.7
Sphericity index (diastole)	0.82 ±0.10

Table 2. Preoperative Echocardiographic Data (n = 91)*
Data are presented as the mean ± SD. and atriobiventricular pacing was inserted at the end of the procedure in 4 cases to synchronize both ventricles

Surgical Technique:

Myocardial protection was always achieved with intermittent antegrade warm blood cardioplegia [Calafiore 1995].Both cavae were directly cannulated, because we prefer the trans-septal approach for MV exposure. Mitral valve annuloplasty was performed in 64 patients. In 19 patients, surgery was performed with a posterior double suture annuloplasty using a 2-0 polyester suture (Ti-cron;Sherwood Medical, St. Louis, MO, USA) adapted to a no. 26 sizer. In the remaining patients, a pericardial strip (treated with a solution of 0.625% glutaraldehyde for 15 minutes and then rinsed in saline for 15 minutes) was used to reduce the posterior annulus from commissure to commissure. The strip length was 52 mm (corresponding to a no. 26 sizer) in 12 patients. In the last 33 patients, the length was reduced to 40 mm [Calafiore 2003](Fig.2A). The result was a better undersizing of the MV annulus, with an area between 3.0 and 3.5 cm2 and a mean gradient of 1 to 3 mm Hg. When the MV was replaced (n = 27), only a small triangle of the anterior leaflet was excised, and the papillary muscles were drawn toward the annulus with the prosthetic sutures (Figure 2A). The choice of MV repair or replacement depends on the MVCD. If the MVCD is 10 mm or less, MV repair is always possible. If it is greater than 10 mm, the alterations of the subvalvular apparatus are such that FMR is expected to return in a short period of time. MV replacement is then indicated (Fig.2B). Tricuspid annuloplasty was obtained with a

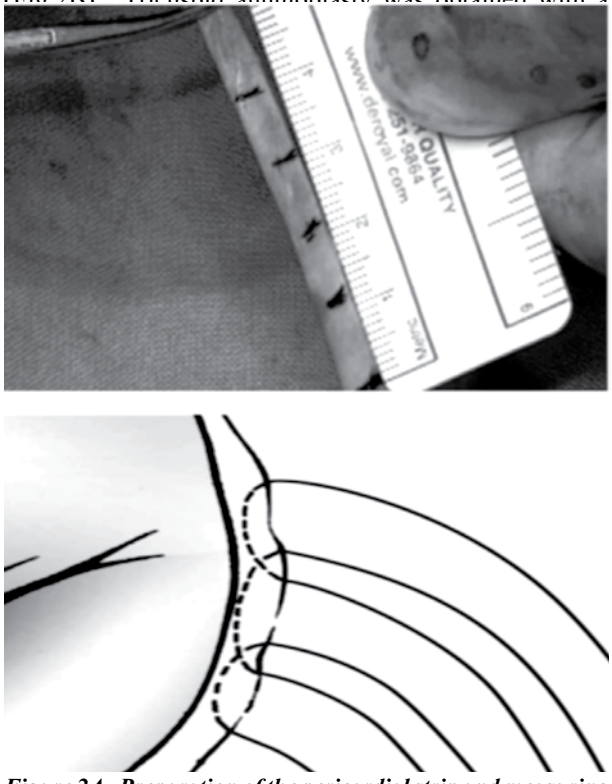
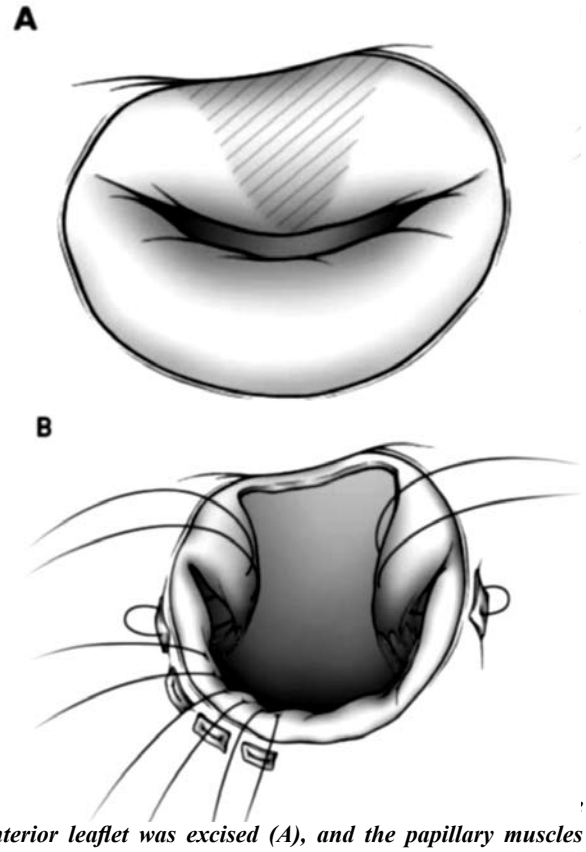


Figure 2A. Preparation of the pericardial strip and measuring 4cm length for the posterior annuloplasty &Technique of taking the sutures at the posterior mitral annulus !!



anterior leaflet was excised (A), and the papillary muscles were drawn toward the annulus with the prosthetic sutures (B). Reprinted with permission [Calafiore 2003].

Postoperative Course:

After surgery, all of the patients were admitted to the intensive care unit and subsequently to the surgical and cardiologic wards. All of the patients were followed up in our outpatient clinic at 3, 6, 9, and 12 months postoperatively and every 6 months thereafter. The follow-up is 100% complete.

Statistical Analysis

Results are expressed as the mean ±SD unless otherwise indicated. Statistical analyses of 2 groups were performed with the unpaired 2-tailed Student t test for means or with the _2 test for categorical variables. Actuarial curves were obtained by the Kaplan-Meier method. Statistical significance was calculated with the log-rank test. SPSS software (Chicago, IL, USA) was used. P values ≥.05 were considered not significant.

Results:

Early Mortality and Morbidity:

Table 3 and Table 4 show the perioperative and postoperative data. Four patients (4.4%) died during the first 30 days after surgery. The causes of death were acute myocardial infarction,rupture of the abdominal aorta, respiratory hemorrhage, and rupture of the left atrium–aorta junction. All of the patients had elective inotropic support for 30 ±32 hours. Seven patients required IABP support, 1 in the operating room and the other 6 in the intensive care unit. Twelve patients required readmission, and all of these patients were redischarged after 36.3 ± 31.5 hours. The total postoperative length of stay (in the surgical and cardiologic wards) was 6.3 ±2.7 days. Medical treatment for chronic problems included angiotensin-converting enzyme inhibitors, diuretics, and B-blockers such as carvedilol.

Data		No.
Mitral valve repair, n		64
I	Isolated	9
	+ CABG	31
	+ Tricuspid repair	14
	+ CABG + tricuspid repair	10
Mitral valve replacement, n		27
	Isolated	4
	+ CABG	13
	+ Tricuspid repair	6
	+ CABG + tricuspid repair	4
CPB time, min		88 ±38
Ao Xcl time, min		69 ± 28

Table 3. Operative Data (n = 91)* *Data are presented as the mean ±SD where appropriate. CABG indicates coronary artery bypass grafting; CPB, cardiopulmonary bypass, Ao Xcl,aortic cross-clamping.

Data	No.
Death, n	4 (4.4%)
Acute myocardial infarction, n	0
Cerebrovascular accident, n	1 (1.1%)
Intra-aortic balloon pump, n	6 (6.6%)
Acute renal failure, n	14 (15.4%)
Acute respiratory failure, n	5 (29.7%)
Bleeding, mL/12 h	791 ±628
Transfused patients, n	34 (37.4%)
Intensive care unit stay, h	33 ± 32
Hospital stay, d	6.3 ±2.7

Table 4. Postoperative Data (n = 91)*
***Data are presented as the mean ±SD where appropriate.**

Late Survival:

After 21 ±30 months, 18 patients had died, 17 from cardiac causes (16 from heart failure and 1 from sudden death) and 1 from a noncardiac cause (respiratory failure). The actuarial survival curve is shown in (Figure 3). The probability of being alive 5 years after surgery was 78.4% ±4.3% and was higher for the patients who underwent MV repair (81.4% ±4.5%) than for the patients who underwent replacement (66.7% ±9.1%), although the P value was not significant.

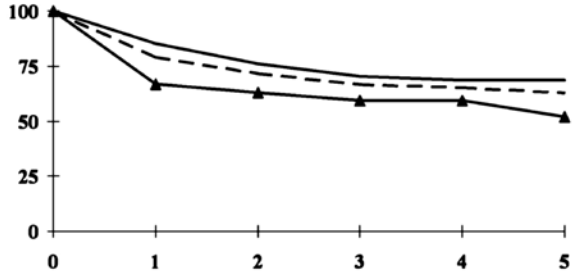


Figure 3. Five-year actuarial survival for all patients (– – –) and for the patients with mitral valve repair (———) and mitral valve replacement (—_——_—). NS indicates not significant.

Functional Results:

After a mean follow-up period of 27 ±30 months, the New York Heart Association (NYHA) class decreased from 3.5 ±0.7 to 2.1 ±0.6 (P < .001) in the group of 69 survivors. The probability of being alive 5 years after surgery with an improvement of at least 1 NYHA class was 65.9% ±5.0% and was higher in the patients with MV repair (76.6% ±6.0%) than in the patients with replacement (51.9% ±9.6%), although the P value was not significant (Figure 4).

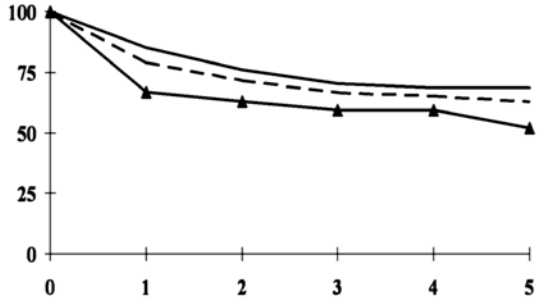


Figure 4. Probability of being alive at 5 years with at an improvement of at least 1 New York Heart Association class for all patients (– – –) and for the patients with mitral valve repair (———) and mitral valve replacement (—_——_—). NS indicates not significant.

Echocardiographic Results

Fifty patients were carefully followed with serial evaluations in our echocardiographic laboratory (Table 5). The results were comparable and were independent of MV repair or replacement, even if the latter patients were the most dilated. Volumes, as well as the stroke volume and EF, were unchanged. However, the NYHA class was significantly lower for both groups. Some degree of MR was present in all but 8 of the patients who underwent MV repair. The analysis of these patients showed that all of the patients who had no residual MR had a MVCD of less than10 mm and had a better functional result. The MVCD was shorter in patients who had no or mild (1/4) residual MR than in patients who had a residual MR >1/4. The NYHA class was lower in patients with no or up to 1/4 residual MR, showing that the purpose of the procedure is the reduction or elimination of FMR, which is the determinant of the clinical result.

	Preoperative	Postoperative	P
End-diastolic volume, mL/m2	144 ±52	131 ± 38	NS
End-systolic volume, mL/m2	105 ±44	90 ±35	NS
Stroke volume, mL/m2	40 ± 14	42 ±16	NS
Ejection fraction, %	27 ±7	32 ±12	NS

Discussion:

The Laplace law states that myocardial wall stress is proportional to the radius of the curvature and to the intraventricular pressure and inversely proportional to the thickness of the wall. According to this law, an increase in the radius of the chronic failing heart exposes the myocytes to a higher wall stress. This stress leads to chamber and cellular hypertrophy, which acts in an adaptive process to normalize the wall stress. As the chamber continues to dilate over time and the limits of hypertrophy are reached, the wall stress ultimately increases with a consequent reduction in pump efficiency. Techniques of volume reduction, such as the Batista operation, mainly address radius reduction and as a consequence reduce the wall stress to increase the efficiency of the systolic pump. However, the limit of every technique that reduces LV volume is the unpredictability of such a volume reduction on the diastolic pump properties. When the LV volume is reduced, diastolic filling can be worsened, because the remaining LV cavity can be stiffer than necessary to receive a volume of blood at a low-end

diastolic pressure that is sufficiently reasonable to ensure a normal stroke volume [Zile 2002]. The correction of FMR has less spectacular consequences, because its effects on LV volumes, if any, are minor; however, the FMR correction triggers a mechanism that, in reducing the LV endoventricular pressure, is able to maintain the stroke volume unchanged, thereby increasing the net antegrade flow. The appearance of FMR has a negative impact on the natural history of DCM in that the degree of heart failure increases and life expectancy decreases [Romeo 1989, Blondheim 1991, Junker 1993]. FMR is related to incomplete MV closure. Displacement of the papillary muscles postero-laterally and apically increases the distance over which the mitral leaflets are tethered from the papillary muscle to the anterior annular ring and restricts the possibility of their closing at the annular level [Otsuji 1997]. The leaflets take on a tented geometry, and their coaptation depth increases. When FMR starts, the MV annular area increases together with the mitral annulus, and, consequently, the base of the heart increases. This process causes a further increase in FMR. Surgery has as its purpose the restoration of MV competence to reduce LV endoventricular pressure and to change the stroke volume from antegrade and retrograde to only or primarily antegrade, with the achievement of an immediate increase in cardiac output. Reduction of the LV volume and an increase in the EF are not purposes of the procedure, which remains palliative because the underlying disease is not corrected. The degree of MR is not the determinant of surgical indication, because the FMR can change with time. Because the echocardiographic anatomy remains unchanged, a careful evaluation of the different aspects of the mechanisms of FMR can allow us not only to indicate surgery but also to understand which kind of procedure has to be performed. In fact, the decision to repair or to replace the MV depends on the degree of displacement of the papillary muscles, which is mirrored by the MVCD. We have found in some cases that MV replacement is the procedure of choice, because MV repair when the MVCD is too great is not as effective as it is when the geometry of papillary muscles is not deeply modified [Calafiore 2001]. Mitral valve repair is often possible, and overreductive annuloplasty is nearly always able to correct MR, even in the presence of double regurgitant jets. We prefer to use a 40-mm ring, which is either commercially available or made of autologous pericardium, because it totally eliminates the posterior leaflet from the mechanism of MV closure, thus acting only as a doorstop. However, the possibility of allowing both leaflets to coapt depends on the ability of the anterior leaflet to move toward the annulus and to reach the posterior one. If this movement is insufficient, the mitral leaflets never coapt no matter how much the posterior annulus is reduced. For this reason, for each patient, we evaluate the depth of the anterior leaflet during systole. According to our experience (Calafiore , 2001), this value is crucial for deciding whether to repair (if 10 mm or less) or to replace (if more than 10 mm) the MV. It is evident that the more the PMs are displaced, the higher the possibility that the anterior leaflet could be limited in its movement. Therefore, MV replacement with intact subvalvular apparatus is reserved for patients with the most-displaced PMs. These patients have generally the largest hearts and the lowest EFs. (Calafiore, 2004) The long-term results in our patients are satisfying, and these results are supported by those of other investigators[Bolling 1998, Calafiore 2001, Badhwar 2002, Radovanovic 2002]. The probability of being alive with an improvement of at least 1 NYHA class is definitively higher in the patients who underwent repair, and the difference, although not statistically significant, is clinically significant. However, the patients who underwent MV replacement had hearts that were more enlarged and, globally, more advanced degrees of disease. Volume, stroke volume, and EF did not change significantly; this lack of modification did not influence the late functional result. How long the palliative effects of the surgical procedure will last is not possible to say. However, the great improvements in medical treatment that today are able to increase life expectancy and to reduce heart failure symptoms in patients with DCM, allow us to conceive of a synergy between cardiologists and surgeons, because eliminating or reducing FMR can be crucial for achieving a higher effectiveness of a combined strategy to improve the global outcome of these patients.

Conclusion:

Long-term results in our patients are satisfying for both repair and replacement groups.Although better outcome could be achieved by repair but it was statistically insignificant. FMR can be crucial for achieving a higher effectiveness of a combined strategy to improve the global outcome of these patients.

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CARDIOPLEGIA: WHICH IS WHICH?

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Background : **We performed a, prospective study to compare intermittent antegrade warm blood cardioplegia to intermittent antegrade and retrograde cold crystalloid cardioplegia.**
Methods. Three hundred patients underwent isolated coronary bypass surgery groups : were randomized into two Group 1 (n=132) received cold crystalloid cardioplegia with moderate systemic Hypothermia, while Group 2(n=168) received intermittent antegrade warm blood Cardioplegia with systemic normothermia.
Results **: Concerning that cardiopulmonary bypass duration (105+/- 25.6 vs 130+/-20 minutes), and total ischaemic arrest duration (70+/-15.5 vs 95 +/- 20 minutes ,p<0.001)were shorter in group 2 Cardiac troponin levels** ***Conclusions :*** **Intermittent anegrade warm cardioplegia shows a significant less myocardial damage than cold crystalloid cardioplegia with a better earlier recovery of the myocardium.**

Usage of intermittent antegrade warm blood cardioplegia (IAWBC) had been Proposed as a safe technique of myocardial protection,(1) . Superiority of continuous warm blood cardioplegia over conventional cold cardioplegia with regards to myocardial and functional recovery was reported,(2) Interrupted infusion is needed to prevent flooding of cardioplegia in the field(,3) Currently, blood cardioplegia is the preferred cardioprotective strategy in the United States and in most West European countries. The technical details of blood cardioplegia have evolved as a consequence of experimental studies and clinical application, including multidose cold blood cardioplegia, warm blood cardioplegia reperfusion, warm induction, antegrade and retrograde delivery, continuous cold blood perfusion, and intermittent warm blood cardioplegia.(4)

The fact that blood cardioplegia has emerged as one of the preferred cardioprotective strategy is based on its versatility, because a blood vehicle for cardioplegic delivery blends onconicity, buffering, rheology, and antioxidant benefits with its capacity to augment oxygen delivery and ability to 'resuscitate' the heart, prevent ischemic injury, and limit reperfusion damage.(5)

In detail, the cardioprotective potential of blood cardioplegia is represented by the synergistic effect of its different component (6). :

- Hyperkalemia: induction and maintenance of cardioplegic arrest
- Hypocalcemia: avoidance of mitochondrial calcium overload and prevention of irreversible myocyte injury.
- Tris buffer: prevention of tissue acidosis
- Hyperosmolarity and hyperglycemia: prevention of myocardial edema
- Glutamate and aspartate: these amino acids replenish key Krebs-cycle depleted during ischemia by enhancing aerobic metabolism and reparative processes.

Our study was performed to evaluate and compare the effect of IAWBC with normthermia on myocardial protection with intermittent antegrade and retrograde cold crystalloid cardioplegia with moderate hypothermia(in the means of simple induction and easy recovery) .

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METHODS:

Between May 2006 and December 2007, 300 patients scheduled for isolated coronary bypass grafting were included in this study, All emergency cases and/ or combined valvular and coronary surgical procedures were excluded from the study . Patients were randomized into two groups : Group 1 (n=132) received combined antegrade and retrograde cold crystalloid cardioplegia with moderate systemic hypothermia , while in GROUP 2 (n = 168) received intermittent antegrade normothermic blood cardioplegia with systemic normothermia .

Anesthesia was introduced by the same team with a fixed protocol for all patients; as well cardiopulmonary bypass was performed by the same team. Systemic heparin was given to achieve an activated clotted time greater than 450 seconds (300 u/kg). Arterial and venous cannulation was performed according to the planned surgical procedure. The cannulaes were connected to the heart-lung machine. Insertion of a combined antegrade **cardioplegia**-vent catheter, cannulation of the coronary sinus, and connection of the **cardioplegia**-catheters to a manifold **cardioplegia** delivery system and the pressure monitoring lines are performed thereafter. In group 1 , cardiac arrest was obtained by infusion of 1 liter of cold crystalloid solution into the aortic root combined with 500 ml of the same solution infused in the coronary sinus at an average pressure ± 40 mmHg .

An additional dose of 500 ml solution without procaine was introduced whenever needed . Body temperature was always dropped to ± 30 0c . while in group 2 , cardiac arrest was achieved by intermittent infusion of normothermic hyperkalemic blood in the aortic root . Blood was collected from the oxygenator and infused into the aortic root . An additional 500-mL solution without procaine was administered every 15± 5 minutes or whenever necessary (eg, at resumption of electrical activity). Rewarming was initiated during completion of the last distal anastomosis. In group 2, cardiac arrest was achieved by intermittent infusion of normothermic hyperkalemic blood in the aortic root. Blood was collected from the oxygenator and infused into the aortic root using a roller pump. During CPB, blood temperature was maintained around 37°C. Controlled reperfusion is a strategy to reduce reperfusion injury after acute coronary occlusion.

In the intensive care unit (ICU), heart rate and rhythm, systemic blood pressures, and pulmonary artery pressures were continuously monitored. A complete hemodynamic profile, including cardiac index and arteriovenous oxygen content difference, was systematically obtained on arrival from the operating room, at 4 and 8 hours postoperatively,

on days 1 and 2 after operation, and whenever needed. A 12-lead electrocardiogram was recorded at the same time points for detection of ischemic episodes or Q-wave infarction, or both. Additional recordings were performed if clinically necessary

Blood was drawn for enzymatic assay (creatine kinase [CK] and aspartate aminotransferase) simultaneously. For CK-MB mass measurement and for cardiac troponin I (cTnI) levels.

Results :Males were 96 in group 1 & 117 in group 2 (total = 213) , while female were 36 in group 1 & 51 in group 2 (total = 87) . Mean age was(57.6 ± 9.6 years) in group one , and (55.0 ± 10.5 years) in group two .All pre-operative characteristics between two groups are cleared in table (1) .

Cardiac Troponin levels cTnI were significantly lower in group 2 than in group 1 at each time point, , The peak level of cTnI was lower in the normothermic group (5.8 +/- 3.3 versus 10+/ - 4.8 mg/L, p , 0.0001) , Gas exchange parameters were significantly better in warm blood cardioplegia group with a longer duration of intubation in the cold combined cardioplegia group(5) .

Higher K levels were noted in group 2 patients on arrival from the theatre . All other measured data were not different at any time point; in particular, hemoglobin and platelets levels were almost the same postoperative.

Our study demonstrated a significant reduction of myocardial cell damage with the use of IAWBC. Specific markers of cardiac cell lesions, especially cTnI, are indeed significantly lower after normothermic cardioplegia at each time point until the second postoperative day. Because cTnI has been shown to be highly specific for myocardial cell damage and to be unaffected by skeletal muscle lesions or renal insufficiency (7), this finding clearly indicates that fewer myocardial cell lesions occurred in the normothermic group.

Moreover, the proportion of patients requiring inotropic support or an intraaortic balloon pump was higher in the cold crystalloid cardioplegia group . A higher proportion of our patients required inotropic support than those evaluated by Lichtenstein and colleagues (3) and Calafiore and associates(6).

Both more liberal criteria for the use of inotropic drugs and longer total ischemic duration in our

Variable	Group 1 Cold Cardioplegia (n=132)	Group 2 Warm cardioplegia (n=168)	p_ value
Age (years)	57.6 ± 9.6	55.0 ± 10.5	0.061
M / F	96 / 36	117 / 51	0.048
Diabetes mellitus	83(62.87%)	46 (27.4%)	0.003
Renal Impairment	14 (10.6%)	11(6.54%)	0.07
Hypertension	62(46.96%)	53(31.54%)	0.005
COPD	23(17.42%)	17(10.12%)	0.0018
LVEF (%)	45.0 ± 17.5	48 ± 15.8	0.065
No: of Diseased vessels	2 : 4	2 : 3	-

Table (1) data of patients (n=300) included in the study : Cardioplegia COPD : Chronic obstructive pulmonary disease. LVEF : Left Ventricular Ejection Fraction .

Variable	Group1 (n=132)	Group 2 (n=168)	P Value
Distal Anastomosis.	2 : 5	2 : 4	0.63
LIMA to LAD	130 (98.5 %)	166(98.8%)	0.50
Volume of Cardioplegia Solution	1.75 ± 0.75 ML	750 ± 150 ML	< 0.0001
CPB time (min.)	130 ± 20.0	105 ± 25.6	0.01
Aortic cross clamp time (min.)	95.0 ± 20.0	70.0 ± 15.5	0.05
Mean Blood. Pressure	68.0 ± 7.0	75.0 ± 15.0	0.007
Lowest body temp . (^{0}c)	30.0 ± 1.5	34.5 ± 1.0	0.001
External Pacing	30 %	9 %	0.243
IABP	16 (12 %)	-	0.0001

Table (2) Intra operative data : Cardioplegia LIMA : Left internal mammary artery . LAD : Left anterior descending artery . IABP : Intra-aortic balloon pump .

Variable	Group1	Group 2	P Value
Reopen (bleeding)	16 (12 %)	8 (4.7 %)	8 (4.7 %)
Post op Infraction	13 (9.8 %)	4 (2.4%)	4 (2.4%)
Nephropathy (Renal impairment)	11 (8.3 %)	7 (4.2 %)	7 (4.2 %)
Dialysis	10(7.6%)	2(1.2%)	2(1.2%)
ICU Stay (hours)	48 ± 10	36± 8	36± 8
In hospital (days)	7 : 9	5 : 7	5 : 7
Death	5 (3.8%)	2(1.2%)	2(1.2%)

Table (3) outcome:

hypothermic groups (57 minutes of average cross-clamping time in 69 patients) can explain this difference between the present study and previous reports. If, as suspected, longer intra operative ischemia increases the need for inotropic support, this assumption certainly raises some concern as to the outcome of patients with a lower ejection fraction. However, even if the ischemic duration was relatively shorter in our study, cTnI release was lower in the normothermic group and inotropics requirements for normothermia was less than cold cardioplegia group.

Statistical analysis :

Categorized data are presented as numbers with percentages , while numerical data are presented as means with standard deviation. Univariate analysis was conducted using SPSS version 16 (spss inc., usa) Categorized data are compared using HI-square test while numerical data are compared using ANOVA . Statistical significance are indicated when p-value is ≤ o.o5 .

Discussion:

In accordance with previous studies, the incidence of ventricular or supraventricular arrhythmias and the need of temporary pacing were higher in the cold cardioplegia group(8).

The length of stay in the ICU and in the hospital were less in the IAWBC group,however these are gross markers because they are influenced by numerous external factors independent of the cardioplegia strategy (9).

The versatility of blood **cardioplegia** provides the cardiac surgeon with a tool to actively treat the jeopardized myocardium as well as to prevent ischemic damage. The known benefits of using blood as the vehicle for delivering oxygenated **cardioplegia** include oxygen carrying capacity, active resuscitation of myocardium, avoidance of reperfusion damage, limitation of hemodilution, provision of onconicity, buffering, rheologic effects, and endogenous oxygen free radical scavengers. The major prerequisite to provide these benefits to the patient is ensuring adequate delivery of the cardioplegic solutions.(10)

Current standard of myocardial protection using blood **cardioplegia** had been evolved as a consequence of experimental studies and their subsequent clinical application over the last decades. It combines different principles, such as cold blood **cardioplegia**, warm blood cardioplegic reperfusion, warm induction, and alternating and simultaneous ante- and retrograde delivery to compensate for the individual shortcomings of each procedure and permit optimum myocardial preservation.(11)

It is essential to understand and use the various techniques to obtain the desired protective effect. Some surgeons who are not familiar with blood **cardioplegia** criticize it as cumbersome and overly complicated compared to the simpler administration of crystalloid **cardioplegia**. However, in this case, simplicity and safety are not synonymous. Cardiac damage from inadequate myocardial protection leading to low-output syndrome can prolong hospital stay and cost, and may result in delayed myocardial fibrosis.(12) In our study, there was a significant decrease in the incidence of atrial fibrillation, use of postoperative IABP, and time required for return of normal sinus rhythm after cross clamp release. We believe that these were due to better myocardial protection from warm blood cardioplegia . Our subgroup analyses indicated that the benefits of warm blood cardioplegia are statistically significant in routine low-risk CABG, but not more apparent in the higher-risk subgroups,

The limitations of this study include the fact that it was not randomized. The two groups were separated by time but there were no changes in the operative management protocols during the study period. . It was concluded from this study that the use of intermittent antegrade warm blood cardioplegia for myocardial protection is safe and clinically appropriate during cardiac surgery. Clinical benefit was not apparent in high-risk subgroups The advantages are probably wider in low-risk patients, and larger trials would be required to settle this issue(13) . It was noted that the use of intra aortic balloon support was in a higher incidence in cold crystalloid cardioplegia group Finally, lengths of stay in the ICU and in the hospital were less in IAWBC group. However, these are very gross markers of outcome because they are influenced by numerous external factors independent of the cardioplegia or bypass temperature (9)..

Conclusion:

IAWBC results in less myocardial cell damage than cold crystalloid cardioplegia, as assessed by the release of cardiac-specific markers. Better right ventricular preservation is possible and results in less need for inotropic support.

Normothermic bypass increases the need for vasoconstrictors during CPB without significant effects on end-organ function. IAWBC could be used as a safe technique in non complicated cases that could safe a lot to patient`s safety and surgeons outcome .

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LATE HYPERTENSION AFTER REPAIR OF COARCTATION OF AORTA "RISK FACTORS AND PREVENTION"

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Background: **Late hypertension after repair of coarctation of aorta is an important problem that has its risk factors as delaying surgical repair and presence of residual coarctation. The relationship between the timing of repair of and the development of late postoperative hypertension raises the question about the proper timing of elective repair of coarctation of aorta. Objectives: to identify the proper timing for repair of coarctation of aorta & its relation to the incidence of late postoperative hypertension, operative mortality and residual coarctation.**

Methods: **The records of the 102 patients that were regular in follow up after undergoing a surgical procedure for isolated coarctation of the aorta between 1995 and 2007 in Abo El-Rish insurance student hospital were reviewed. The patients were grouped according to age: infants (up 12 months, n = 36), toddlers (preschool children; 1 to 4 years, n = 49), and children up to 16 years (more than 4 years, n = 17). Specific outcomes analyzed included mortality, recurrent coarctation, and development of late hypertension**

Results: **There was one death and 16 patients (15.6 %) with persistent coarctation with no statistically significant determinants for either mortality or persistent coarctation, in particular, type of operation and age at operation. Of 23 patients operated on during infancy and were followed up for more than 5 years, late hypertension has developed in only 2 (8 %); both of them had recurrence of coarctation. In contrast, 14 of the 48 patients (29 %) operated on after 1 year of age had late hypertension (p < 0.002 compared with the infant group). Only four of these patients had recurrent coarctation. Multivariate analysis identified age at repair as a significant predictor of late hypertension.**

Conclusion: **the optimal age for elective surgical relief of coarctation of the aorta is during the first year of life. There was no increased mortality or recoarctation rate by repair in this young age group. Although the incidence of recurrence was relatively low and unrelated to the surgical approach, identification and proper treatment of recoarctation at an early age are imperative to minimize the development of late hypertension.**

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Proper timing for elective repair of coarctation of the aorta remains controversial. Delaying the surgical procedure until later in childhood may fail to relieve systemic hypertension completely [1, 2–6]. Old studies dating from the 1970s and 1980s have suggested that relief of aortic coarctation should be performed before school age to reduce the incidence of persistent hypertension [4–6]. Even more, recent studies recommended elective surgical relief of coarctation of the aorta to be done during the first year of life to avoid a sixfold increase in

the incidence of late hypertension compared to delayed repair in the toddler and older age groups [7].

Residual or recurrent coarctation is a risk factor for persistent systemic hypertension after repair of coarctation of aorta. Some studies reported up to 50% incidence of late hypertension in patients with recurrence of coarctation which underscores the importance of identifying this complication at an early age [2–4, 7].

In this study we try to identify the proper timing for repair of coarctation of aorta & its relation to the incidence of late postoperative hypertension, operative mortality and residual coarctation.

Methods:

The records of the 102 patients that were regular in follow up after undergoing a surgical procedure for isolated coarctation of the aorta between 1995 and 2007 in Abo El-Rish medical insurance student hospital were reviewed. This retrospective study reviewed operative notes, follow-up clinic visits, and postoperative echocardiographic and cardiac catheterization data, if were done. Ninety-nine percent of the patients have been followed up for a mean of 5.5 years (range, 6 months to 10 years).

Patents with coarctation of aorta associated with other cardiac anomalies (e.g. VSD, & others) were excluded from this study to avoid the influence of the associated anomalies on the mortality and on the decision of timing of repair.

The median age at operation was 25 months (range, 2 months to 16 years). The patients were grouped according to age: infants (up 12 months, n = 36), toddlers (preschool children; 1 to 4 years, n = 49), and children up to 16 years (more than 4 years, n = 17).

All operations were performed through a left posterolateral thoracotomy. Resection of the aortic isthmus and ductal tissue with primary end-to-end anastomosis was performed in most cases (n = 54). The extended end-to-end technique was used to augment the hypoplastic aortic arch in 10 infants [8, 9, 10, 11]. Subclavian flap arterioplasty was performed in 19 patients [12, 13]. Patch aortoplasty (n = 17) and interposition graft (n = 2) were used primarily in older patients.

Systemic hypertension was defined in adults when the right arm blood pressure exceeded 160/90 mm Hg. For patients less than 18 years of age, hypertension was defined as blood pressure greater than the 90th percentile for age [14]. Hypertension that persisted for more than 5 years after the operation was considered late hypertension. Residual or recurrent coarctation was defined as a systolic blood pressure gradient between the right arm and either leg exceeding 20 mm Hg. Documentation of persistent coarctation was confirmed with echocardiography, angiography, or both.

Variables used in the univariate analysis included age at repair, class of coarctation, type of operation, and residual or recurrent coarctation. Specific outcomes analyzed included mortality, recurrent coarctation, and development of late hypertension. Multivariate analysis was performed using the Cox proportional hazards model. Actuarial data were analyzed by the Kaplan–Meier method with 95% confidence limits. Categoric data were compared with the Fisher's exact test. Statistical significance was defined when p was less than 0.05.

Results:

Mortality:

One of the 102 patients with isolated coarctation died (0.009 %) due to postoperative cerebral hemorrhage and chest infection in a 4 month old boy that had an extended end-to-end technique. An additional 5 patients died between 2 months and 10 years after the operation due to non cardiac causes. No statistically significant determinants for mortality were identified with multivariate analysis. In particular, type of operation and age at operation were not predictors of mortality.

Residual or recurrent coarctation:

A total of 16 patients (15.6 %) had evidence of persistent coarctation. Eleven of them have undergone reintervention in the form of balloon angioplasty. Overall freedom from reintervention at 1, 5, and 10 years was 95%, 93%, and 90%, respectively. The 5-year freedom from reintervention stratified according to age at repair was 86 % for infants (5/36 patients), 89 % for toddlers (5/49 patients), and 94 % (one patient) for children and adults (not reaching statistical significance). No statistically significant determinants for residual or recurrent coarctation were identified with multivariate analysis. In particular, type of operation and age at operation were not predictors of recurrence.

Late hypertension:

Seventy one patients have been followed up for more than 5 years. Late hypertension has developed in 16 (22.5 %). Twenty three patients operated on during infancy have been followed up for more than 5 years. Of these, late hypertension has developed in only 2 (8 %); both of these patients had recurrence of coarctation. In contrast, 14 of the 48 patients (29 %) operated on after 1 year of age had late hypertension ($p < 0.002$ compared with the infant group). Only four of these patients had recurrent coarctation. Multivariate analysis indicated that age at repair was a significant predictor of late hypertension.

Discussion:

Although many studies have searched for the optimal surgical procedure for repair of coarctation of aorta, few have searched for the proper timing of surgical repair. However, in the absence of a large, randomized study, superiority of one technique over another is unlikely to be demonstrated. In our study, we could not demonstrate an advantage for any of the surgical approaches in minimizing mortality, recurrence, or late hypertension. These findings are similar to those reported by other investigators [9, 10, 14]. However, it is recognized that each technique has specific indications according to the age of the patient and the criteria of the coarctation.

The 15.6 % incidence of recurrence of coarctation in this study is similar to that reported by others [1–3, 7, 8, 9, 10, 13, 14, 15, 16]. Several investigators have shown a higher incidence of recurrence following repair of coarctation during infancy [1, 2, 3, 6]. This higher rate of recurrence in very young patients may reflect inadequate relief of aortic arch hypoplasia commonly seen in this age group. In the current study, we did not find a significantly higher rate of recoarctation in neonates and infants. This may have reflected a more aggressive approach in recent years to augment the aortic arch with the extended end-to-end anastomotic technique.

As regarding the occurrence of late hypertension after coarctation repair, we found a direct relationship with the age at operation. Surgical relief of coarctation of the aorta before the age of 1 year was associated with a very low (8 %) incidence of late hypertension. In contrast, relief of coarctation after 1 year of age resulted in much increase in the occurrence of late hypertension (29 %). Similar results have been shown by Seirafi and collegues who demonstrated that relief of coarctation after 1 year of age resulted in a sixfold increase in the occurrence of late hypertension when compared with cases operated during the 1st year of life [7]. The importance of the prevention of persistent elevation of blood pressure after coarctation repair is clearly illustrated in other studies which have shown that late postoperative hypertension is an independent risk factor for premature death [1, 7, 8, 16].

Prevention of occurrence of late hypertension:

There are 2 arms for this; avoidance and early management of residual coarctation, and proper timing of correction of coarctation.

The 37.5 % incidence of late hypertension in our patients with recurrence of coarctation (16 patients) show the importance of identifying this complication at an early age [2–4]. Early relief of recoarctation with either balloon angioplasty or a reoperation before 1 year of age may prevent the onset of late hypertension. Close surveillance of all patients is thus warranted after repair of coarctation.

Most of the previous investigations which have attempted to determine the appropriate age for repair often failed to include significant numbers of patients from all age groups, thus precluding accurate statistical comparisons [2–4]. Bergdahl and coworkers [5] recommended surgical repair before school age; however, no patient less than 5 years of age was included in the study. Campbell [13] suggested that the optimal age for surgical correction was during infancy; however, children older than 1 year of age were not included in the study. Even in two studies from Great Britain reported in the 1970s that suggested that the optimal age for coarctation repair was during the first year of life, the conclusions of both studies were not supported by the data [2, 3]. In the study by Shinebourne and associates [2], the incidence of late hypertension was nearly identical in patients operated on either before or after 1 year of age (29% versus 32%). Even more, the operative mortality was actually greater in the neonatal and young infant groups when compared with older children (21% versus 4%). Similarly, in the study by Patel and coworkers [3], the rates of persistent hypertension were virtually the same for the infant and older age groups. More important, both operative mortality and the development of recoarctation were significantly greater in the infant age group. Hence, contrary to the stated conclusions, the results from these two studies suggest that safe repair of coarctation should be performed in children after, not before, 1 year of age.

In contrast to these previous studies, statistical analysis of the data from the current study does support our conclusion that repair of coarctation should be performed during the first year of life. Using a variety of surgical techniques we demonstrated that the surgical mortality and freedom from recurrence in the neonatal and infant age groups were equivalent to those of toddlers and older patients. Thus, repair of coarctation during infancy in our series of patients was performed safely and with minimal morbidity. The benefit of early repair was clearly shown in the analysis of the long-term results. The relatively low incidence of late hypertension in the infant repairs (8%) compared to the 29% incidence in the toddler and older age groups provides compelling evidence that repair of coarctation of the aorta should be performed during the first year of life to avoid this serious lifelong complication.

Conclusions:

In summary, the findings in this study indicate that the optimal age for elective surgical relief of coarctation of the aorta is during the first year of life. There was no increased mortality or recorctation rate by repair in this young age group. Although the incidence of recurrence was relatively low and unrelated to the surgical approach, identification and proper treatment of recoarctation at an early age are imperative to minimize the development of late hypertension.

Limitations of study:

A recognized limitation in this study is that the data were collected and analyzed in a retrospective manner. It is possible that important determinants for the stated outcomes of the study (mortality, recurrence, and late hypertension) were either not appreciated or not properly analyzed. We also realize that because this was not a prospective randomized study the inferences made may be subject to further statistical scrutiny. However, we believe that the relatively large number of patients in our study has established a sufficient database for proper statistical analyses to support our conclusions.

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Bidirectional cavopulomnary shunt without cardiopulmonary bypass, the experience of Ain Shams University

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Backgrawnd : **The bidirectional Glenn shunt (BDG) is an operation to divert systemic venous return from the superior vena cava (SVC) directly to both lungs through the right pulmonary artery (RPA), bypassing a hypoplastic or absent right ventricle.**

Methods: **Evaluation of the Ain Shams University pediatric cardiac surgery unit in off pump bidirectional cavo-pulmonary shunts.**

Methods:Between 2001 and 2009, 193 patients had bidirectional cavopulomnary shunt. Cardiopulmonary bypass was used for selected patients in case of the inability to clamp the pulmonary artery. In the off pump cases, different type of shunts were used to prevent the increase of SVC pressure and the consequent possibility of brain edema. Anti-platelet treatment and diuretics were used for all patients in the postoperative period.

Results: **The cardiopulmonary bypass was used in 32 patients (16.6%) and 161 patients (83.4%) had an off pump cavo-pulomnary shunt. In 32 patients a bilateral bidirectional cavopulomnary shunt for a persistent left SVC without an innominate vein; 28 of them were performed without cardiopulmonary bypass. There was only three mortalities (1.6%), the cause in two of these mortalities were continuous capillary leakage because of high pulmonary artery pressure that resulted in recurrent serous membrane effusions. The third mortality was due to septicaemia and multi-organ failure. The most common postoperative morbidity was right sided pleural effusion in 57 patients (29.5%), of them 18 patients (9.3%) were controlled with increasing the diuretics and 29 patients (15%) needed insertion of an intercostal tube.**

Conclusion: **The cavo-pulomnary shunt can be done safely off pump in most but not all case. Cardiopulmonary bypass should be used in selected cases. The selection should be confirmed intraoperatively.**

The bidirectional Glenn shunt (BDG) is an operation to divert systemic venous return from the superior vena cava (SVC) directly to both lungs through the right pulmonary artery (RPA), bypassing a hypoplastic or absent right ventricle. This cavo-pulomnary connection provides excellent palliation in complicated malformations associated with low pulmonary blood flow, low pulmonary arterial (PA) pressure, and low pulmonary vascular resistance. It raises systemic arterial oxygen saturation (SaO2) by increasing the effective pulmonary blood flow. At the same time, it can relieve the volume load of the single functional ventricle and improve the geometric structure of the ventricle [1-2].

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It is also performed as part of a one and a half ventricle repair in patients with hypoplastic right ventricle and for lesions like Ebstein's anomaly to reduce volume overload. Most often, it is performed under cardiopulmonary bypass (CPB), with its associated complications and costs. The conduct of this operation without CPB can be associated with significant elevation of the proximal superior vena cava (SVC) pressure that may lead to neurological damage. Safety of performing BDG without CPB has been reported earlier [3–10].

Most of these authors have reported this procedure using various techniques to drain the SVC blood during clamping. Since the first suggestion made by Lambarti et al. [11], transient external shunt techniques used for caval drainage had become increasingly popular. However, criteria for performing the bidirectional cavo-pulmonary shunt without cardiopulmonary bypass are not well established. Some surgeons have employed this approach in patients at particular risk for cardiopulmonary bypass [12]. Since professor Shoeb has performed the 1st bidirectional cavopulomnary shunt in Egypt in 1994 tens of this procedure are done by all of the 6 paediatric surgeons of our unit each year. We started to perform all the bidirectional cavopulomnary shunts on Cardiopulmonary bypass. Starting from 2000 some selected cases were performed without bypass and slowly off pump bidirectional cavopulomnary shunt became the routine while performing it on cardiopulmonary bypass became reserved to selected cases or in case of inability to perform the operation off pump. In this study we aimed at the evaluation of our experience in the off pump bidirectional cavopulomnary shunt.

Methods:

Between 2001 and 2009 193 patients had bidirectional cavopulomnary shunt. The patient characteristics are shown in table 1.

Variable	Value
Age	6 – 129 months(median 28 + 11)
Sex: female	101 (52.3%)
Male	92 (47.7%)
Weight:	6-32 Kg (median 12 + 5.3 Kg)
Diagnosis:	
Pulmonary atresia	19 (9.8%)
Tricuspid atresia	33 (17.1%)
Shone syndrome	6 (3.1%)
DORV	13 (6.7%)
Unbalanced TOF	21 (10.9%)
Single ventricle	74 (38.3%)
TGA, VSD, PS	27 (14%)
Systemic venous drainage abnormality:	41 (21.2%)
Lt SVC with an innominate vein	9 (4.7%)
Lt SVC without an innominate vein	32 (16.6%)
O2 saturation:	
Less than 75%	121 (62.7%)
More than 75%	72 (37.3%)
Previous operation:	83 (43%)
Pulmonary artery banding	58 (30%)
Modified Blalock-Taussig shunt	25 (13%)

Table 1: Patients` characteristics

ECG, plain chest X-ray and echocardiography were done to all patients. Angiography was performed to selected patients (37, 19.2%). Cardiopulmonary bypass was used for selected patients in case of the inability to clamp the pulmonary artery. In the off pump cases, different type of shunts were used to prevent the increase of SVC pressure and the consequent possibility of brain edema. One of our staff surgeons doesn't use any shunt.

The anastomosis between the SVC and the pulmonary artery was done using proline7/0 or 6/0. The azygos vein was ligated in all patients except in case of interrupted IVC. All patients had near occlusive pulmonary artery banding to decrease the pulmonary artery pressure while maintaining a pulsatile flow and hepatic factor reaching the lungs. All the right MBT shunts were disconnected from the right pulmonary arteries and the site was used for the new anastomosis. All patients were put in fowler's position and rapid extubation to decrease the intrathoracic pressure. Anti-platelet treatment and diuretics were used for all patients in the postoperative period.

varaible	**Group A**	**Group B**
Age	**12 – 39 months**	**6 – 129 months**
	(median 16.4 +7.7)	**(median 22.1 + 9.6)**
Sex: female	**23 (71.9%)**	**85 (52.8%)**
Male	**11 (18.1%)**	**76 (47.2%)**
Weight:	**6-18.5 kg (median 10.8 + 4.7)**	**6-32 Kg (median 14.1 + 5.8 Kg)**
Diagnosis:		
Pulmonary atresia	**13 (40.6%)**	**6 (9.8%)**
Tricuspid atresia	**5 (15.6%)**	**28 (17.1%)**
Shone syndrome	**2 (6.3%)**	**4 (3.1%)**
DORV	**4 (12.5%)**	**9 (6.7%)**
Unbalanced TOF	**3 (9.4%)**	**18 (10.9%)**
Single ventricle	**4 (12.5%)**	**70 (38.3%)**
TGA, VSD, PS	**1 (3.1%)**	**26 (14%)**
Systemic veins:	**7 (21.9%)**	**34 (21.1%)**
Lt SVC + innominate	**5 (15.6%)**	**4 (2.5%)**
Lt SVC no innominate	**2 (6.3%)**	**30 (18.6%)**
O2 saturation:	**27(84.4%)**	**94 (58.4%)**
Less than 75%	**5 (15.6%)**	**67 (41.6%)**
More than 75%	**7 (21.9%)**	**76 (47.2%)**
Previous operation:	**0**	**48 (29.8%)**
Pulmonary artery banding	**7 (21.9%)**	**18 (11.2%)**
M. Blalock-Taussig shunt	**2 (6.3%)**	**1**
Late mortality	**85%**	**87%**
O2 Saturation (median)		
Pleural effusion	**15 (46.9%)**	**42 (26.1%)**
Medical treatment	**4 (12.5%)**	**14 (8.7%)**
Tube drainage	**11(34.4%)**	**28 (17.4%)**
Hospital stay (median)	**9 + 2.8 days**	**7 + 1.4 days**

Table 2: differences between group A and B.

Results:

There was no operative mortality. The cardiopulmonary bypass was used in 32 patients (16.6%) – group A - and 161 patients (83.4%) - group B - had an off pump cavopulomnary shunt. A comparison between the two groups is shown in table 2. In 32 patients a bilateral bidirectional cavopulomnary shunt for a persistent left SVC without an innominate vein; 28 of them were performed without cardiopulmonary bypass. Four of the 6 left MBT shunts were left opened being small (3.5 mm and difficult to be controlled. Thirteen patients (6.7%) needed early postoperative exploration for bleeding. There was only three late mortalities (1.6%), the cause in two of these mortalities were continuous capillary leakage because of high pulmonary artery pressure that resulted in recurrent serous membrane effusions. The third mortality was due to septicaemia and multi-organ failure. Smaller pulmonary arteries for age with associated with much higher incidence of using cardiopulmonary bypass. The most common postoperative morbidity was right sided pleural effusion in 57 patients (29.5%), of them 18 patients (9.3%) were controlled with increasing the diuretics and 29 patients (15%) needed insertion of an intercostal tube. Two patient had postoperative thrombotic problems that was controlled by intravenous heparin both were from group B. The median oxygen saturation 5 days postoperative was higher in group B (89 + 2.4 %) compared with group A (87 + 3.1%).

The median hospital stay was 8 + 2.1 days (4 – 17). The median follow up time was 3.7 + 3.2 years (2 months – 9 years)

Discussion:

After a series of experiments on the direct delivery of venous blood into the PA circulation, Glenn demonstrated the clinical use of an SVC-RPA shunt in 1958. The classic Glenn shunt used to be performed through a thoracotomy without CPB [13]. Glenn, in his original report had partially occluded the SVC. However, in practice many of these shunts used to be performed with total occlusion of the SVC, without any apparent neurological injury. Lamberti et al. [3] described construction of BDG without CPB in seven patients, one of whom had bilateral SVC in whom no intraoperative shunt was used. In the other six patients, intraoperative SVC-right atrial temporary shunt was used with standard vena cava cannulas for shunting, with special efforts made to prevent air embolism. There is no consensus on the criteria for performing BDG. Most authors would suggest that the mean PA pressure should be less than 18 mmHg, or ideally below 15 mmHg. In contrast to a systemic pulmonary shunt, the cavopulmonary shunt does not increase ventricular work, thereby avoiding further ventricular hypertrophy and compliance reduction. In comparison with the classic Glenn shunt, BDG provides bilateral pulmonary blood flow, thereby avoiding the mismatch that may occur between the SVC flow volume and thecross-sectional area of the entire right lung. The role of accessory pulmonary blood flow in the setting of a BDG remains contentious. An additional source of pulmonary blood flow may mitigate some of the benefits of a bidirectional cavopulmonary shunt physiology by offsetting the reduction in ventricular volume load and increasing the likelihood of pulmonary vascular complications. On the other hand, it may offer some advantages over a pure cavo-pulomnary shunt physiology: the increased SaO2 may be sufficient to reduce baseline cyanosis, and the additional source of pulmonary blood flow may allow for modestly improved exercise tolerance. In addition, by providing hepatic blood directly to the lungs, introducing an element of pulsatility to the pulmonary flow and increasing flow rates, an additional source of pulmonary flow may in fact reduce the likelihood of pulmonary vascular complications (such as arteriovenous fistulas and aortopulmonary collaterals) and improve pulmonary artery growth[2]. Subsequent studies also demonstrated that bidirectional cavo-pulmonary shunt and even extracardiac Fontan operations might be executed without cardiopulmonary bypass [5,12,14]. Murthy et al. performed bidirectional Glenn shunt operation by using different types of transient external shunt [5]. In their series of five patients, they demonstrated that the avoidance of cardiopulmonary bypass and aortic cross-clamping has the advantages including earlier extubation, lesser usage of blood products, decreased necessity and duration of inotropic support. Mohan Reddy et al., demonstrated a post-operative increase in pulmonary vascular resistance and hypoxia after cardiopulmonary bypass and reported that transient external shunt approach must be indicated on a wider basis [15]. One of the major concerns of performing BDG without CPB is the concern of cerebral damage due to SVC clamping. Clamping the SVC without decompressing the internal jugular venous system has been demonstrated to reduce cerebral perfusion pressure. Rodriguez et al. [16] reported a case of transient obstruction of the SVC by a venous cannula. This resulted in increased central venous pressure, reduced cerebral blood flow velocities, followed by regional cerebral venous oxygen desaturation and global electroencephalographic slowing. Repositioning of the

cannula was associated with return of the values to the baseline. Rodriguez also reported major reduction (50%) in the diastolic, mean, and peak systolic blood flow velocities of the middle cerebral artery, followed by mild electro-cortical alterations indicated by longer latencies of the cortically generated evoked potentials on clamping the SVC without CPB. In contrast, this situation did not occur or was minimal in those cases in which clamping of the SVC were done with the support of CPB. Our primary results [17-19] was more directed towards the results of the bidirectional cavopulomnary shunts and the safety of doing it without bypass in selected cases. From all those studies we can see both the recommendation of doing the cavo-pulmonary shunt without CPB and the warning from clamping the SVC without venting. Our experience shows clearly that the only contraindication for off pump bidirectional cavopulomnary shunt is the failure of maintaining hemodynamic stability and acceptable O2 saturation after clamping of the ipsilateral pulmonary artery. Causes of clamping test failure varies from considerable difference of the pulmonary arteries size, contra lateral lung problems or being dependent on and ipsilateral shunt with the inability to clamp distal to the shunt. The extra cardiac shunt varies from a persistent left SVC (draining to the atrium) with an innominate vein, innominate or SVC-right atrial shunt or internal jugular-femoral venous shunt with or without a roller. The aim of the shunt is to prevent any cerebral venous pressure above 25 mmHg. The most important factor in patient selection is the pulmonary artery pressure and the matching between the size of the SVC and the pulmonary artery. The ideal pulmonary artery pressure after the operation is 16-20 mmHg. Total or near total pulmonary occlusion is performed to avoid unnecessary high pulmonary artery pressure while maintaining flow pulsatility and some of the IVC blood to reach the lung (the hepatic factor theory). Early extubation and ambulation is an essential part of the postoperative management to prevent complications. We can't ignore the clear superiority off pump bidirectional cavo-pulmonary shunt as regard economics, easiness and simplifying the completion of Fontan operation. We have also to mention the weaknesses of our study being in a big part a retrograde study, the absence of long term neurological assessment and the inability to compare between the two groups being nonrandomized or even of completely different selection criteria.

Conclusion:

The bidirectional Glenn shunt without cardiopulmonary bypass is a safe procedure in selected patients. It avoids cardiopulmonary bypass related problems and is economical, with excellent results. Selection of the appropriate patient for the procedure is a very important factor in the outcome.

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Chest wall reconstruction; Single Center Experience

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Background: **Chest wall defects continue to present a complicated treatment scenario for thoracic and reconstructive surgeons. The purpose of this study is to evaluate our results in patients who underwent chest wall resection and reconstruction with and without prosthesis.**

Methods: **This is a retrospective review of 40 patients who underwent chest wall resection and reconstruction at Cairo university hospitals. Patients' demographics, the location of the chest wall defect, performance of lung resection if any, the type of prosthesis and postoperative complications were recorded.**

Results: **From October 2006 to December 2008, 40 patients underwent chest wall resection for primary bronchogenic carcinoma with extension to the chest wall in 18 patients (45%), primary chest wall tumors in 12 patients (30%), primary breast cancer with recurrence or metastases to the ribs in 2 patients (5%), osteomyelitis in 3 patients (7.5%), and radiation necrosis in 5 patients (12.5 %).**

Prosthetic reconstruction was rigid (polypropylene mesh/ methylmethacrylate) in 22 patients (55%), non rigid (polypropylene mesh only) in 11 patients (27.5%), no prosthesis in 7 patients (17.5%). Postoperatively, we had no mortality, respiratory complications in 4 patients (10%), no respiratory failure in any patient, 3 patients had chest infection and 1 patient had atelectasis. Wound complications in 5 patients (12.5%), 3 patients had superficial wound infection, 1 patient had seroma all of them controlled conservatively, and 1 patient had donor site hernia.

Conclusion: **Chest wall resection and reconstruction with or without prosthesis can be performed as a safe, effective one-stage surgical procedure for a variety of major chest wall defects.**

Accepted for publication
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Defects of the chest wall almost always occur as a result of neoplasm (primary, recurrent or locally invasive), radiation necrosis, infection or trauma[1].the surgeon is eager to obtain wide margins and rid the patient of all possible malignant, contaminated, or irradiated tissues while leaving a defect that can be closed to maintain life itself. A thorough knowledge of reconstructive techniques with a clear operative plan is most desirable. We believe that this dilemma is best managed by the combined effort of both a thoracic and plastic surgeons. [2-4]

Improvements of surgical techniques and anesthesia, critical care units, antibiotics, and the development and refinement of reconstruction techniques

have allowed extensive chest wall resection and reconstruction to be performed with acceptable morbidity and mortality [5].

The management of such lesions includes resection, skeletal reconstruction & soft tissue coverage of the defect. If chest wall integrity is compromised, the use of exogenous materials is crucial for the successful management of these cases, the initial materials used consisted of autogenous tissues such as fascia lata, rib grafts or large cutaneous flaps [3].

The use of prosthetic materials including polytetrafluoroethylene (PTFE), polypropylene mesh (PPM), and polypropylene mesh methylmethacrylate composites (PMM) has enabled successful reconstruction of even the largest chest wall defects (6). This innovative technique of reconstruction of the bony chest wall defects within fabricated heat-cure polypropylene methylmethacrylate ribs provide many advantages, it does not require much experience, less time consuming and also provides stability and rigidity to the chest wall. Also it is inexpensive material compared with various implants in use. The technique also results in a near normal contour and configuration of the chest wall. Also the danger of tissue damage caused by exothermic reaction is nonexistent [7].

Soft tissue coverage of the reconstructed chest wall is equally important and various techniques have been used by the plastic surgeons including pedicled muscle transposition and free muscle flaps have been used to provide adequate wound coverage that allows for quick healing, rehabilitation, and cosmesis. The Latissimus dorsi muscle have an axial blood supply permits elevation and rotation with or without their overlying skin, so Latissimus dorsi muscle flap was used frequently to cover antero-lateral chest wall "rib-defect" after tumor resection [8].

Also the Pectoralis major muscle and the Rectus abdominus muscle usually used to cover sternal defects.

However despite these techniques, complications after chest wall resection and reconstruction are common, respiratory complications continue to be the frequent .The high incidence of respiratory complications has been attributed to the presence of flail segment of the chest wall, leading to poor pulmonary toilet and subsequently respiratory failure. Other frequent complications include arrhythmias and wound complications [9].

Methods

The medical records of 40 patients who underwent chest wall resection and reconstruction at Cairo University hospitals from October 2006 to December 2008 were retrospectively reviewed .Patients with less than two ribs resections, routine pectus resection or Eloesser procedures were not included in this study. All patients received conventional chest roentgenography which occasionally detects a defect or mass, for patients with mass a computed tomography (CT) scan or magnetic resonance imaging (MRI) was done to evaluate the extent and exact nature of the lesion.

The preoperative data collected included patients' demographics and medical co-morbidities; surgical data were obtained from operative reports and included: the location of the chest wall lesions, the number of the ribs resected, whether lung resection was also performed and the methods of skeletal and soft tissue reconstruction.

Anterior chest wall defects were defined as being located between the sternum to the anterior axillary line; lateral defects located between the anterior and posterior axillary lines; and posterior defects as located between the spine and posterior axillary line .The size of the chest wall defects and the histological diagnosis were obtained from the final pathology report. Skeletal reconstruction was categorized as a rigid prosthesis, a non-rigid prosthesis, or no prosthesis.

Rigid reconstruction consisted of polypropylene mesh-methylmethacrylate sandwich (PMM) in which methylmethacrylate is applied within double layer of polypropylene mesh tailored to the size and contour of the defect we managed to create strips of the methylmethacrylate that mimics the natural ribs rather than using it as a solid plate except when we resects the whole sternum.

Non-rigid reconstruction means the use polypropylene mesh (PPM) alone to reconstruct the chest wall.

When chest wall resection was done for radiation necrosis no reconstruction of the chest wall is done only soft tissue reconstruction using myocutaneous flaps were used, as the chest wall was fixed and the underlying tissues are scarred down.

All soft tissue reconstruction was done by the same plastic surgery team, postoperative analgesia was provided through epidural catheter or intravenous analgesia.

Our routine Peri-operative management was early extubation, usually in the operating room at the end of the procedure, then overnight stay in the intensive care unit, and transfer to the thoracic surgical ward on the second postoperative day.

Complications were considered perioperative if it occurs within 30 days of the time of surgery. Prolonged air-leak was defined as chest tube air-leak of more than 7 days postoperatively .Pneumonia defined as localized pulmonary infiltrates with culture-positive identification of a pathogenic organisms.

Results

Our study included 40 patients who underwent chest wall resection and reconstruction in Cairo University Hospitals. There were 31 males and 9 females with median age of 43 years (range 23 to 65 years)

The significant medical history of the study group is presented in (table 1)

	No patients
Hypertension	14(35 %)
Diabetes Mellitus	8 (20 %)
Chronic Obstructive Pulmonary Disease	4 (10 %)
Ischemic Heart Disease	2 (5 %)
Smoking	29 (72.5 %)

Table.1 Significant Medical History

The indications for resection were tumors in 30 patients (75 %) which included primary bronchogenic carcinoma with extension to the chest wall in 18 patients (45%), primary chest wall tumors in 12 patients (30%), primary breast cancer with recurrence or metastases to the ribs in 2 patients (5%), infection in 3 patients (7.5%), and radiation necrosis in 5 patients (12.5 %). (Table 2)

	No patients
Bronchogenic Carcinoma	18 (45 %)
Primary Chest wall Tumor	12 (30 %)
Radiation Necrosis	5 (12.5 %)
Infection of the chest wall	3 (7.5 %)
Breast Carcinoma	2 (5 %)

Table.2 Indication for chest wall resection

The most common histological findings were non-small cell bronchogenic carcinoma, bone or soft tissue sarcoma and breast carcinoma.

The lesions were located in the sternum or anterior chest wall in 19 patients, posterior in 5 patients and lateral in 16 patients. Lesions in the anterior locations were frequently repaired with a rigid prosthesis whereas posterior and lateral defects were repaired more frequently by PPM or no prosthesis.

Concomitant lung resection was performed in 18 patients (33.3 %). Some form of sternal resection was done in 7 patients (17.5 %), including partial sternectomy in 4 patients, and total sternectomy in 3 patients. (Table 3)

	No patients
Combined Lung/chest wall resection	18 (45 %)
• Rib Defects	
Anterior	12 (30 %)
Lateral	16 (40 %)
Posterior	5 (12.5 %)
• Sternal defects	
Partial Sternectomy	4 (10 %)
Total Sternectomy	3 (7.5%)

Table.3 Chest wall resection: Anatomic Defects

Prosthetic material were used to reconstruct the chest wall defects in a total number of 35 patients, rigid prosthesis(PMM) in 22 patients (55 %), and non-rigid prosthesis(PPM) in 11 patients (27.5%),where no prosthesis was used in 7 patients (17.5%).

Primary soft tissue coverage was achieved in all patients, when transposed tissue was required, pedicled myocutaneous flaps were used in all patients. The most common source for the transposed tissue was Latissimus Dorsi muscle in anterolateral and posterolateral defects. Pectoralis major muscle advancement is used to cover the sternal reconstruction.

Soft tissue reconstruction is done alone without skeletal reconstruction in 7 patients, in 5 patients we used Latissimus Dosi myocutaneous flap, Rectus

Abdominus in 1 patient, and Omentum in 1 patient. (Table 4)

	No patients
Rigid Reconstruction Methylmethacrylate Composite	22 (55 %)
Non rigid Reconstruction Polypropylene Mesh only	11 (27.5 %)
Soft tissue Reconstruction only	7 (17.5 %)
Latissimus Dorsi	5 (12.5 %)
Rectus Abdominus	1 (2.5 %)
Omentum	1 (2.5 %)

Table.4 Methods of Reconstruction

The size of the defect was significantly larger in patients who had rigid reconstruction as compared with those who had a non rigid or no reconstruction. The patients who had rigid reconstruction overall had significantly more ribs resected.

The overall length of hospital stay was 16 days, range (7 to 23) days ,the length of intensive care unit stay was 2 days, range (1 to 4) days.

(Table 5) shows the characteristics of different types of reconstruction.

	Rigid (PMM)	Nonrigid (PPM)	None	P Value
Median age, (range)	62(20-75)	57(18-69)	55(23-66)	0.07
Median no. ribs(range)	4(2-6)	3(1-5)	3(1-4)	0.001
Median size of defect, cm	90(50-110)	51(20-70)	22(10-35)	<0.001
Median length of stay, days	19(10-23)	10(8-17)	6(5-7)	0.12
Complications	5	2	1	0.006

Table 5 : Characteristics of Different Methods of Reconstruction

The most common complications were wound complications, which occurred in 5 patients (12.5 %);no wound dehiscence occurred in any patient, superficial wound infection occurred in 3 patients, all of them controlled by repeated dressing and intravenous antibiotics, wound seroma in 1 patient. We had 1 patient who got donor site hernia, the patient for whom we used the Rectus abdominus muscle to reconstruct the sternum. We don't have any deep wound infection that required debridment or removal of prosthetic material. Respiratory complications occurred in 4 patients (10 %); no patients had respiratory failure, pneumonia in 1 patient, pneumonitis in 2 patients, and atelectasis in 1 patient. (Table 6)

	No Patients
• Respiratory Complications	4 (10%)
Atelectasis	2
Pneumonitis	1
Pneumonia	1
• Wound Complications	5 (12.5 %)
Wound Infection	3
Wound Seroma	1
Donor site Hernia	1

Table 6: Surgical Complications

There was no significant difference in respiratory complications among different groups of reconstruction, but the group of rigid reconstruction (PMM) had significantly higher number of wound complications. (Table7)

Complications	Rigid (PMM)	Nonrigid (PPM)	No	P Value
Respiratory	2	1	1	N.S.
Wound	3	1	0	0.05

Table 7: Difference in complications analyzed by the type of Reconstruction
Analyzed by the Fisher exact test (p<0.1)

Factors associated with postoperative complications were analyzed. The type of the prosthesis, the location of the lesion, type of soft tissue reconstruction, medical comorbidities was not significant predictors of postoperative complications. Multivariate analysis identified patient age, size of chest wall defect, and lung

resection to be significant predictors of postoperative complications. (Table 8)

Variables	p Value
Age	0.005
Lobectomy	0.02
Size of defect	0.001

Table 8: Multivariate Analysis of Predictors of Complication

Discussion:

In the management of patients requiring chest wall resection & reconstruction, three tenets of surgical resection should be maintained. First, a sufficient amount of tissues must be resected to dispose all devitalized tissues. Second, a replacement must be found to restore the rigid chest wall to prevent paradoxical motion during respiration. Third, healthy soft tissue coverage is essential to seal the pleural space and prevent infection. (5) The importance of chest wall reconstruction is illustrated by the historical and recent reports of the treatment of the traumatic flail chest, which suggest that these patients will benefit from chest wall stabilization, which in turn decreases pulmonary complications and length of ventilator support. (10)

There is some controversy to which chest wall defects to be reconstructed but, generally, lesions less than 5 cm in size in any location, and those up to 10 cm in size posteriorly do not need reconstruction for functional reasons. (1).Posterior defects in proximity to the tip of the scapula, larger lesions likely to produce paradoxical chest wall motion and most anterior defects require reconstruction. The prosthetic material used most commonly include polypropylene mesh and polypropylene mesh methylmethacrylate composites.

Complications after chest wall resection are common and range from 23% to 46% in two of the largest series of chest wall resection (1, 5).

Wound complications such as infection, dehiscence, flap loss, and haematoma are reported to occur in 8% to 20 % (1, 9). In our study the incidence of wound complications is matching with these studies, but the severity is much less this can be explained by the technique of using methylmethacrylate as prefabricated isolated ribs which allows better fluid drainage into the pleural space than the nonporous plate of methylmethacrylate also the use of soft tissue coverage using muscle or myocutaneous flaps helps to eradicate any possibility of infection by its rich blood supply.

Respiratory complications including pneumonia, respiratory failure, and atelectasis are by far the most common complications and have been reported to be as high as 24% (5). This series represent single institution experience over multiple decades and therefore don't represent the summation of improvements in surgical techniques, reconstructive materials and postoperative care.

Another recent and big study by Weyant and co workers (9) showed that respiratory complications occurred in 11% of their patients.

Our study showed that the respiratory complications occurred in 10 % of patients, although all the respiratory complications in our study were minor and we didn't have any respiratory failure, our experience reiterates the fact that respiratory complications remains a significant problem especially when large defects were resected.

It is unclear whether surgical technique, careful selection for use of a rigid prosthesis, or both, minimize the possibility of post-operative respiratory complications. Advances in anesthetic management and perioperative care surely play a role in the improved outcome of these patients. However, the use of rigid prosthesis and its influence on respiratory mechanics, especially for large chest wall defects or those located anteriorly or laterally, cannot be discounted.(9)

Lardinois and coworkers(11) reported their experience with 26 patients having chest wall resection and reconstruction with polypropylene mesh methylmethacrylate composites no 30-day mortality and nearly all patients had satisfactory cosmetic and functional outcome.

The prostheses were imaged with cine-magnetic resonance imaging and found to exhibit no paradoxical chest wall motion in any patient (11).

Although our findings do not unequivocally prove the superiority of PMM reconstruction, they certainly emphasize the efficacy of this prosthesis for very large defects that would otherwise leave the patient with a flail chest.

Few prior series have analyzed possible risk factors contributing to post-operative complications after chest wall resection [1].Risk factors that may predispose to postoperative complications include the type of the prosthesis, patient age, the size of the chest wall defect, the addition of sternal resection, concomitant lung resection, medical co morbidities, prior radiotherapy or chemotherapy, reoperation, and the type of soft tissue reconstruction. We identified patient age, size of the defect, and concomitant anatomical lung resection as predictors of postoperative complications by multivariate analysis. It's not surprisingly that the patient age especially age above 60 years is associated with higher morbidity, it's also obvious that the larger the chest wall defect the more likely are postoperative complications. It's important to say that measuring the size of the defect by the number of ribs resected doesn't reflect the accurate size of the chest wall defect.

In conclusion, chest wall resection and reconstruction will yield satisfactory results in most patients and a little difference exists between different techniques of reconstruction. The decision of which technique to use remains the surgeon's choice according to the defect size and site.

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The Management of Stab Wounds of the Heart: Analysis of 73 Cases in the Last 10 Years

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Background: **Despite the advances in the hospital care and emergency room management, stab wounds to the heart still represent an increasing cause of traumatic deaths. Aim of this study is to evaluate our results in the last 10 years to detect the outcome of the patients who had cardiac stab wounds requiring an emergency thoracotomy.**

Methods: **Preoperative and operative variables were reviewed for all patients treated for cardiac stab wounds at Mansoura Emergency Hospital from August 1998 to July 2008 as regard age, sex, anatomical site of injury, time since stab, clinical status of the patient, diagnostic procedure, site of thoracotomy and outcome of the patient.**

Results: **This is a retrospective study of the last 10 years which included 73 patients presented by stabbed heart. There were 69 males (94.5%) and only 4 females (5.5%) and the age ranged from 15 to 65 years with the predominant age group between 20 – 30 years with mean age (28.5 ± 5.8 years). The anatomical site of injury on the pericordium was on left side just to the left of the sternum in 20 cases (27.4%), near the left parasternal line in 28 cases (38.4%) and near the left midclavicular line in 25 cases (34.2%). As regard time since stab most of the patient were coming within the first hour of injury (35 patients, 48 %). The clinical status of the patients were stable in 22 patients (30.1%) with systolic blood pressure (SBP) > 90 mmHg, unstable in 26 patients (35.6%) with SBP < 90 mmHg and shocked not arrested in 10 patients (13.7%) with SBP < 40 mmHg and 15 patients were shocked then arrested before thoracotomy (20.6%). Emergency room (ER) thoracotomy was done in 18 patients (24.7%) and operative room (OR) thoracotomy was done in 55 patients (75.3%). The commonest sites of stabbed heart were in the right ventricle 28 patients (38.4%) followed by left ventricle in 25 patients (34.2%). Mortality occurred in 17 patients (23.3%), twelve of them (16.4%) were after ER thoracotomy and 5 of them (6.8%) were after OR thoracotomy. Morbidity occurred in 12 patients of 56 survival (21.4%). Prognostic factors of outcome of the patients including clinical status (shocked patients had mortality rate 50% while arrested patients was 60%), patients who needed cardiopulmonary resuscitation (CPR) had mortality rate 68.2% and patients needed ER thoracotomy had mortality rate 66.7%.**

Conclusion: **Successful management of this injury depends on prompt diagnosis based on clinical judgment and rapid decision. Reanimation of the patients, rapid transfer to the operating theatre with rapid repair of the cardiac tear in OR. The clinical status of the patients, CPR and ER thoracotomy were a prognostic factors of outcome of the patients and associated with high mortality rate.**

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Keyword: Stab Wound, Heart, Prognostic Factor.

Eighty to ninety percent of stab wounds to the heart result in cardiac tamponade. In most cases, the etiology is penetration of the myocardium with hemorrhage into the pericardial sac. The pericardium spontaneously seals, thereby preventing decompression [1]. Nevertheless, injury to any structure invested by the pericardium, including the proximal pulmonary vasculature, can lead to cardiac tamponade. Patients with penetrating trauma to the heart are often unstable on initial presentation and require early surgical management [2].

Penetrating cardiac injuries are often fatal 10 – 90% and a substantial number of patients is found already dead at the scene. However, if a patient arrives at a medical facility in a compensated state with intact vital signs, the chance for survival is substantially increased [3].

Because of the life-threatening nature of cardiac tamponade, all patients at risk should be carefully evaluated. Classic physical findings include a precordial wound, distant heart sounds, shock, a paradoxical pulse, electrical alternans, hypoxemia, and distended neck veins [2,4]. Beck's triad of distended neck veins, hypotension, and muffled heart sounds was noted in fewer than 10% of patients [5]. Furthermore, distended neck veins associated with elevated central venous pressure may be absent in the setting of profound hypovolemia [2,6]. Therefore, it is often necessary to supplement physical examination with diagnostic tests to identify those patients with cardiac tamponade. Chest X-ray study, central venous pressure measurement, and pericardiocentesis lack the sensitivity and specificity to make these useful screening tests [7]. In addition, pericardiocentesis has risks. Echocardiography is a safe noninvasive alternative that can readily detect even small volumes of pericardial blood [8].

Several factors including the patient's physiologic status on admission, presence of tamponade, mechanism of injury, type and number of cardiac chambers involved, injury severity score, and site of thoracotomy (emergency room [ER] vs. operating room [OR]) all have an effect on prognosis [1,3,6].

In most cases, a stab injury to the heart leads to cardiac tamponade requiring (unless it is the immediate cause of death) emergency thoracotomy and simple cardiorrhaphy [6,8].

Victims of penetrating cardiac injury represent some of the most challenging patients presenting to the ER. Those with cardiac stab wounds who present to the hospital with signs of life have the highest rate of overall survival with intact neurologic function of all patients undergoing resuscitative ER thoracotomy [9]. Management issues include the need for rapid transport, assessment and thoracotomy, the most appropriate physical location for thoracotomy (ER vs. OR), and final outcome based on mechanism of injury, exact location of injury, and presenting vital signs [8,10].

The traditional approach to penetrating cardiac laceration repair consists of control of hemorrhage, which is followed by horizontal mattress suture repair with nonabsorbable Teflon pledget reinforcement [11,12].

The aim of this work is to evaluate our results in the management of the patients with stab wound of the heart to detect the outcome of these patients requiring an emergency thoracotomy.

Methods:

The records of all patients undergoing an emergency thoracotomy for stab wounds of the heart from August 1998 to July 2008 in Mansoura Emergency Hospital were reviewed. The hospital records were cross checked with emergency room records to ensure that no patients were missed.

Data gathered included patient age, sex, site of injuries, physiologic status on admission, the investigations which were used, indication for thoracotomy, presence or absence of tamponade, timing and location of thoracotomy ER vs OR, and patient prognosis. Tamponade was considered to be present if it was described in the operative note, either by the explicit word "tamponade" or a "tense pericardium filled with blood".

This study included all patients with intrapericardiac cardiac wounds who reached alive to the hospital. An intrapericardial cardiac wound was defined as an injury to any chamber of the heart or to the great vessel inside the pericardium. We excluded from this study, arrived dead patients or any stabbed patients either with superficial wound or with penetrating wounds not attacking the heart itself and its intrapericardial great vessel (i.e. without any intrapericardiac injury).

Clinical status of the patient before thoracotomy were detected and according to Arreola et al. [13] the patients were divided into patients considered stable when the systolic

blood pressure (SBP) was > 90 mmHg and considered unstable when the SBP was < 90 mmHg and considered shocked when SBP was < 40 mmHg and considered arrested if shocked then arrested before thoracotomy.

All patients had manifested at least one sign of life. Signs of life included a pulse, measurable blood pressure, or cardiac rhythm. The patients were met in a dedicated trauma resuscitation room where initial resuscitation efforts were undertaken aggressively for every patient. Patients were examined clinically and if stable, diagnosis was usually confirmed by chest x-ray and two-dimensional ultrasound, or preferably by echocardiogram, if it was immediately available. Patients who were in extremis with penetrating chest trauma and who lost their vital signs in transport or in the resuscitation room underwent emergency room thoracotomy (ERT). Patients who survived ERT, and other patients in more stable conditions, were taken to the operating room for a definitive procedure. The whole operations were performed by trauma-trained cardiothoracic surgeons without cardiopulmonary bypass.

Efforts were made to perform all thoracotomies in the OR if possible. Cardiorrhaphy was made by Prolene, Silk, Nylon and Tickron sutures.

Postoperatively, all patients were transported to ICU with monitoring of all vital signs and drainage by intercostal tubes to detect and manage any complication until discharge.

Results:

This is a retrospective study of the last 10 years included 73 patients with stabbed heart.

There were 69 males (94.5%) and only 4 females (5.5%) and the age ranged from 15 to 65 years with the predominant age group between 20 – 30 years with average age (28.5 ± 5.8 years). The anatomical site of injury on the pericordium was on left side just to the left of the sternum in 20 cases (27.4%), near the left parasternal line in 28 cases (38.4%) and near the left midclavicular line in 25 cases (34.2%).

As regard time since stab, most of the patients were coming in the first hour of injury (35 patients, 48%). The clinical status of the patients were stable in 22 patients (30.1%) SBP > 90 mmHg and unstable in 26 patients (35.6%) SBP < 90 mmHg and shocked in 10 patients (13.7%) and 15 patients were arrested before thoracotomy (20.6%).

Clinical status of the patients before thoracotomy was detected. The number of the patients in different clinical status was described with other preoperative data in table (1) and Fig (1) and (2).

Data	Number	%
Age group:		
15 – 20 years	12	16.5%
20 – 30 years	28	38.4%
30 – 40 years	16	21.9%
40 – 50 years	10	13.7%
50 – 60 years	5	6.8%
60 – 65 years	2	2.7%
Sex:		
Male	69	94.5%
Female	4	5.5%
Anatomical site of wound:		
Just to the left of the sternum	20	27.4%
Near to the left parasternal line	28	38.4%
Near to the left midclavicular line	25	34.2%
Time since stab:		
< 1 hour	35	48%
1 – 2 hour	21	28.8%
2 – 4 hour	9	12.3%
4 – 6 hour	5	6.8%
> 6 hour	3	4.1%
Clinical status of patient before thoracotomy:		
Stable (SBP > 90 mmHg)	22	30.1%
Unstable (SBP < 90 mmHg)	26	35.6%
Shocked (SBP < 40 mmHg)	10	13.7%
Arrested (shocked then arrested)	15	20.6%

Table (1): Preoperative data.

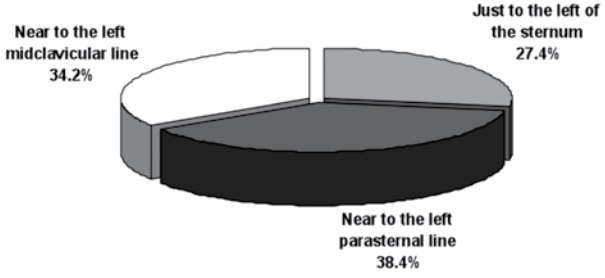

Fig (1): Anatomical sites of the stab wound.

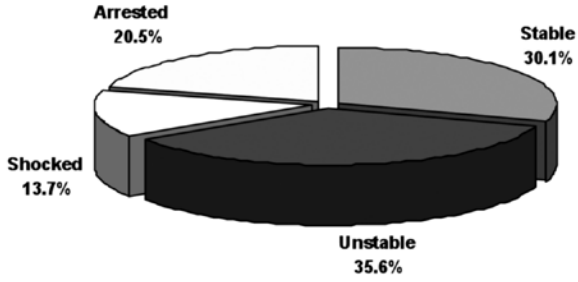

Fig (2): Clinical status of patient before thoracotomy.

Emergency room thoracotomy was done in 18 patients (24.7%), including left anterior, left extended anterior to right and left anterolateral thoracotomy. Operative room thoracotomy was done in 55 patients (75.3%) including left anterolateral, left posterolateral and median sternotomy as shown in table (2).

Data	Number	%
ER thoracotomy (18 cases, 24.7%):		
Lt anterior	7	9.5%
Lt extended anterior to the right	3	4.1%
Lt antero lateral	8	11%
OR Thoracotomy (55 cases, 75.3%):		
Lt anterolateral	26	35.6%
Lt posterolateral	21	28.8%
Median sternotomy	8	11%
Stabbed site (intraoperative) (73 cases):		
Rt ventricle	28	38.4%
Lt ventricle	25	34.2%
Lt atrium	8	11%
Aorta	5	6.8%
Pulmonary	4	5.5%
Rt atrium	3	4.1%
Associated stabs (24 cases):		
Lung	22	One patient
Chest wall	15	may have >
Diaphragm	11	1 associated
Abdomen	8	stabbed

Table (2): Operative data.

The commonest site of stabbed heart were in the right ventricle 28 patients (38.4%) followed by the left ventricle in 25 patients (34.2%), then left atrium and right atrium represent the least site of stab and there were associated stab in the chest wall, lung, diaphragm and abdomen as shown in table (2) and Fig (3).

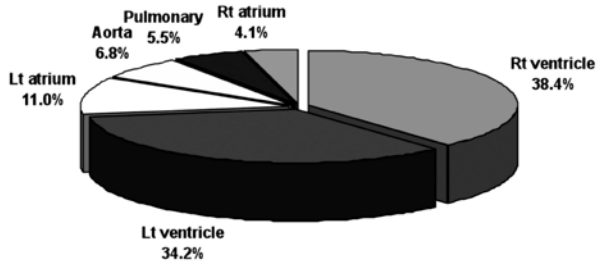

Fig (3): Intraoperative stabbed site of the heart.

Cardiorrhaphy was made by Prolene 2/0 in 8 patients, 3/0 in 23 patients and 4/0 in 11 patients. Silk 3/0 was used in 5 patients while Nylon 3/0 used in 7 patients and Tickron suture 2/0 used in 9 patients and 3/0 in 10 patients.

Morbidity occurred in 12 patients of 56 survival (21.4%) including wound infection, cerebral insult, arrhythmia, myocardial infarction and empyema. Mortality was found in 17 patients (23.2%), while ER mortality was 12 (16.4%) whether intraoperative in 5 patients (6.8%) and postoperative in 7 patients (9.6%), and OR mortality was 5 (6.8%) whether 3 intraoperative (4.1%) and 2 postoperative (2.7%) as showed in table (3).

The clinical status of the patients were prognostic factors of outcome of the patients as patient who was shocked or arrested before thoracotomy has a mortality rate 50% and 60% respectively. Also, patients having cardiopulmonary resuscitation CPR and those with ER thoracotomy has mortality rate 68.2% and 66.7% respectively, but tamponade and associated injuries had only 33.3% and 34.3% mortality rate respectively as shown in table (4).

Discussion:

Although patients with stab wounds of the heart usually survive when treatment is adequate, penetrating injuries to the heart are fatal in a significant percentage of patients so injured (13,14,15) and a high number of patients is found already dead at the scene. However, if a patient arrives at a medical facility in a compensated

	Number	%
Morbidity (12 cases/56 survival):	12	
Types of complications:		21.4%
Wound infection	5	
Cerebral insult	3	One patient may have > one complication
Arrhythmia	4	
Myocardial infarction	2	
Empyema	4	
Mortality (17/73 cases):	17	23.2
ER morality	12	16.4
Intraoperative	5	6.8
Postoperative	7	9.6
OR morality	5	6.8
Intraoperative	3	4.1
Postoperative	2	2.7

Table (3): Morbidity and moratlity:

	Number	Survivor	Nonsurvivor
Patients	73	56 (76.7%)	17 (23.3%)
Clinical status			
Stable	22	21 (93.5%)	1 (4.5%)
Unstable	26	24 (92.3%)	2 (7.7%)
Shocked	10	5 (50%)	5 (50%)
Arrested	15	6 (40%)	9 (60%)
CPR	22	7 (31.8%)	15 (68.2%)
Associated injuries	35	23 (65.7%)	12 (34.3%)
Tamponade	42	28 (66.7%)	14 (33.3%)
ER thoracotomy	18	6 (33.3%)	12 (66.7%)

Table (4): Prognostic factor of outcome

state with intact vital signs the chance for survival is substantially increased if well and quickly managed (15). This matches with our study as the rapidly arrived patients within the first hour of stabbing were quickly managed and survived but with delay and loss of vital signs the patients become unstable or shocked and their management becomes critical as matched with other investigator (16). The victims of penetrating cardiac injuries are predominantly young males as usual regarding urban violence (1,2). This matches with our study as the male represent 94.5% with age predominant between 20-30 years (mean age 28.5 years) which also matches with study of Arreola et al. (13) as their male percentage was 84% and their average age was 31.4 years and study of Tyburski et al. (17) where their male represent 91% and their average age was 32.1 years.

There are three typical manifestations of penetrating cardiac injury: (i) hemorrhage, (ii) pericardial tamponade, and (iii) the combination of both (14,16). Hemorrhage may lead to shock while pericardial tamponade is classically associated with decreased blood pressure, increased central venous pressure, and distant heart sounds, together better known as Beck's triad (14,17). Due to the muscular nature of the ventricle, walls lacerations following stabs often seal temporarily thus allowing time for transportation. This is in contrast to the thin atrial walls that seldomly seal without external force (13,14,16,18). Tamponade, usually considered to be a premorbid condition and uniformly lethal if untreated, had a lower than expected survival rate. But, as has been pointed out by Karrel et al. (19), cardiac tamponade following cardiac injury is a dynamic phenomenon with variable presenting signs. Depending on the size and location of both the chamber injury and the pericardial defect, blood may either accumulate in the pericardium or drain into the pleural cavity. Often both processes occur at variable and unpredictable intervals. The resultant clinical course may fluctuate, with alternating signs of Beck's classic triad or hypovolemic shock. Also, they stated that tamponade represents an immediately treatable mechanism and this matched with our study as tamponade was noted frequently in our patients, and 63% of the patients who developed it survived. In our study, the clinical status of the patients were unstable in 26 patients (35.6%) with SBP < 90 mmHg and shocked in 10 patients (13.7%). Blood loss certainly was the main cause of hypotension in our series, mainly among non-survivors, since the majority of them presented clear signs of hypovolemia (hypotension, hemothorax and absence of jugular venous distention), instead of signs of cardiac tamponade. Therefore, clinical signs of cardiac tamponade, if present, were concealed by hypovolemia and this matched with Velmahos et al. (20) who stated that there are data supporting that pericardial tamponade is a determinant of survival in penetrating cardiac injuries and also Asensio et al. (21) who stated that it is really difficult to determine which mechanism (myocardium self-homeostasis, intrapericardial blood clots, elevation of intrapericardial pressure, or the lower intracardiac pressure due to hemorrhage) was

preponderant to avoid exsanguinations and was less deleterious to the victim (7,22). Some patients presenting with penetrating cardiac injuries may be completely stable, and the diagnosis can be missed (3,23). This matched with our study as clinical picture of our patients was stable in 22 patients (30.1%) with SBP > 90 mmHg. In our study, none of the victims presented evidences of penetrating head injury, unconsciousness could be a consequence of their poor hemodynamic status. This matchs with other study who expect that an interaction between blood pressure and consciousness level would almost certainly be included in the logistic model, since Glasgow Coma Scale (GCS) in penetrating cardiac trauma may suffer influence from the victim hemodynamic status (21).

A non-invasive method including transthoracic echocardiography and computed tomography can be used successfully to diagnose penetrating cardiac injury (24,25,26). Initial assessment in the trauma usually includes transthoracic two-dimensional echocardiography (18,21) which was found to have a greater than 90% accuracy, specificity, and sensitivity for the diagnosis of cardiac penetration (24). In selected cases and if the patient is compensated and hemodynamically stable, contrast-medium enhanced multiphasic computed tomography may be used to localize the site and extent of the injury as well as to exclude other relevant pathologies (26). Other strategies such as pericardiocentesis (14,15,22,23), electrocardiography (18,19) and chest radiography (14,19) are of limited value as they are associated with high rates of false results and non-specificity. Tamponade is defined sonographically as the presence of both perlcardial effusion (PE) and diastolic collapse of the right ventricle. In our study, diagnosis was confirmed by cardiac ultrasound, and echocardiography used regularly in the acute stable (22 patients; 30.1%) and rapidly in 14 of unstable patients (53.8%) in our institution, and has been shown to be reliable, in the absence of haemothorax. Chest x-ray were used in stable patients and chest CT was used only in 8 patients of stable group. Pericardiocentesis is not used in our trauma unit in the acute setting for diagnosing cardiac trauma, as it has been shown to be unpractical, and this may explain why this was not performed as an initial diagnostic procedure or as initial treatment as explained by other investigators who stated that treatment by aspiration alone has been shown to be inadequate in the acute setting, as recurrent pericardial effusions may occur, requiring numerous aspirations (22).

Emergency thoracotomy and repair of myocardial wounds is the only way of salvaging patients with penetrating cardiac wounds (27,28). External cardiac massage is unlikely to be of benefit in the patient with an empty heart or pericardial tamponade (21,29). Resuscitative thoracotomy will enable the physician to arrest the source of haemorrhage, cross-clamp the

aorta if necessary, and perform internal cardiac massage (28,30,31). It is essential that thoracotomy is performed extremely rapidly following loss of signs of life and further loss of blood should be controlled immediately. The site of the cardiac wound is significant, as wounds to the relatively thin right-ventricular wall are more often associated with pericardial tamponade, which is likely to be a major factor associated with survival in a stabbed heart (15,26,27,32,33). The right ventricle is injured in

bout half of surviving patients; the left ventricle less often, and one of the atria is perforated least often (6,8,10). A review of 1802 cases of penetrating cardiac trauma indicated the right and left ventricles to be injured in 43% and 30% of cases, respectively. For the atria, right-sided lesions were found in 14% of cases and left-sided lesions in 5% (13). Similar distributions of injuries have been reported by other authors (14,15) and can be attributed to the different exposure of the chambers with respect to the anterior chest wall (6). In our study, the commonest site of stabbed heart were in the right ventricle 28 patients (38.4%) followed by left ventricle in 25 patients (34.2%), then left atrium and right atrium represent the least site of stab.

The place of resuscitative thoracotomy for penetrating injuries is well established. The optimum site for surgery is the operating theatre, but it is clear that in some circumstances there is no time to transport the patient to a theatre. Emergency room thoracotomy for patients with severe haemodynamic instability or those that have lost vital signs may then be required (33,34,35). The surgical approach to the heart is usually either a median sternotomy or a left thoracotomy. Emergency left thoracotomy was perfomed to rapidly access the thoracic cavity and to evaluate cardiac tamponade. In our study, ER thoracotomy was done in 18 patients (24.7%), including left anterior, left extended anterior to right and left anterolateral thoracotomy. OR thoracotomy was done in 55 patients (75.3%) including left anterolateral, left posterolateral and median sternotomy.

Cardiorrhaphy is the procedure most often used for repair. Usually done by prolene or Dacron 2/0 and 3/0 in the ventricular wound and 3/0, 4/0 in atrial wound, some of them on Teflon pledgett (18,19,21,28,32). This matched with our study in which we used Prolene, Silk, Nylon and Tichron sutures. Patients surviving cardiorrhaphy must be monitored postoperatively for delayed sequelae that may require further evaluation (25,28,35,36). Survivors of cardiac injuries should be observed closely postcardiorrhaphy for physical findings or symptoms suggesting need for further evaluation (37,38). In our results, all patients were transported to ICU with monitoring of all vital signs and drainage by intercostal tubes to detect and manage any complication until discharge. Complications not directly attributable to the injury itself but to subsequent organ hypoperfusion due to hemorrhagic shock and reduced cardiac output may include systemic inflammatory response syndrome (SIRS), cerebral hypoxia and organ failure. Reported mortality rates range from 10% to 70%, reflecting a variety of presentations, injury mechanisms and pre-hospital care capabilities (14, 15, 16). In our study, morbidity occurred in 12 patients of 56 survival (21.4%) including wound infection, cerebral insult, arrhythmia, myocardial infarction and empyema. Morality was 23.2% (17 patients), these were ER mortality in 12 patients (16.4%) and OR mortality in 5 patients (6.8%). The ER mortality was 9.6% (7 patients) postoperatively and 6.8% (5 patients) intraoperatively and OR mortality was 4.1% (3 patients) intraoperatively and 2.7% (2 patients) postoperatively. Also, Arreola et al. (13) and Tyburski et al. (17) reported a mortality rate of 47% and 42% respectively.

Several prognostic factors have been identified for survival and outcome in patients with penetrating cardiac trauma: (i) status of the patients on presentation [4,6,10,15,26], (ii) location of injury, i.e. right versus left ventricle (16), (iii) presence or absence of vital signs upon ED admission (10,28) (iv) absence of cardiac arrhythmia (10,29) and (v) pericardial tamponade limiting exsanguination into the left hemithorax (10,14,16). In our study, the clinical status of the patients was a prognostic factor of outcome of the patients as patient who was shocked or arrested before thoracotomy has a mortality rate 50% and 60% respectively. Also, patients having cardiopulmonary resuscitation CPR and those with ER thoracotomy has mortality rate of 68.2% and 66.7% respectively, but tamponade and associated injuries had only 33.3% and 34.3% mortality rates respectively. But, Arreola et al. (13) stated that although profound hypotension SBP < 40 mmHg, CPR and ER were associated with poor outcome, none were uniformly predictive of death. Some patients survived with each of these characteristics. Also, Tyburski et al. (17) who concluded that the physiologic status of the patient at presentation, mechanism of injury, and presence of a tamponade were significant prognostic factors in his series of penetrating cardiac injuries. Also, other investigator stated that the only preoperative factors that significantly

predicted a lethal outcome were profound hypotension and the application of CPR in the field, neither was 100% predictive.

aWhile we identified preoperative factors associated with an increased likelihood of death (CPR, clinical status and ER thoracotomy) or survival (tamponade and associated injuries). We could not identify any single preoperative factor that uniformly predicted mortality from stab wounds to the heart. This matchs with Arreola et al. (13) who stated that in their study, despite being one of the larger investigations into outcome from a single type of cardiac injury, still suffers from relatively small numbers of patients and the inherent limitations of a purely retrospective review, in regard to their hypothesis, it is a "negative" study, as unfortunately no single preoperative factor was indicative of uniform mortality. A more detailed statistical examination utilizing multiple regression 'analysis to examine the abilities of various combinations of factors to predict mortality might prove more helpful in this respect, but would require a much larger study population. Retrospective studies traditionally serve as internal quality assurance measures of institutional performance to compare with other published data (13). Unfortunately, few reports contain sufficient details necessary for such comparisons. Ivatury and colleagues (6) calculated the "Penetrating Cardiac Trauma Index" and measured the "Physiologic Index" in a landmark study proposing a systematic categorization of cardiac trauma to facilitate such interinstitutional comparisons. Such a system is unfortunately impractical for the trauma surgeon, since it is often a senior resident who is responsible for deciding who should or should not undergo ER thoracotomy (13). The system also contains the obvious limitation of requiring a thoracotomy to completely assess the extent of injury. Also, Arreola et al. (13) stated that many injured patients are saved by well-developed prehospital care systems, but this is difficult to prove in injuries such as penetrating trauma without a detailed analysis of all components of the patients' care. Additionally, the total number of patients with a specific injury needs to be determined to help establish a given community's incidence of such wounds, to serve as a denominator to assess whether patients are first seen by the emergency department of the hospital or the coroner's office. Only then can one institution compare its results with others' (13).

Conclusion:

We recommended that all patients suspected of having cardiac stab wounds must be fully resuscitated and undergo thoractomy, as significant survival can be achieved and death is not always the outcome.

Thoracotomy, whether done in the emergency room or the operating room, is necessary to completely assess the ultimate survivability of penetrating stab wounds to the heart as the clinical status of the patients, CPR and ER thoracotomy were a prognostic factors of outcome of the patients and associated with high mortality rate.

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The Predictors Of early Death After Repair Of Blunt Traumatic Diaphragmatic Rupture(BTDR)

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Background: **Blunt Traumatic diaphragmatic Rupture (BTDR) is an under-recognized sequela of thoraco-abdominal trauma , Its diagnosis is a true challenge especially in multi-trauma victims A retrospective study was done to detect the Predictors of the early results of repair of blunt traumatic diaphragmatic rupture.**

Methods: Fifty two cases of blunt traumatic diaphragmatic rupture(BTDR) were managed in the emergency hospital In Mansoura university between 1995 and 2009. Diagnosis was made by either chest X ray, CT chest, Chest X ray with Nasogastric Tube with or without gastrograffin or intraoperatively whether thoracotomy or laparotomy. Repair was done either by thoracotomy and or laparomy.

Results: **BTDR was managed in 52 cases in Mansoura university emergency hospital between 1995 and 2009. The mean age was 33.5±7.6 years, 41 were males. BTDR was left-sided in 40 cases. CXR was diagnostic in 27. Thoracotomy was done in 31, laparotomy for 16 and combined approach was needed in 5 patients. Four cases died. The mean age of the dead cases was 24.7±8.1 years. The mean time between their diagnosis and repair trial was 14 ±5.3 days. They were all males.**

Conclusion: **The predictors of mortality in BTDR in our study are male gender, associated injuries especially liver and intestinal tears and combined thoracotomy laparotomy and splenectomy.**

Blunt Traumatic diaphragmatic Rupture (BTDR) is an under-recognized sequela of thoraco-abdominal trauma ; Its diagnosis is a true challenge especially in multi-trauma victims. It is reported in about 2% of patients hospitalized for blunt trauma and up to 8% of all patients undergoing surgical exploration for trauma. Due to its location between the abdomen and chest, an injured diaphragm is almost never the sole injury and has an associated injury rate approaching 100% (1) Functional loss of one hemi-diaphragm results in 25% to 50% decrease in pulmonary function. (2-3) The Pathognomonic diagnostic signs that should not be missed are gas bubbles in the chest, naso-gastric tube in the chest and positive Gastrografin study. (3) Which surgical approach that will be used depends on the presence or absence of associated injuries. The most threatening injury must be explored first. In delayed and chronic cases, the approach of choice is thoracotomy. Laparotomy must be performed in patients with associated abdominal lesions or haemo-dynamic instability. (4-5)

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Key words; Foreign Body inhalation, Veil pins and Rigid bronchoscopy.

Methods:

This retrospective study was conducted including our cases of BTDR managed surgically in our centre in Mansoura in 14 years between 1995 and 2009. Our diagnostic tools were chest x ray with or without nasogastric tube,

gastrograffin study, CT chest and abdomen. We always follow the ABCDE Rule in the assessment of trauma patients by our trauma team in our tertiary centre. Either laparotomy and or thoracotomy were used to explore and repair the diaphragmatic defect. Thorough exploration of the chest and or abdomen for associated injuries was done. The defect was repaired using either directly or by a prolene mesh. Two chest tubes are kept in the pleura for few days. We used Fisher's Exact test for all the variables to get the significant predictors. SPSS 16 was used.

RESULTS:

Male gender was the victim in 41 cases. Male/ Female ratio is about 4/1. The mean age was 33.5±7.6. RTA was accused in 40, fall from height in 6, crush injuries in 4 and I patient with non identified type of blunt trauma. Associated injuries were in 51 and lone BTDR in a case. Less than 24 hours was the interval between diagnosis and repair in 43 cases and 9 cases were delayed(Table 1). Left hemi-diaphragm was injured in 40 cases. Right hemi-diaphragm was injured in 12 cases. We never managed a case of bilateral BTDR. CXR was used in all cases, but diagnostic in only 27 cases of whom18 cases diagnosed only after a naso-gastric tube was inserted(Fig.1). CT chest was used in 18 cases. Thoracotomy was done in 31, laparotomy for 16 and combined approach was needed in 5 patients. Primary direct repair with interrupted non-absorbable (prolene) sutures in 46 patients. Prolene mesh was used for repair in 6 cases(Fig.2). Concomitant procedure was needed in 35 cases. Splenectomy was the commonest concomitant procedure (in 12 cases). Pneumo-rrhaphy was done in 10 patients. Pulmonary lobectomy, liver tear repair and intestinal injury repair in 6 patients; 2 patients each (Table 2) . The postoperative complications included lung collapse in 10 cases, pleural effusion in 6 cases, empyema in 1 case, ARDS in 4 cases; 3 of them recovered. Four cases died. The mean age of the dead cases was 24.7±8.1 years. The mean time between diagnosis and repair trial was 14 ±5.3 days. They were all males(Table3). The hospital stay ranged from 8 to 35 days with mean of 10.1±6.4 days. We used Fisher's Exact test for all the variables. The significant predictors were; Male Gender (P value 0. 0002), Splenectomy (p=0.002) , Combined thoracotomy and laparoromy (p=0.003), Intestinal tear (p=0.005) and Diagnosis within 1week to 1 month (P 0.005).

PREOP. DATA	No.(%)
Age	33.5±7.6.
1st decade	6(11.5%)
2nd decade	18(34.6%)
3rd decade	17(32.7%)
4th decade	11(21.2%)
Male/Female	41/11
Left Side	40(77%)
Right Side	12(23%)
Diagnosis	
Within 24 hours	40(77%)
Within 1 week	6(11.5%)
Within 1 month	5(9.6%)
>1 month	1(1.9%)

Table 1); Demographic, clinical and radiological Data.

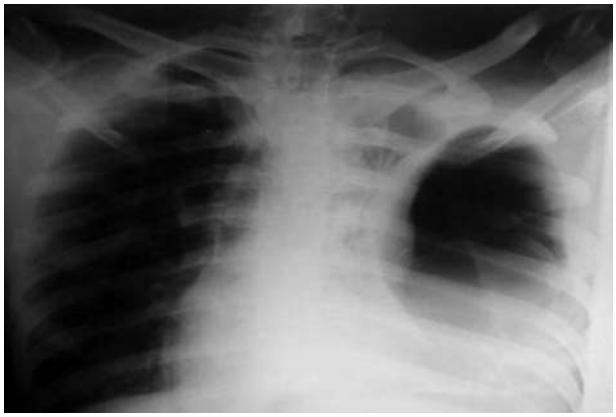

Figure (1);Plain Chest X ray; PA View, showing left lung collapse with huge gas bubble in the left hemithorax with a nasogastric tube inside. It is diagnostic of a huge left diaphragmatic hernia with gastrothorax.

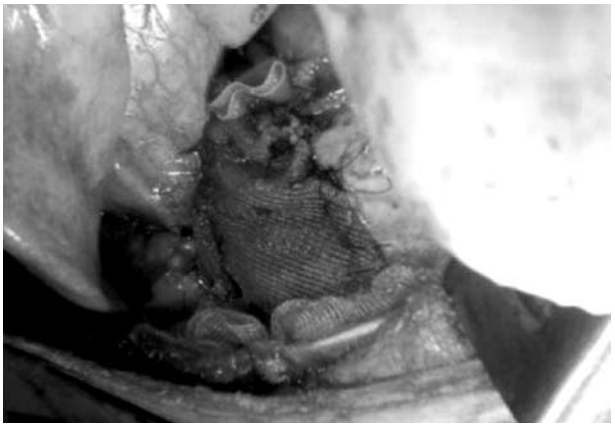

Figure (2); Intra-operative photo showing a left posterolateral thoracotomy, chest retractor, hands of the surgeon and assistant with a prolene mesh closing a huge defect in the diaphragm.

PROCEDURE	No(%)
Thoracotomy	31(60%)
Laparotomy	16(30.4 %)
Combined	5(9.6%)
Splenectomy	12(23%)
Pneumo-rrhaphy	10(19%)
Pulmonary lobectomy	2(3.8%)
liver tear repair	2(3.8%)
intestinal injury repair	2(3.8%)

Table 2); Some operative data.

Mortality Data	No	P value
Age In Years		
1st decade	24.7±8.10	
2nd decade	1	
3rd decade	2	
4th decade	1	
Male/Female	4/0	0.00002
Left Side	3	
Right Side	1	
Diagnosis		
Within 24 hours	1	
Within 1 week	0	
Within 1 month	3	
>1 month	0	0.005
Thoracotomy	2	
Laparotomy	1	
Combined Thoracotomy&laparotomy	1	0.003
Splenectomy	2	0.002
Pneumo-rrhaphy	0	
Pulmonary lobectomy,	2	0.005
intestinal injury repair	2	
liver tear repair	2	

Table 3); Mortality cases Data.

Discussion:

We are presenting a retrospective study with the defects of retrospective nature. It includes 52 cases in about 14 years. This may be because either this condition is not a common practice or the diagnosis is sometimes missed. Male/Female ratio is about 3.7/1. Males are more commonly affected than females as they are the main workman power that are more subject to high velocity automobile accidents, fall from height during work and crush injuries. This is consistent with the series of Al-Refaie et.al.,2009 where male/female ratio is 3.6/1(4) . M/f ratio in the series of Lucido and Wall 1963 is about 1.7/1(6). The mean age was 33.5±7.6 years. It was the commonest in the 2nd decade and about 67.3% was between the age 11-30 years old. It is the rarest below 10 years. This also may be explained by its relation to work, travel, high velocity automobiles. The cause of BTDR was either RTA in 40, fall from height in 6 , crush injuries in 4 or unidentified in one case. The mechanism may be shearing stress of a stretched membrane diaphragmatic avulsion from its points of attachment , and sudden force transmission through viscera acting as a viscous fluid increasing the positive pressure gradient between peritoneal and pleural cavities to exceed 100 cm H2O during maximum respiratory effort. (2) Associated injuries were diagnosed in 51 and I case only with lone BTDR. The commonest were fractured ribs, fracture limb, abdominal injuries and and lung injuries. In the series of Lucido and Wall 1963, the commonest associated injury was lacerated spleen, severe head injuries and fracture pelvis and the rarest was urinary bladder injuries. (6) Patients with BTDR had approximately a 6 times increased risk of suffering an associated Blunt Aortic Injury (BAI). Chughtai et.al.,2007 found that BTDR had an associated BAI at a rate of 7.4 and stated that Blunt Diaphragmatic Rupture Mandates a Search for Blunt Aortic Injury. (7) We were very lucky that we never diagnosed this association may be they were lost before presentation or the diagnosis was missed. The interval between diagnosis and repair was variable. It was between immediate diagnosis to several years. Fourty three cases were diagnosed and managed in the 1st 24 hours while 9 cases were diagnosed and managed late. Its clinical features pass into three phases; Acute phase, Latent phase and obstructive phase. (2) The significant predictors of mortality in our study are Male Gender, Splenectomy, Combined thoracotomy and laparoromy, Intestinal tear, Diagnosis within 1week to 1 month and Thoracotomy.

Analysis of our results showed that diagnosis after 1 week and within 1 month was a predictor of mortality. This may be due to the mal or uncorrected fluid and electrolyte imbalance due to the neglected diaphragmatic rupture which is more evident in this interval. The left hemi-diaphragm was injured in 40 cases and the right was affected in 12 cases. This may be due to weaker strength of the left hemidiaphragm, hepatic protection of the right side, underdiagnosis of right-sided ruptures, and weakness of the left hemidiaphragm at points of embryonic fusion.(2-4) The left sided dominance is consistent with many authors. Left/right ratio was 3.1/1 in the series of Shah et.al.,1995. It was 1.6/1 in the series of Athanassiadi et.al.,1999 and 2.85/1 in the series of Al-Refaie et.al.,2009 (2-8-4) CXR was used in all cases as we consider CXR a part of the examination, but it was diagnostic in only 27 cases of whom 18 cases diagnosed only after a naso-gastric tube was inserted. The Pathognomonic findings are Gas bubbles in the chest, nasogastric tube in the chest and or Positive Gastrografin study. The Suggestive radiological feature are either irregularity of the diaphragmatic outline, elevated diaphragm, Mediastinal shift without pulmonary or intrapleural cause and or atelectasis of the lower lobe as per Van Vugt AB and Schoots FJ.1989 and Shah et.al., 1995.(9-2). CT chest was used in 18 cases. Ct usually shows discontinuity of one hemidiaphragm with Stomach or right lobe of liver dependent on left or right posterior ribs, which is positive "dependent viscera" sign. Partial waistlike constriction—collar sign—is visible along anterior surface of right lobe of liver and is attributable to partial hepatic intrathoracic herniation. The dependent viscera sign was observed on the CT scans of 100% of the patients with a left-sided diaphragmatic rupture and of 83% of the patients with right-sided diaphragmatic rupture. (10) Intraoperative diagnosis was made in 12 cases (23.1%) in our series. It was 17.4% in the series of Al-Refaie et.al.,2009. This variation depends upon who examines the patient first, missed diagnosis is more with the general surgery team. Hanna et.al.,2008 believe that Intraoperative identification remains the gold standard for the diagnosis and treatment of TDI. Exploration of the abdomen, by laparotomy or laparoscopy, has traditionally been advocated because it allows concurrent examination of the often-injured abdominal organs. (4-1).

An important point is to remember that

1. Not Only Uniform diagnosis depends on a high index of suspicion, careful scrutiny of the chest roentgenogram in patients with thoraco-abdominal or poly-trauma, and meticulous inspection of the diaphragm when operating for concurrent injuries. Repeated evaluation for days after injury is necessary to discern injury in patients not requiring laparotomy. (2)

2. But Also medical history of severe blunt trauma should provoke a high index of suspicion for diaphragmatic rupture during annual medical surveillance. (11)

First of all we agree with Gordon Bryan's study (1921) of both types of diaphragmatic injury is a surgical classic. (12) Then comes the question, (laparotomy vs thoracotomy), It may depend on the associated life-threatening injuries. The major indication for thoracotomy was hemodynamic instability caused by injury to the heart or great vessels. In the delayed phase, either during the same admission (post-trauma) or after discharge, the approach to repair is to be determined by the preference of the operating surgeon. The high association of intra-abdominal injuries, irrespective of the location of penetrating wounds, mandates that BTDR to be approached from the abdomen in patients who require exploration. Stable patients with a suspicion of diaphragmatic injury may be evaluated by thoracoscopy. (1) we depend upon the clinical status and suspicion, chest x ray with NGT or CT chest. We used thoracotomy in most of the included cases. The general belief in our hospital is that the diaphragm is mainly a thoracic surgery task. Thoracotomy was done in 31(60%), laparotomy for 16 (30.4%) and the combined approach was needed in 5 (9.6%). Direct repair with interrupted non-absorbable (prolene) sutures in 46 patients. Prolene mesh was used for repair in 6 cases. Splenectomy was the commonest concomitant procedure (in 12 cases). Pneumo-rrhaphy was done in 10 patients. Pulmonary lobectomy, liver tear repair and intestinal injury repair in 6 patients; 2 patients each. Our mortality rate was (7.7%) which is cooping with some authors such as Probert and Havard 1961 who reported a 10% mortality, Ward et.al.,1981 who showed a 6% mortality. Hanna et.al., 2008 showed a mortality of 17.9% and Al-Refaie et.al., 2009 found a mortality rate of 4.3%. (12-13-1-4). The main cause of death was pre-operative hemorrhagic shock due to multiple organ injuries, fluid and electrolyte imbalances and adult respiratory distress syndrome (ARDS). The first one presented with hemorrhagic shock, multiple fractures, splenic injury and he developed adult respiratory distress syndrome postoperatively. The second mortality had multiple fractures, multiple abdominal and lung injury, and needed a large amount of blood transfusion(over

transfusion). The 3rd one had multiple fractures in the acetabulum, hip, left upper limb, fluid and electrolyte imbalance and he was kept ventilated for 3 days postoperatively and died. The 4th one was presented in the emergency room with surgical abdomen for which he was explored to show a big retroperitoneal haematoma, splenic laceration, liver and intestinal tear. He was in a severe hemorrhagic shock. The chest was explored to show a big tear in the diaphragm. Analysis of the mortality cases showed mean age of 24.7±8.years, 50% in the 3rd decade, all were males,75% on the left side, 50% with thoracotomy, when either liver tear or intestinal tear repair was needed. The significant predictors were; Male Gender (P value 0. 0002), Splenectomy (p=0.002), Combined thoracotomy and laparoromy (p=0.003), Intestinal tear (p=0.005) and diagnosis within 1week to 1 month (P 0.005). As per Hanna WC et.al., 2008, blunt trauma by itself is no longer a predictor of death from traumatic diaphragmatic injury. Rather, severe injuries, as evidenced by Injury Severity Score exceeding 15, are associated with a higher mortality rate. (1) Shah et.al.,1995 stated that the associated injuries are responsible for the high mortality(17%) and that the pulmonary complications head the list of complications in the group undergoing repair.(2)

Conclusion; The significant predictors of early mortality after BTDR in our study were; male gender, splenectomy, combined thoracotomy and laparoromy, intestinal tear and diagnosis within 1week to 1 month.

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