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Editorial

Developing Academic Cardiothoracic Surgeons in Egypt. Joy of Leadership.

Ezzeldin A. Mostafa, MD

The vision that you glorify in your mind, the ideal that you enthrone in your heart - this you will build your life by; this you will become."

Six years ago, a symposium, associated with and supported by the American Association for Thoracic Surgery (AATS). "Developing the Academic Cardio-thoracic Surgeons. " It was presented on April 20, 2000, at the 80th Annual Meeting of AATS, Toronto, Ontario, Canada and published in the Supplement of the Journal of Thoracic and Cardiovascular Surgery on April 2001 issue. (1) Since that time I was trying to emphasize on that topic.

Achieving the position of division chief of a cardiothoracic training program in Egypt is like many things in life-both a tremendous honor and a demanding responsibility. Although many of the financial resources available to run a division in earlier eras have diminished, and administrative demands have increased, the rewards are great, but you must honestly understand early what you are getting yourself into. For those of us committed to academia, the balance of resident education, the academic pursuit of new solutions to complex problems, and the stimulation of treating patients with challenging problems are rewards for each day. I suspect that most of us who have a passion for this challenge could not imagine spending our time in any other career pursuit either inside or outside of medicine. If you are committed to the emotional, intellectual, and lifestyle concepts of an academic surgical career, running a division of cardiothoracic surgery may allow you to fulfill personal aspirations and make a meaningful difference.

The following insights into the process of becoming a division chief are personal and not meant to be a blueprint. There are numerous ways to reach goals. Every candidate brings a unique background and set of life or professional experiences to the chief position. Such diversity in backgrounds is essential to maintaining vibrancy and excitement. Each position also has a unique set of problems and as many unique solutions. When the match is right, both institution and individual benefit.

Academia is always in a state of flux. What seems like a solid foundation or set of rules for engagement in one era can rather rapidly change. Understanding the academic environment both locally and nationally is essential because priorities can differ substantially in different regions. Some resources necessary

to achieve a level of success may be constant across all departments of surgery, all academic medical centers, or all schools of medicine. Divisional autonomy, clinical demands on faculty, title, administrative support, the likelihood of finding academic collaborators are examples of constant issues. On the other hand, some resources needed for success can be unique to a particular region or institution. Examples of unique local issues include inherited faculty, the rules of tenure, the quality of the current residency, the need to deal with an ongoing residency review committee probation, the penetration of regional managed care, patient case mix, and fiscal remuneration profile. Both constant and unique factors must be weighed in the decision to consider a particular chief position.

When you pursue a position of leadership within an academic medical center, you have to deal with at least four major concerns during the interview and after you arrive at your new institution. How are you going to make a contribution in the three major areas of academic responsibility-(l) clinical care, (2) research, and (3) education? At the same time, how are you going to develop the time, background, or experience in (4) administration to run an important, revenue-dependent division such as cardiothoracic surgery? There are few "triple or quadruple threats" out there with expertise in all four areas of responsibility. Each of these areas individually could consume one person's entire career in this marketplace. On the other hand, as a division chief, you must have a strategic plan and an operational system that can work within the new environment to bring some degree of identity to each of these areas. To do so, you have to be able to objectively assess the strengths, weaknesses, opportunities, and threats related to each of these issues.

Clinical environment :

To establish leadership within an academic medical center, a surgeon must first establish his or her quality as a surgeon. In bygone eras you might be an effective academic leader without a credible reputation as a surgeon, but such credentials are less likely to be successful in the current competitive clinical marketplace (Table I).

The Egypian surgical specialty health care system has championed a decentralized approach to patient care. In addition, local hospitals are looking for ways to fill inpatient beds, and interventional cardiology programs want in-house surgical backup for their elective interventional procedures. We have trained excellent surgeons and sent them into the community. Such community medical centers then demand not only secondary surgical services but also tertiary and in some cases even quaternary services. Such local expansion of complex surgical services usually comes at the expense of the original academic medical center. Training programs become surrounded by excellent surgeons (often trained locally) capable of providing most of the routine and many of the more unusual surgical services, and they do this without carrying the burden of education or research. Because of changing certificate of need processes to enhance competition, the effect of managed care, decreased remuneration, and a cost shifting, vertically integrated academic health care delivery system, the clinical future of the academic medical center may be threatened unless the local environment is carefully assessed.

Educational environment :

Alive, Awake and Aware! How Ordinary People Create Extraordinary Lives

"Leaders are readers." We've all heard this phrase, and we know that highly successful people invest in their education. They read for inspiration, for information, for motivation and for examples. We also know that most people read very little, and it shows in their lives. One of the best things you can do is spend just 15 minutes a day reading a positive, educational book to enrich your life, and yet most people never do. I urge you to buy and read! Think about your values, learn how other people organize their time and create the life of their dreams. There are no "secrets," just models and choices that make all the difference. Teaching cardiothoracic surgery in the year 2006 not getting easier. Most of our training programs last 2 years, and most of our residents going in practice perform both general thoracic and adult cardiac surgical procedures. Often the first year of cardiothoracic training is dominated by attempts to prepare and pass the MD examinations. The volume of bread-and-butter index operations for a training program may be decreasing. The case mix often reveals an increasing complexity of disorders among patients denied care in the community. In addition, new technology has introduced substantial challenges due to the marketplace demands of off-pump revascularization (OPCAB) and minimally invasive incisions.

The knowledge base continues to increase. Surgeon in training need clinical experience in the non-surgical components of cardiothoracic education-cardiothoracic anesthesia, cardiac catheterization, echocardiography, pulmonary medicine, and oncology. The opportunities to introduce new techniques and tools in surgical education are expanding with the introduction of concepts such as surgical simulation, robotics, an internet-based learning. Developing methods to determine competency

over many years of practice as technology and surgical techniques change remains a formidable challenge and opportunity.

Research environment :

The ancient writer tells us in Proverbs that "Without a vision, the people perish." And Thoreau told us that "The mass of men lead lives of quiet desperation." No doubt because the masses are without a vision for their lives. What is your vision for your future, your ideal life? Is it written down? Do you review it and think about it often? Have you "enthroned" it in your heart? Is your life organized around goals and objectives that will ensure your vision is reached? "If one advances confidently in the direction of his dreams, and endeavors to live the life which he has imagined, he will meet with a success unexpected in common hours." And that's worth thinking about.

The era of surgical descriptive physiology is rapidly disappearing. Although more research Egyptian pounds are available for translational research than ever before, multidisciplinary research must be described, mechanistic biology must be emphasized, and a successful record in publication must be demonstrated to obtain funding at the national level. In many ways, funding is more accessible for those who understand funding principles, who have done preliminary foundation research, and who can write a comprehensible grant proposal. The surgical competition is not as vigorous as it was in earlier eras. The trick, of course, is finding a supportive environment, developing appropriate, respectful multidisciplinary interactions with basic scientists, asking the right questions, and making research a priority in an environment where clinical activity can always be viewed as a logical and appropriate excuse. Other areas for clinical research are outcomes research and clinical trials, but once again, meaningful clinical research requires priority and resources.

Administrative environment :

Most of us received little or no formal administrative training during our residencies or in our junior faculty roles. Running a division of cardiothoracic surgery requires us to play different administrative roles concomitantly, such as department or medical center administrator. Training is needed to understand the complex health care marketplace in periods of rapid evolution (managed care) and to understand the essential components of leadership. National courses are available, such as those offered by the Ain-Shams University, Cairo University and American University in Cairo (AUC), to help with the essentials of these issues. The local administrative resources within the institution are essential to both short- and long-term success as a division chief. A standardized checklist include the following:

a)Strength of advocate mentors.
b)Strategies to overcome stereotyping and role modeling.
c)Practice makes perfect.
d)Do your homework.
e)Interview skills. Assessment skills.
f)Negotiating skills.
g)Understand personal strengths. Strategic vision..
h)Operational systems.
i)Respect your family's needs.

Random thoughts. It is important to not underestimate the following concepts: (1) the need for a clinical profile (you will find few strong division chiefs who cannot operate), (2) the magnitude of the responsibility for education, (3) the difficulty in establishing an academic niche in the current marketplace, (4) the importance of developing administrative skills, and (5) leadership.

Your success will be measured by the accomplishments of your team, not your personal accomplishments. You must take care of the people who rank below you in the institutional hierarchy and not to worry a great deal about those who rank higher. If you do your job, your boss will know. You have to assume the people who work for you are capable and competent, and you have to delegate responsibility early and often. Most times your team members will respond if they believe in the vision and respect your operational system. Keys to success include being fair, consistent, and honest. When you accept the position, you become responsible for a new extended family. Be careful what you wish for.

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Off-pump coronary artery bypass graft surgery: To do or not to do?

Ahmed I. Rezk, MD
Adel Ragheb, MD
Yousry Almoazmy, MD
Hani K. Najm, MD

Objective: **To compare hospital outcomes of on-pump and off-pump coronary artery bypass surgery.**

Methods: Data of 603 consecutive patients were analyzed. Of these patients, 396 underwent ON-CABG while 205 had OPCABG. Clinical outcomes were compared between groups.

Results: **While low cardiac output was significantly higher in the ON-CABG group (5.5 versus1.5, p=0.02), in-hospital mortality (2.5% versus 1.4%) as well as other postoperative complications (stroke 0.2% versus 0%; newly developed RD(renal dysfunction) 20% versus 13%, hemofiltration 1.5% versus 1%; AF 12% versus 11%, prolonged ventilation 4% versus 2%), were overall similar between ON-CAB and OPCAB patients. The mean CrCl (creatinine clearance) in ON-CABG group was preoperatively 91± 12 ml/min versus 73±9ml/min postoperatively; and similarly, CrCl in the OPCAB group was 92±12 ml/min versus 78±14 ml/min.**

Conclusion: **The present study could not show benefits that were anticipated from off-pump CABG.Although there was a trend for lower perioperative mortality and morbidity with OPCAB, however, the overall rate is nearly similar in both ON-CAB and OPCAB. We could not confirm that OP-CABG significantly reduces perioperative renal dysfunction compared with ON-CABG surgery. This could suggest that reduction of renal risk alone should not be an indication for OPCABG over ONCABG surgery. Until Early and late results are compared in a large prospective randomized study, we believe that the indication for OPCAB should be selective rather than routine.**

Key words : **Off-pump versus on-pump coronary artery bypasses grafting, in-hospital mortality, renal function, creatinine clearance.**

Dr. Ahmed Rezk, MD, FFCCS (Paris)
Assistant professor, cardiac surgery, Ain Shams University, Cairo, Egypt
Associate consultant, cardiac surgery, King Abdulaziz Cardiac Centre, National Guard health affairs, Riyadh, KSA.
E-mail; rezk_a@hotmail.com
Phone: +966-1-2520088 ext-16783
Fax-+966-1-2520088 ext-16700

Beating-heart surgery was originally the only approach to myocardial revascularization. In 1967, Kolessov [1] reported a left internal thoracic artery (LITA) to left anterior descending (LAD) coronary artery anastomosis through a left thoracotomy on a beating heart, as a method of treatment for angina pectoris. However, this was quickly abandoned in favor of coronary artery bypass grafting (CABG) via median sternotomy with modern cardiopulmonary bypass (CPB) techniques because of the improved safety and ease of suturing on a still, bloodless field.

In recent years, the deleterious effects of CPB and aortic manipulation have become well known. Therefore, surgeons have attempted to reduce even further the morbidity of cardiac operations by turning once again to off-pump coronary artery bypass. The renewed interest in off-pump myocardial revascularization has generated technological advances that have improved methods of coronary artery stabilization and exposure, allowing access to all coronary arteries and complete revascularization. However, does off-pump surgery truly reduce morbidity and mortality? Some clinical studies appear to indicate that [2, 3] it does and the others not. This issue remains unresolved.

Patients and Methods :

This is an observational study approved by the Human Research Ethics Committee of the National Guard hospital. Written consents were not obtained from the individual patients, as the study is based on data collected for routine care. The computerized prospective cardiac surgical database at our Hospital maintains data on all cardiac operations performed at the hospital. We used our prospective database to compare all patients having off-pump coronary surgery (n =205) with those having on-pump coronary surgery (n =396) between January 2002, and December, 2004. Criteria for selection were that patients were having first-time on-pump coronary artery bypass grafting and that no known acute or chronic renal disease on dialysis pre-existed.

1. Plasma Creatinine Level and Estimation of ClCr

Plasma creatinine levels are reported in micromoles per liter by

our laboratory with normal range of 65 to 109 µmol/l. Those values were divided by a conversion factor of 88.4 to obtain values in milligrams per deciliter for the present study. After conversion, the upper limits for normal plasma creatinine levels in our institution Are 1.2 mg/dL (109µmol/L).

The CrCl was estimated using the equations developed by Cockroft and Gault, and adjusted for each 1.73 m2 of body surface area (BSA):

This equation is closely correlated with measured creatinine clearance (correlation coefficient, 0.83) and gives a more accurate assessment of renal function than serum creatinine alone. The preoperative Creatinine (CrPre) was the value on the day before surgery and the postoperative Creatinine (CrmaxPost) was defined as the highest of the daily in-hospital postoperative values. Creatinine levels were measured for a minimum of 3 days after peak values were reached on all patients to confirm that levels were decreasing. Similarly, the creatinine clearance was calculated according to the CrPre and the CrmaxPost.

2. RD definition :

RD was defined according to the guidelines from the National Kidney Foundation (4). Based on serum creatinine level, RD was divided into mild, moderate and severe as following: values above the upper limit of our institution's normal range of 109 µmol/L (1.2 mg/dl) but equal to or less than 149 µmol/L (1.6 mg/d), defined as mild renal dysfunction (mild RD); elevation above149 µmol/L (1.2 mg/dl) but equal to or less than 179 µmol/L (2 mg/d) defined as moderate renal dysfunction (moderate RD); elevation above179µmol/L (2 mg/dl) defined as severe renal dysfunction (severe RD). Based on CrCl level, normal renal function was defined as a CrCl of 90 mL/min or more. Mild, moderate, and severe RD was defined as CrCl values of 60 to 90 mL/min, 30 to 60 mL/min, and less than 30 mL/min, respectively. For the purpose of this study, we stratified patients into the following 3 groups: group I (preoperative normal renal functions), group II (preoperative mild RD); and group III (moderate to severe RD).

Perioperative mortality and postoperative morbidities were correlated to the preoperative renal status.

3. Clinical variables :

The studied outcomes were in-hospital mortality, acute renal failure requiring dialysis, in addition to other major postoperative morbidities including: (1) cardiovascular: low cardiac output, hypotension, or both treated with intra-aortic balloon pump or with the

Infusion of at least two inotropes or vasopressors for > 24 h, (2) respiratory: mechanical ventilation for > 48 h, tracheostomy, reintubation; (3) neurologic: focal brain injury with

Permanent functional deficit, irreversible encephalopathy; (4) infectious: deep sternal wound infection requiring IV antibiotics and/or surgical debridement.

4. Patients selection for OPCAB or ON-CABG :

The choice of OPCAB versus on-pump CABG was surgeon preference. Factors favoring OPCAB included patients with suitable anatomy, epicardial target vessels

1 mm or larger, which were noncalcified and easy to expose, patients considered at high risk for CPB, elderly patients with multiple preoperative morbidities, and especially patients with significant calcification of the ascending aorta and vascular disease.

Contraindications to OPCAB included technical issues such as small, calcified, intramyocardial coronary targets. Difficulty in vessel exposure and unstable condition of the patient also precluded an off-pump approach. Patients who were converted from off-pump to on-pump bypass were retained (n = 4); thus, this represents an intent-to-treat study.

5. Surgical technique :

Conventional CABG

Conduits were harvested and prepared, and patients were heparinized. Standard cannulation for CPB was performed with ascending aortic cannulation and dual-stage cannulation of the right atrium. Both antegrade and retrograde cardioplegia cannulas were placed. The aorta was crossclamped, and cold blood cardioplegia was administered either antegrade or retrograde or in combination on induction and every 15 minutes. Patients' temperatures were either kept warm or allowed to drift to 34°C during CPB. Distal anastomoses were usually constructed first, and the proximal anastomoses were constructed to the ascending aorta during a single crossclamp period in the majority of cases, thus eliminating the need for tangential and multiple clampings of the aorta.

OPCAB

A median sternotomy was used. In the majority of cases intraluminal coronary shunts were used. Blood was cleared from the anastomotic site with a humidified oxygen saline-blower. Commercial stabilizers included suction stabilizers (Medtronic Octopus III

Medtronic, Inc). A heparin dose of 10,000 units was given and the activated clotting time (ACT) was maintained at twice control ACT. Heparin was fully reversed before sternal closure. Exposure for lateral and inferior wall vessels was achieved by a combination of

deep pericardial stitches, an opening of the right side of the pericardium to the inferior vena cava-right atrial junction, and a right decubitus Trendelenberg position. Alternatively, star fish commercial stabilizer was used recently. Distal anastomoses were usually constructed before proximal anastomoses. The left internal thoracic artery to left anterior descending coronary artery anastomosis was constructed first. Proximal anastomoses were constructed to the aorta with a tangential clamp. If significant aortic

Calcification precluded safe clamp placement, proximal anastomoses were made to the side of the ITA.

6. Preoperative patient's characteristics :

Preoperative patient's characteristics are shown in table 1& 2. The OPCAB patients were significantly older (61±13 versus 58.9±12; P = NS) and had more previous Cerebrovascular accident (4.3% versus 1.7%) than on-pump CABG patients. ONCABG patients had more frequent preoperative insertion of IABP (15% versus 7%) and more severe LV dysfunction (7.5% versus 3.4%) than OPCABG patients.

Table 1. Preoperative variables. (Total no. of patients = 601)

Variables	ON pump N= 396	Off Pump N= 206	P-value
age	58.9±12	61±13	NS
Male	328 (82%)	156 (76%)	NS
Females	68 (18%)	49 (24%)	
obesity	91 (23%)	46 (22%)	NS
DM	219 (55%)	103 (50%)	NS
hypertension	145 (36%)	83 (40%)	NS
hperlipideamia	232 (58%)	112 (54%)	NS
recent MI	61 (15%)	30 (14%)	NS
CVA	7 (1.7%)	9 (4.3%)	NS
IABP	62 (15%)	16 (7%)	0.007
Severe LV dysfunction (EF% < 35%)	30 (7.5%)	7 (3.4%)	0.04

DM, diabetes mellitus; MI, myocardial infarction; CVA cerebrovascular accident; IABP, intra-aortic balloon pump; LV, left ventricle; EF, ejection fraction. P-value, NS, non-significant.

Table 2. Preoperative classification according to preoperative renal functions according to Creatinine clearance. (Total no. of patients = 601)

	On-Pump no.=396	Off-Pump no.=205	P-value
Normal renal function:	197 (49.9%)	103 (50%)	NS
Mild RD	140 (35.3%)	65 (31%)	NS
Moderate RD	53 (13.3%)	35 (17%)	NS
severe RD	6 (1.5%)	2 (0.97%)	NS

RD, renal dysfunction; CrCl, creatinine clearance.

7. Statistical Analysis :
Patients were summarized with percentage for categorical data and means for continuous data. Group comparisons were analyzed by cχ2 tests. A probability value less than 0.5 were considered significant.

Results :

In-hospital mortality was overall similar between ON-CAB and OPCAB patients (2.5% versus 1.4%). While LCOP was significantly higher in the ON-CABG group (5.5 versus1.5, p=0.02), other postoperative complications (stroke 0.2% versus 0%; newly developed RD 20% versus 13%, hemofiltration 1.5% versus 1%; AF 12% versus 11%, prolonged ventilation 4% versus 2%, Deep sternal wound infection 3.7% versus 4.5% and perioperative myocardial infarction 3.7% versus 4.5%), were overall similar between ON-CAB and OPCAB patients. Postoperative blood loss and any blood product usage were not different (red cell transfusion 56% versus 48%, re-operation for Bleeding 2.5% versus 1.5%). New dialysis was slightly more prevalent in the ON-CABG group, but the difference was not statistically significant (20% versus 13%) (Tables 3, 4).
The mean CrCl in ON-CABG group was preoperatively 91± 12 ml/min versus 73±9 ml/min postoperatively; and similarly, CrCl in the OPCAB group was 92±12 ml/min versus 78±14 ml/min (Table 5).

Table 3. Postoperative mortality and morbidity: (Total no. of patients = 601)

Postoperative variables	On-pump (n=396)	Off-pump (n= 205)	p-value
Mortality	10 (2.5%)	3 (1.46%)	NS
Low cardiac output	22 (5.5 %)	3 (1.5%)	0.02
New onset AF	48 (12 %)	23(11.2%)	NS
Prolonged ventilation (>24 h)	16 (4%)	4 (2 %)	NS
Stroke	1 (0.25%)	0 (0.0%)	NS
Dialysis	6 (1.5%)	2 (1%)	NS
New RD	81 (20%)	27 (13%)	NS
Red cell transfusion	224 (56.5%)	98(47.8%)	NS
Reoperation for Bleeding	10 (2.5%)	3 (1.5 %)	NS
MI	21 (5.3 %)	8 (4%)	NS
Deep sternal wound infection	15 (3.7%)	9 (4.5%)	NS

AF, atrial fibrillation; MI, myocardial infarction; RD, renal dysfunction.

Discussion :

In recent years, the deleterious effects of CPB and aortic manipulation have become well known. Therefore, surgeons have attempted to reduce even further the morbidity of cardiac operations by turning toward off-pump coronary artery bypass. Off-pump coronary artery bypass surgery is now possible, but is it better? Multiple clinical studies have examined this question without arriving at a consensus. The problems are twofold. First, both on- and off-pump strategies yield good outcomes in experienced centers. Second, patient selection has had a large confounding effect on comparisons.

Table4. Patient population stratified by post-operative creatinine clearance (total no. of patients = 601)

	On-Pump no.=396	Off-Pump no.=204	P-value
Normal renal function	118 (30%)	69 (34%)	NS
Mild RD	145 (36.6%)	75 (37%)	NS
Moderate RD	96 (24%)	48 (23%)	NS
severe RD	34 (9%)	10 (5%)	NS
New RD	81 (20%)	27 (13%)	NS

RD, renal dysfunction;

Table5. Mean CrCl (ml/min) preoperative and postoperative in both groups (Total no. of patients = 601)

	On-Pump no.=396	Off-Pump no.=204	P-value
Preoperative	91.1±11	92.1±14	NS
postoperative	73.2±9	77.9±12	NS

Although Off-pump coronary artery bypass (OPCAB) has been adopted enthusiastically by many surgeons throughout the world, but despite more than 9 years' experience and progressive refinement of techniques and equipment, many surgeons use it only sporadically and some use it hardly at all. This reluctance persists despite the insistence by many of OPCAB's advocates that it can be performed regularly by any competent surgeon without compromising the safety and sustained improvement that are hallmarks of the standard operation. It has never been clear whether the reluctance of many surgeons to

adopt OPCAB is due to their unwillingness to struggle with a tedious technique even though it has "obvious" benefits, or whether, as others have insisted, there is still insufficient evidence to show that its modest benefits are worth all the trouble.{5,6} Presently, only less than 20% of patients in the United States are undergoing myocardial revascularization without CPB support. Currently, OPCAB use in Canada appears to be less than that in the United States, and only a minority of surgeons and centers routinely perform this technique. The majority of Canadian surgeons do not appear convinced that the current literature or their clinical experiences support increasing the use of OPCAB surgery. [7] At our centre, we have similar attitude after period of great enthusiasm toward the OPCAB techniques. {fig.1}

Many retrospective or randomized studies have focused on early results after myocardial revascularization without CPB. Many benefits were identified both in the clinical and in the neurocognitive fields, often in high-risk patients [8, 9]. However, not all reports confirmed these findings. Van Dijk et al, found in their study that at 30 days' follow-up, there were no differences in mortality, intensive care unit stay, stroke, atrial fibrillation, myocardial infarction, use of blood products, quality of life, and hospital cost—parameters that might have been expected to benefit from OPCAB. Another randomized study was carried out by a single surgeon (John Puskas at Emory University). There was significantly less release of myocardial enzyme in the OPCAB group, the OPCAB group length of stay was 1 day shorter, and the OPCAB group received fewer transfusions. But results were otherwise the same in the two groups. [10, 11, 12]

In our study, there was more postoperative morbidity in the on-pump patients. Prolonged ventilation; red blood cell transfusions, re-exploration for bleeding, newly developed renal dysfunction, and renal failure requiring dialysis were all more common. We believe that these morbidities in the on-pump patients can be attributed directly to CPB. Low cardiac output was also more frequent in on-pump patients but we could attribute these morbidities to the fact that on-pump patients had more frequent LV dysfunction and preoperative insertion of IABP. Surprisingly, wound infection was more frequent among off-pump patients. Except for low cardiac output, all these differences were not statistically different among the 2 groups.

The serum creatinine level is influenced by many factors which are independent of the golmerular filtration rate: tubular secretion and reabsorption, endogenous production, variable intake, extrarenal elimination and interference, caused by the laboratory diagnostic techniques and medicaments used [12]. Since the assessment of the renal

Function, based on the determination of serum creatinine, is associated with several limitations [13, 14] and the measurement of creatinine clearance by urine collection is rather time-consuming, several formulas estimating the renal function from serum creatinine, body weight, age and sex, as well as ethnic features, has been developed. All these formulas exhibit certain limitations. The most commonly used equation for estimating creatinine clearance, [15], is the Cockcroft-Gault formula. Although this formula also does not provide absolutely accurate results (e.g., in elderly patients) and it may over- or underestimate the true renal function, several studies on cardiac insufficiency and renal impairment have shown a good correlation between the creatinine clearance values calculated according to Cockcroft and Gault and the measured golmerular filtration rate [16, 17]. Similar results have been reported in previous studies. [18, 19]

In this retrospective study, although the incidence of renal dysfunction and the need for dialysis was higher among patients underwent on-pump surgery, however, the difference was not statistically different than those who had off-pump surgery. We could not confirm that off-pump surgery confers reduced renal risk compared with on-pump surgery. No difference was found in mortality, stroke, perioperative myocardial infarction, or acute renal failure in either this study or previous randomized studies.

Limitations :

This study was a clinical review of patients who underwent off-pump and on-pump primary CABG. Patients were not randomly assigned to either group, but instead the choice of procedure was made by the surgeon at the time of operation. Therefore, selection bias may affect our findings.

Conclusion :

The present study could not show benefits that were anticipated from off-pump CABG.Although there was a trend for lower perioperative mortality and morbidity with OPCAB, however, the overall rate is nearly similar in both ON-CAB and OPCAB. We could not confirm that OP-CABG significantly reduces perioperative renal dysfunction compared with ON-CABG surgery. This could suggest that reduction of renal risk alone should not be an indication for OPCABG over ONCABG surgery. Until Early and late results are compared in a large prospective randomized study, we believe that the indication for OPCAB should be selective rather than routine.

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Early sternal instability following Coronary Bypass Surgery: Is early aggressive surgical intervention beneficial?

Magued A. Zikri, M.D.
Department of Cardiothoracic Surgery, Kasr El Aini Faculty of Medicine, Cairo University

Patients and Methods: **480 patients had primary coronary revascularization over an 8 year period. Group (A) consisted of 23 patients (4.8%) with early sternal instability and wound discharge while group (B) consisted of 457 patients whose sternal incisions were intact. Intraoperative risk factors included IMA harvesting (100%), sternal fractures (43.5%) and prolonged surgery (26.1%). Post operative risk factors included low cardiac output (13%), reoperation for bleeding (8.7%), prolonged ventilation (21.7 %) and simultaneous SV harvesting site infection (13%).**

Results: Sternal rewiring using interlocking figure of eight sutures was applicable in 21 patients (91.3%). Bacterial cultures identified staph epidermidis in 5/13 (38.5%), staph aureus (30.8%), pseudomonas (23.1%) and klebsiella (9.5%).10 cases had sterile cultures.

Postoperative data included duration of ICU stay (range 1-4 days, mean of 2.2 +/- 0.8days), prolonged ventillation (one case), prolonged inotropic support (two cases) and post operative hospital stay (range 8 to 12 days, mean 9.4 +/- 1.1days). One case died of severe sepsis on day four. Of 10 different factors analyzed, only diabetes (p=0.033), overweight (p=0.0001) and sternal fracture at initial surgery (p=0.0001) attained statistical significance. Follow up was completed in 91% of survivals (range 8m-9.5 y, mean 3.9 y). Sternal rewiring could achieve sternal stability in 19 of the 21 patients.

Conclusion: **Early surgical interference had excellent consistent and long lasting results, achieving in one stage a stable sternal reconstruction using a technique of interlocking figure of eight wire sutures. Identified risk factors included diabetes, overweight and sternal fracture at time of initial operation.**

Key words: **CABG: Coronary Artery Bypass Grafting. IDDM: Insulin-dependent diabetes mellitus. COPD: Chronic Obstructive Pulmonary Disease. PO: Postoperative.**

Despite its near universal use for cardiac and great vessels exposure, sternal split remains today a significant risk factor with an incidence of dehiscence and infection ranging from 1 to 5% in different reports [(1),(2)]. The periosteal devitalization by the surgical maneuver together with the frequently prolonged exposure both put the sternal edges at jeopardy for proper healing [(3)]. A strict midline

sternotomy, minimal use of bone wax and diathermy, and skeletonised dissection or a narrow pedicled internal mammary are all useful to limit damage to the vascularity of the sternum [4].

The profile of the cardiac patient with multiple co-morbidities in term of older age, diabetes, overweight and smoking habit adversely affect sternal integrity. The management of patients that develop sternal instability has evolved over time [5].

Recently, a trend for a more aggressive early intervention has replaced the initial conservative treatment using repeated open wound dressings. The impact of such a paradigm shift is well reflected in the literature as a significant decrease in multiple morbidities and a lower mortality with less financial burden and a more rapid return to active life [6].

Aim of work: Having followed such an agg ressive approach over the last decade, we are hereby reviewing our experience with this challenging subgroup of patients.

Patients and Methods :

In the period between November 1995 and October 2003, 480 patients had primary isolated coronary revascularization through a midline sternotomy by the same surgical team. 23 patients (4.8%) developed sternal instability with wound discharge. Patients were categorized into two groups: (A) which included 23 patients (4.8%) who developed postoperative sternal instability with wound discharge while in group (B) which included 457 patients, this did not occur. Demographics in group (A) patients showed 6 patients (26.1%)of the female gender and patients age ranged from 44 to 76 years with a mean of 68 y.

Preoperative identified risk factors: included the following. Nineteen patients (82.6%) were smokers and 11 (47.8%) were overweight. Fourteen patients (60.9 %) were diabetics. Obesity was associated with diabetes in 10 out of 11 cases (90.9%). Two patients had peripheral arterial disease (8.7%). The preoperative patient data and risk factors are shown in **Table (1)**

Surgical Protocol:

All patients had a full re-exploration of the sternotomy wound 24 to 36 hours following institution of antibiotics. After removal of sternal wires and loose fragments of bones, an evaluation of degree of tissue destruction was made. Radical debridement was then performed for necrosed bone, cartilage, pectoral muscle at its sternal insertion and subcutaneous tissue. Samples were sent for pathological and bacteriological examination. Copious irrigation with warm povidone iodine 1% was used to remove all debris and clots.

In situations where the sternal bone structure was judged adequate for sternal rewiring, eight interlocking figure of eight wire stitches were passed through the manubrium and intercostal spaces.

Table (1) : Preoperative patient Data and risk factors

Variable	Value
No.of patients having sternal instability and PO Wound discharge	23
Age (years)	44-76
- Range	68
- Mean	
Gender (number & %)	17 (73.9%)
- Men	6(26.1%)
- Women	
Cigarette-Smokers (number & %)	19 (82.6%)
Overweight (number&%)	11 (47.8%)
Diabetes Mellitus (number & %)	14 (60.9%)
Obesity with DM	10/11 (90.9%)
Peripheral arterial disease (number& %)	2 (8.7 %)

In cases with advanced bone destruction, a bilateral pectoral muscle flap was developed to the anterior axillary line and the muscle flaps were used to fill the gap between the bone edges. An indwelling single lumen CVP catheter was inserted in the retrosternal space via the suprasternal notch and a 32 french tube was inserted retrosternally . The skin, subcutaneous tissue and muscle are then closed in a single layer of simple tension suture using prolene 1 spaced one inch apart. Wash with povidone iodine 1% irrigation at a rate of 70 cc/hour for 48 hours is also started using the indwelling suprasternal catheter. Regimen of antibiotic is continued unchanged until the result of culture is available. A total of 10 days of IV antibiotics is usually used and stopped at time of patient home discharge.

Oral antibiotics based on culture are used for an additional 2 weeks. If culture is negative in all specimen samples, ciprofloxsacillin 500 mg every 12 hours was empirically used. All stitches and retrosternal tube are removed not before three weeks of time of surgery.

Intraoperative idenftified risk factors: included use of LIMA grafts in all cases, sternal fractures in 10 cases (43.5%) and prolonged operative time in 6 cases (26.1%). Post operative identified risk factors included low cardiac output in 3 cases (13%), reoperation for

bleeding in 2 cases (8.7%) and prolonged ventilation more than 8 hours in 5 cases (21.7 %). In 3 patients (13%), simultaneous discharge was also present from the SVG harvesting site. Wound swabs were sent from any sternal discharge for gram stain with culture and sensitivity for aerobes and anaerobes. All patients were started immediately on an IV antibiotic regimen of Imipenem 500 mg every 8 hours to which Vancomycin 500 mg every 8 hours was added in patients with normal kidney function. In 3 cases, an elevated creatinine level either at the start or during treatment dictated titrating down vancomycin dose. Blood cultures were requested whenever systemic signs of sepsis were detected as was evident in 6 patients (26.1%). The intraoperative and postoperative patient risk factors aredemonstrated in (**Table 2**).

Table (2) : Intraoperative and Postoperative patient risk factors after INITIAL revascularization procedure.

Variable	Value
* Intraoperative risk factors:	
- LIMA harvesting (no. & %)	23 (100 %)
- Sternal fracture	10 (43.5 %)
- Prolonged operative time.	6 (26.1 %)
* Postoperative risk factors:	
- PO Low-cardiac output	3 (13 %)
- Reoperation for bleeding	2 (8.7 %)
- Prolonged ventilation > 8 hour after INITIAL CABG	5 (21.7 %)
- Simultaneous discharge from sternal & SVG wound.	3 (13 %)

Statistical Methods:

All categorical variables were expressed as a percentage of the total and all continuous variables were expressed as a variation of the mean. Univariate analysis using Student t–test was used to identify risk factor with a potential negative effect on morbidity and mortality. P value less than 0.05 was considered of clinical significance.

Results:

Analysis of pre and postoperative patient risk factors:

The different risk factors for early mediastinitis and sternal dehiscency in the whole population were analysed to identify statistical relevance. (**Table 3**), shows their relative incidence in the general population in contrast to that in the dehiscence group. Of 10 different factors analyzed, only diabetes, overweight and sternal fracture at initial surgery attained statistical significance.

Table (3) : Analysis of pre and postoperative patient risk factors.

Variable	Group A (Sternal instability)	Group B (Sternal stability)	P Value
Female Gender	6	67	0.233*
Smoking	19	366	0.978*
Obesity	11	74	0.0001
Diabetes	14	167	0.033
Use of LIMA	23	409	0.2*
Sternal fracture	10	54	0.0001
Operating time > 5h	6	65	0.27*
Low Cardiac output	3	26	0.319*
Reop for bleeding	2	29	0.99*
Ventilation > 6h	5	49	0.196*

Group A = Sternal instability = Dehiscence (no: 23 patients).
Group B = Sternal stability = Non Dehiscence (no: 457 patients).
P value of statistical significance if < 0.05.
**** = P value non-significant if > 0.05.***

Results of the re-wiring technique:

The technique of sternal rewiring using interlocking figure of eight sutures could be used successfully in 21 (91.3 %) out of the 23 patients. In the remaining two cases, overt local sepsis with frank pus and near-total sternal destruction made rewiring impractical and bilateral pectoral muscle flap were advanced. Sternal rewiring could achieve sternal stability in 20 (86.9 %) of the 21 patients intraoperatively and in 19 patients (82.6 %) on follow up. The one late failure (4.3 %) was in a morbidly-obese lady that had inefficient bracing her sternum with sternal binder because of breast size. (**Table 4**.)

Table (4) : Surgical intervention done and its results.

Surgical Intervention & its Timing	Value
(1) Simple rewiring done within 10 PO days (early presentation)	21 (91.3 %)
- Intraoperative stability.	20 (86.9 %)
- Stability on follow-up.	19 (82.6 %)
(2) Failure of rewiring:	3 (13 %)
- Non applicable technique (secondary to overt local sepsis).	2 (8.6 %)
- Early failure.	1 (4.3 %)
- Late failure.	1 (4.3 %)

Results of bacteriological cultures obtained intraoperatively:

Cultures obtained at time of operation were sterile in 10 cases (43.4 %). In the remaining 13 cases (56.52 %) with either bacterial or fungal growth was detected. Bacteriologic results were as follow, staph epidermidis in 5/13 (38.5 %), staph aureus in 4/13 (30.8 %), pseudomonas in 3/13 (23.1 %) and klebsiella in 1/13 (7.7 %). (**Table 5**).

Table (5) : Results of bacteriological cultures obtained intraoperatively.

Intraoperative Culture Results &Organism	Value
- No bacterial growth (Sterile Culture)	10 (43.4 %)
- Growth (Positive bacterial Culture) :	13 (56.52 %)
- Staph epidermidis	5 (38.5 %)
- Staph aureus	4 (30.8 %)
- Psudomonas	3 (23.1 %)
- Klebsiella	1 (7.7 %)

ICU and Hospital Stay times and postoperative patient data:

Duration of ICU stay ranged from one day to 4 days with a mean of 2.2 +/- 0.8 days

Duration of hospital stay ranged from 8-12 days with a mean of 9.4 +/- 1.1 days.

Morbidity:

Ventillation more than 6 hours was needed in one case (4.3 %) **after the rewiring procedure**.

Inotropic support was required in two cases (8.6 %) for 8 hours or more.

Sternal re-dehiscence was detected in two cases (8.6 %), one with intact skin and was treated conservatively with chest binder and the other case was a late failure on follow up in an obese female. Both were treated conservatively. Neither of them had a skin wound dehiscence.

Reoperation :

Another case required a reoperation for a suppurating chondritis of the left costal arch. One case with severe COPD developed an anterior abdominal wall hernia between the two recti and was repaired using prolene mesh reinforcement.

Early postoperative mortality :

One case died of severe sepsis and multi organ failure on day four. He presented on the third post operative day following CABG with multiple surgical and line punctures site infections that were positive for pseudomonas aeruginosa. His preoperative profile included insulin dependent diabetes mellitus, obesity, low ejection fraction, unstable angina and peripheral vascular disease. He was not a smoker **(Table 6)**.

Table (6) : Early postoperative outcome & events during the hospital stay.

Type of the postoperative event	Value
*ICU duration of stay (in days)	
- Range	1- 4
- Mean	2.2
* Ventilation more than 6 hours	1 (4.3 %)
* Need for Inotropic Support for 8 hours or more	2 (8.6 %)
* Duration of postoperative hospital stay (in days)	
- Range	8-12
- Mean	9.4
* Sternal Instability (re-dehiscence)	
- With intact skin à Conservative mgt (chest binder)	2 (8.6 %)
* Suppurative chondritis of the left costal arch	1 (4.3 %)
* COPD causing anterior abdominal wall hernia à repaired	1 (4.3 %)
* Early hospital mortality	1 (4.3 %)

COPD: Chronic Obstructive Pulmonary Disease

Postoperative Follow up:

Of the 22 surviving patients (95.6 %) only two were lost to follow up. The duration of follow up ranged from 8 months to 9.5 years, with a mean of 3.9 years. It consisted of office visits monthly for the first six month and telephone interview yearly thereafter.

Late postoperative morbidity :

Apart from one case of chondritis and one case with abdominal wall herniation no morbidities were detected in relation with the sternal reconstruction procedure. There was no necessity for wire removal either for discomfort or for local recurrence of infection.

Late postoperative mortality :

Four patients died (17.39 %), one of lymphoma and the other of old age at 3 and 5 years post operatively. The other two had recurrence of cardiac symptoms. One died of an angina attack 6 years post operatively and the other

developed severe left ventricular dysfunction 2 years post operatively. **(Table 7)**.

Table (7) : Late postoperative events during the follow-up period.

Type of the postoperative event	Value
* Number of surviving patients	22 (95.6 %)
* Number of patients who completed the follow-up	20 (86.9 %)
* Postoperative follow-up period :	
- Duration	8 m – 9.5 y
- Mean	3.9 +/-1.9 y
* Late Morbidity complications (total number & % to study cases):	2/20 (10 %)
- Chondritis	1 (5 %)
- Abdominal wall herniation	1 (5 %)
* Late postoperative mortality (total number & % to study cases)	4/20 (20 %)
- Lymphoma (3 years PO)	1 (5 %)
- Old age (5 years PO)	1 (5 %)
- Recurrence of ischemic pain (6 years PO)	1 (5 %)
- Development of LV dysfunction (2 years PO)	1 (5 %)

Y: Years M: Months PO: Postoperative

Discussion:

While management of mediastinal contamination is best addressed at the prophylactic stage, two important issues need to be emphasized for a successful outcome, namely early intervention and radical tissues debridement [4-6]. The initial manifestation is frequently subtle. The mere presence of an unstable sternum should be an alarming sign [7].

It was our observation, as well as that of others [8-13], that tissue destruction can be minimized if wound re exploration is done early enough. This also translates into a simpler one stage procedure with direct sternal and skin closure and a shorter hospital stay [14],[15].

Some surgical groups [16-17] reported that the majority of the patients that failed initial simple closure had a delayed presentation. Moreover, if the skin incision gaps; secondary infection, frequently with opportunistic organisms such as fungi, may further complicate the management.

The sine qua non of surgical management directed to infected space and tissues will always remain free drainage and radical debridement [18]. A prolonged antibiotic course, when used alone, gives the clinician a false impression of safety. We uniformly used for a 48 hours period a combination of imipenem and vancomycin to attain a satisfactory tissue level at time of surgery. All necrotic areas from the subcutaneous area down to the periosteum and all avascular bone were excised. This was extended until an area of intact vascularity was reached.

More advanced cases with total destruction of the sternum can be addressed by a variety of techniques. We have found that pectoral muscle advancement succeeds in the majority of the cases to fill the gap left by upper sternal excision. It also has the advantage of not requiring a separate incision. In situation where a lower sternal gap needed to be filled, an omental flap proved useful [19].

In this series, the use of complex hardware to stabilize the sternum was negated by the technique of using sternal wire in a series of interlocking figure of eight. The mechanism of interlocking the stainless steel wire distributes all coronal disruptive forces to the longitudinal axes. This counteract tendency of separation of the sternal plates and provide the necessary stability for bone fracture healing. Moreover, every wire transmits the coronally directed forces to the wire above and below. This translates into a very efficient chain of metal that at many times could successfully bridge a portion of missing bone. The short hospital stay and absence of early readmission for infection recurrence compares favorably to those reported elsewhere [18-20].

A number of other approaches were advocated including compression plates, Harrington compression system, stainless steel bands and Dall–Miles cable system. The use of hardware in an infected surgical field should be reserved to a very limited subset of patients. The need of another go to remove the compression plates is another short coming of such procedures.

The follow up of this series points to two facts. The stability and durability of the sternum was achieved in the majority of the cases that could benefit from a one stage repair with sternal rewiring. The other issue was the very low incidence of recurrence of infection whether in the cartilage/bone element or the soft tisues element of the repair. In fact, only one case required re operation for an indolent purulent chondritis. These results echo those of other series with a similar patient population [15-16].

Conclusion:

Because of its negative impact on patient prognosis and the resulting hospital facility and financial burden, an early identification and aggressive management for suspected mediastinal infection should be emphasized. Early surgical interference in patients with sternal instability with signs of local and systemic sepsis had excellent consistent and long lasting results. It did achieve in one

stage a stable sternal reconstruction using a technique of interlocking figure of eight wire sutures. Late presentations almost always call for a more complex reconstructive procedure. Identified risk factors included diabetus, overweight and sternal fracture at time of initial operation and multiple sites wound infection.

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Vacuum-Assisted Closure (VAC) In the Treatment of Mediastinitis. Following Coronary Artery Bypass Surgery. Initial Experience.

Tarek A. Abdel Aziz, MD

Background: **Poststernotomy mediastinitis is one of the most feared complications in patients undergoing cardiac surgery. This complication is associated with a significant mortality and morbidity that have bad prognostic implication. A new technique using vacuum-assisted closure (VAC) was successfully applied in 4 patients with poststernotomy mediastinitis following coronary artery bypass grafting.**

Methods: **Four patients who had mediastinitis or deep sternal wound infection after coronary artery bypass surgery were treated with vacuum-assisted closure therapy, followed by direct surgical closure. The vacuum-assisted closure system is consisting of polyurethane foam into which a noncollapsible tube is embedded, vacuum pump and a transparent adhesive drape. The foam was fashioned and placed in the wound after surgical debridment and irrigation of the wound. The foam and the entire wound are covered with an adhesive drape thus ensuring an airtight system. Finally, a predetermined continuous negative pressure of -125 mmHg is applied to the wound via the non collapsible tube connected to the vacuum pump. All patients received antibiotics according to culture and sensitivity. The dressing was changed every 2 days. When healthy granulation tissue is observed in all parts of the wound and 2 negative cultures are obtained, the sternum and the wound were closed.**

Results: **The mean duration of vacuum-assisted closure treatment time until surgical closure was 11.5 ± 2.3 days (range 5 - 16 days). The mean hospital stay was 66.2 ± 6.8 days (range 48 - 80 days). All patients were discharged alive.**

Conclusions: **Vacuum-assisted closure treatment, followed by surgical closure is a reliable, easily applied and safe new strategy in patients with postoperative mediastinitis or deep sternal wound infection.**

Requests for reprints to Dr. Tarek A. Abdel Aziz

Dubai Hospital, P.O .Box: 7272, DubaiThe Department of Cardiothoracic Surgery, Dubai Hospital, Dubai, UAE

Poststernotomy mediastinitis is one of the most feared complications in patients undergoing cardiac surgery. The overall incidence of poststernotomy mediastinitis is reported to be low, usually between 1% and 3%. However, this complication is associated with a significant mortality, reported to vary between 10% and 35% [1,2]. In addition to increased early mortality, poststernotomy mediastinitis has been reported to be a strong prognostic factor for poor long-term survival after CABG when using conventional treatment [3,4]. The late mortality is reported to be two to three times higher in patients suffering from mediastinitis follow-

ing CABG than in patients without mediastinitis [5].
Risk factors such as obesity, diabetes mellitus, chronic obstructive pulmonary disease (COPD), and heart failure (high NYHA Class, and a left ventricular ejection fraction (LVEF) <30%) increase the risk of developing poststernotomy mediastinitis. Other risk factors include poor sterility techniques in re-exploration for bleeding). Furthermore, the use of bilateral internal mammary arteries has been reported as a risk factor for sternal infection [2].
Poststernotomy mediastinitis was initially treated with surgical revision, with or without multiple open dressing changes, followed by sternal rewiring or secondary healing. A high mortality rate of 45% has been reported following this strategy. One major disadvantage of open dressings is thoracic instability that requires mechanical ventilation. Prolonged immobilization also increases the risk of additional complications such as pneumonia, thrombosis and muscular weakening. Another devastating complication when leaving the sternum open is right ventricular laceration, which is associated with high mortality rates [6].
In early sixties, an important advance in treatment of mediastinitis was made using the method of continuous irrigation in combination with drainage and a closed sternum. Surgical revision with rewiring or dosed irrigation offers an expeditious procedure with the advantage of a closed wound and a stable sternum, but several studies have reported unsatisfactorily high rates of failure with recurrent infections and mortality [7].
Another commonly accepted wound-healing approach is primary, or delayed; wound closure with vascularized soft tissue flaps. Recent studies have reported varying results with pectoral muscle flaps in poststernotomy mediastinitis [8]. Other authors have advocated the technique employing omentum flaps for closure of mediastinal defects [9], or reversed rectus abdominis muscle flaps [6]. Reconstruction with soft tissue flaps has a relatively low mortality rate according to some reports. However, there are disadvantages, including additional surgical trauma and late flap-related morbidity such as pain, weakness and hernias [9].
Another, newer, alternative for reconstruction of the sternum, especially when large bone defects are present, may be the Ley prosthesis. This titanium alloy plate is reported to shorten the length of hospital stay and reduce the need for further surgical intervention [10].
At the present time, there is no general consensus regarding the appropriate surgical approach to mediastinitis following open-heart surgery
Vacuum-assisted closure (VAC) is a recent technical innovation in wound care with a growing number of applications. This wound-healing system was developed by Louis Argenta and Michael Morykwas in the early 1990s and VAC has been available in North America since 1995. The system was introduced in Europe in 1997. This wound-healing technique is based on the application of local negative pressure to a wound [11].
This is a retrospective study aiming to evaluate our initial experience using VAC in treatment of post sternotomy mediastinitis.

Patients and Methods :

Between January 2004 and December 2005, four patients who developed mediastinitis after coronary bypass surgery, were treated with the VAC system (KCI International, San Antonio, TX, USA). The mean age of these patients was 57.5 ± 0.6 years, ranging from 55 to 61 years. There were 3 females and 1 male. The preoperative patients profile is summarized in Table (1).

Table (1): Preoperative patients' profile.

Variable	Patient 1	Patient 2	Patient 3	Patient 4
Age (Years)	61	55	56	58
Sex	Female	Male	Female	Female
Diabetes Mellitus	Yes	Yes	Yes	Yes
Hypertension	No	Yes	Yes	Yes
Hyperlipedemia	Yes	Yes	Yes	Yes
Angio Diagnosis	3 VD	3 VD	3 VD	3 VD
LV EF%	40%	50%	40%	40%
Angina class (CCSC)	III	III	IV	IV
Timing for CABG	Elective	Elective	Urgent	Urgent

Three patients were operated upon using our standard technique of conventional cardiopulmonary bypass with mild systemic hypothermia with combined antegrade/ retrograde cardioplegia with hotshot. One patient was operated off pump (OPCAB). All patients received left internal mammary artery (LIMA) as arterial graft and saphenous vein graft (SVG) as well. The mean number of grafts was 3.5 ± 0.2 ranging from 3 to 4 grafts. Two patients were operated on an urgent basis due to unstable angina not controlled by medical treatment. One patient treated by Intra Aortic Balloon Pump (IABP), (Datascope Corp., Fairfield, New Jersey, USA) inserted prior to induction of anesthesia. One patient had combined CABG and left internal carotid end arterectomy. The intra operative data are illustrated in Table (2).
The infection was noticed between 16 to 86 days after the initial operation with mean of 35 ± 17 days. The isolated organism was Staph Aureus (SA) in 2 patients, Methicillin Resistant Staph Aureus (MRSA) in 1 patient, and E.Coli in 1 patient. Antibiotics were administered in

all patients according to culture and sensitivity studies. Two patients who had SA received Vancomycin (Lilly), 1 patient who had MRSA received Linezolid (Pharmacia) and the last patient received Meropenem (Astra Zeneca) for E.Coli. The sternotomy was reopened fully in 2 cases, while the other 2 cases had only partial resection of the lower end of the sternum. The postoperative data are expressed in Table (3).

Table (2): operative data.

Variable	Patient1	Patient 2	Patient 3	Patient 4
CC (Minutes)	48	66	62	OPCAB
CPB (Minutes)	90	110	100	OPCAB
Grafts	3	4	4	3
LIMA	Yes	Yes	Yes	Yes
Associated procedures	No	Lt.Carotid endarterectomy	IABP	No

Table (3): Postoperative data.

Variable	Patient 1	Patient2	Patient 3	Patient4
Isolated Organism	SA	SA	E. Coli	MRSA
Antibiotic therapy	Vancomycin	Vancomycin	Meropenem	Linezolid
Timing from CABG (Days)	16	18	20	86
VAC duration (days)	5	10	13	16
Hospital stay	48	65	72	80
Hospital mortality	No	No	No	No

Technique :

The VAC materials consist of: polyurethane foam into which a noncollapsible tube is embedded, vacuum pump and a transparent adhesive drape (KCI International, San Antonio, TX). The foam used is black, medical-grade reticulated polyurethane foam with a 400 to 600 µm pore size. Side ports in the evacuation tube allow communication of the lumen of the tube to spaces in the reticulated foam and the open cell nature of the foam ensures equal distribution of the applied pressure to every surface of the wound that is in contact with the foam. The foam is not impregnated with any antibiotics or antiseptics. The VAC treatment is installed on the day of surgical re exploration, wound debridment and wound irrigation. The polyurethane foam is cut and fashioned to fit the size of the wound. One end of a non-collapsible tube is then embedded in the foam and the other end is connected to a container, which is in turn connected to a vacuum pump. The foam and the entire wound are covered with an adhesive drape thus ensuring an airtight system. Finally, a predetermined continuous negative pressure of -125 mmHg is applied to the wound. The foam dressing collapses on application of the negative pressure and transmits an even distribution of pressure across the wound. The polyurethane foam with the drainage tube is changed every 2 days. Mild sedation or light general anesthesia may be needed in some cases if more debridment is required; otherwise change of dressing was done in the ward. Change of the dressing every 2 days makes it possible to inspect the wound regularly and avoid in-growth of tissue into the foam. Moistening the foam makes its removal easier. When healthy granulation tissue is observed in all parts of the wound and 2 negative cultures are obtained, the sternum and the wound were closed.

Results :

The duration of the VAC treatment ranged from 5 to 16 days with mean of 11.5 ± 2.3 days, after which all patients were taken to surgery for wound closure by secondary suture under general anesthesia. Adequate drainage of the wound was very evident at every change of dressing. In patient 1 and patient 4 the sternum was not opened fully, while in patient 2 and patient 3 the sternum was fully opened. We did not found any adhesions between the foam and the retrosternal structures such as the myocardium or the bypass grafts. No complications were seen in the healing of the wound. All patients were discharged alive and the hospital stay ranged from 48 to 80 days with mean of 66.2 ± 6.8 days.

Comment

Deep sternal wound infections not only lead to high mortality, but the morbidity in surviving patients is also significant. Furthermore, poststernotomy mediastinitis is associated with a prolonged length of hospital stay, an increased cost of care and significant impairment in long-term survival [4,5,12].

The VAC technique was described for the first time by Argenta and Morykwas in 1997 [11]. The VAC technique can be regarded as a method that combines the benefits of both closed and open wound treatment for management of postoperative mediastinitis and deep wound infection.

Several studies have reported the benefits of VAC treatment in poststernotomy mediastinitis. In these studies, the VAC technique has been successful, either as a single-line therapy, or as a procedure for providing optimal conditions for second-line treatment with delayed flap closure [13,14].

In our study -as well as other groups- the VAC was used as a primary procedure followed by sternal re-wiring

and wound closure by secondary suture [15].

The exact mechanism by which VAC exerts its wound-healing mechanism seems to be multifactorial. The initial animal studies performed by Morykwas and Argenta demonstrated significantly increased granulation-tissue formation and a markedly elevated blood flow in wounds treated with VAC. Morykwas and colleagues also demonstrated a decrease in bacterial count during VAC therapy [11]. The mechanism behind this finding is not fully understood, and there have been reports of contradictive results regarding the bacterial burden during VAC treatment [16]. An alternative explanation is the reduction of tissue edema by removing osmotically active molecules and mediators, thus preventing capillary compromise [17]. Vacuum-assisted closure also approximates the wound margins and therefore exerts a mechanical force on the surrounding tissue. Tissue expansion is known to stimulate angiogenesis and increase the mitotic activity in skin [18].

One of the major advantages of the VAC technique is this stimulation of tissue granulation that makes secondary closure with a myocutaneous flap unnecessary. This is especially important in patients with relative contraindications for such a major surgical procedure. An additional advantage is the fact that the polyurethane foam only needs to be changed every 2 days whereas in the traditional treatment the wound dressing has to be changed twice a day. In this way the VAC is less time consuming and less discomforting for both patients and nurses.

Although the period of hospitalization of these 4 patients may seem long, yet the conventional treatment of mediastinitis (open drainage, closed irrigation system or myocutaneous flap) might also be associated with prolonged hospitalization.

Conclusion :

Poststernotomy mediastinitis following median sternotomy for cardiac surgery may require multiple wound dressing and debridment before final wound closure can be accomplished. The Vacuum-Assisted Closure has been used in four patients to stimulate granulation tissue formation in the wound, decrease tissue edema in the wound margins and decrease the number of dressing changes required before wound closure. Early vacuum-assisted closure treatment, followed by surgical closure, is a reliable and easily applied new strategy in patients with postoperative mediastinitis or deep sternal wound infection.

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Is Renal Dysfunction a Risk Factor in Patients Undergoing Cardiac Surgery? Mansoura Experience

Nabil A. Mageed, MD
Yasser F. El-Ghoniemy, MD

Abstract: **Objective: To evaluate the effects of preoperative renal dysfunction on the outcome of the patients after cardiac surgery.**

Methods: **From January 2002 to march 2005, cardiac surgery (coronary artery bypass grafting or valve replacement) was performed in 30 patients with preoperative renal dysfunction (Creatinine > 2.0mg/dl) and in 220 patients without renal dysfunction. Hospital outcomes were compared between propensity-matched pairs of 30 patients with renal dysfunction (Renal group) and without renal dysfunction (Control group).**

Results: **In the matched pairs, the early postoperative clinical results showed patients in the renal group were more likely to develop postoperative renal failure (p=<0.0001). The ventilatory support time, the intensive care and hospital stay were significantly longer in the renal group. The ventilatory support time was approximately three folds that for patients with renal dysfunction as for patients without (p=<0.0001). The mean length of stay in critical care units and hospital wards were approximately twice that for patients with renal dysfunction as for patients without (p=<0.01). The hospital mortality was higher in the renal group than the control group (10% vs. 3%, p=0.01, respectively).**

Conclusion: **Renal dysfunction increases the morbidity and mortality in patients undergoing cardiac surgery. It is associated with longer ventilation time, intensive care and hospital stay. However, surgery in this patient population can be performed with acceptable morbidity and mortality rates compared to general patient population. A careful perioperative management and proper choice of therapeutic strategies may be useful for improvement of the outcome**

Address for correspondence: Dr.Nabil A. Mageed

The Department of Anesthesia, Faculty of Medicine, Mansoura University, Egypt.

Email : nabilabdelraouf@yahoo.com

Preoperative renal dysfunction is an important risk factor that influences surgical morbidity and mortality1,2. Previous studies reported associations between preoperative renal dysfunction and poorer outcomes after cardiac surgery especially coronary artery bypass grafting (CABG)2-14 and found that the morbidity was 2-3 times higher than a patient without renal failure.

The purpose of this retrospective study was to determine the incidence of the early postoperative renal failure, the perioperative predictors of renal failure, and hospital morbidity and mortality in patients with renal dysfunction undergoing cardiac surgery in our Mansoura Cardiothoracic Unit.

Patients and Methods:

From January 2002 to march 2005, cardiac surgery (coronary artery bypass grafting (CABG) or valve replacement and combined procedures) was performed in 30 patients with preoperative renal dysfunction (Creatinine >2.0mg/dl) and in 220 patients without renal dysfunction, at the Cardiothoracic Unit and Mansoura International Hospital, Mansoura Faculty of Medicine.

Data Source:

Clinical, operative and outcome data were collected retrospectively in a computerized database for 250 patients undergoing cardiac surgery (CABG or valve replacement and combined procedures). Thirty patients had renal dysfunction with preoperative serum creatinine ≥ 2.0mg/dl.

Hospital outcomes were compared between propensity-matched pairs of 30 patients with renal impairment (Renal group) and 30 patients without renal impairment as a control (Control group). Of the renal group, three patients (10%) were dialysis-dependant.

Both groups (Renal/Control) were then matched on 12 prognostic preoperative variables: (age, sex, LV function, NYHA class, previous cardiac surgery, standard cardiac risk factors, preoperative stroke or TIA, Timing of surgery, peripheral vascular disease (PVD), CHF, shock, and syncope) [Table (1)].

Preoperative evaluation of all patients concerning medical history, clinical examination including ECG and chest x–ray, complete laboratory investigations and Echo Doppler evaluation of the heart and valves, coronary angiography were done.

After arrival in the preoperative area, patients were premedicated with midazolam 0.03 mg.Kg-1, Fentanyl 1 µg.Kg-1via an intravenous catheter. Under local lidoceine 1% anesthesia, an arterial catheter (20 G) was placed to continuously record blood pressure changes and pulmonary artery catheter was inserted via the right internal jugular or subclavian veins for hemodynamic measurements. Cardiac output was measured using the thermodilution technique, by the mean value of six successive injections of 10 ml dextrose 5% at room temperature. All other standard anesthesia safety monitoring was rigorously adhered to, including ECG, pulse oximetry and capnography.

Anesthesia was induced by slow i.v. administration of fentanyl 20 – 30 µg.Kg-1, propofol 1 – 2.5 mg.Kg-1 and 0.6 mg.Kg-1 atracurium to provide neuromuscular blockade and facilitate tracheal intubation. With loss of consciousness, positive pressure ventilation was started via a face mask at a rate of 12 – 15 breaths per minute. Patients were mechanically ventilated with 100% o2 and end – tidal CO2 was monitored and maintained between 35 – 40 mmHg. Anesthesia was maintained with isoflurane 0.2 – 0.8 %, propofol 2 – 4 mg.Kg-1 .hour-1 and incremental doses of fentanyl and atracurium to maintain muscle relaxation. During all procedures, heart rate, rhythm, and computerized ST segment analysis were monitored on ECG monitor, pulse oximetry for O2 saturation measurements. Transesophageal echo Doppler probe was also inserted for assessment of cardiac motions and functions. A urinary catheter was placed to monitor urine output and rectal and nasopharyngeal temperatures were continuously monitored.

Table (1): Preoperative variables in the studied groups: Data are presented as % or mean±SD.

	Control Group (n=30)	Renal Group (n=30)
1. Demographic data		
Age (years)	42±15	48±17
Sex (% of female)	18%	19%
Body surface area	1.85±0.23 m^2	1.9±0.2 m^2
2. Standard Risk Factors:		
Diabetes Mellitus	43%	40%
Hypertension	50%	53%
Hypercholesterolemia	33%	30%
Preoperative MI	13%	16%
Preoperative Angina	66%	63%
Peripheral vascular disease	43%	46%
3. NYHA functional class:		
I	6%	3%
II	6%	6 %
III	30%	33%
IV	58%	58%
4. Previous cardiac surgery	13%	10%
5. Preoperative stroke or TIA	20%	17%
6. CHF	73%	76%
7. Infective endocarditis	13%	16%
8. Timing of surgery		
Elective	87%	84%
Urgent/emergency	13%	16%

Operative technique:

The conduct of the operation was similar in all patients. Following median sternotomy and heparinization, cardiopulmonary bypass was established with two caval cannulae and an ascending aortic cannula.

During bypass, the hematocrit was maintained between 20% and 25%, pump flow rates between 2.0 and 2.5 L/min per square meter, and mean arterial pressure above 50 mmHg using either sodium nitroprusside or phenylephrine hydrochloride as required. In elderly patients, the

mean arterial pressure was maintained above 70 mmHg in an attempt to improve cerebral perfusion.
Blood cardioplegic solution was used in all patients. Blood cardioplegic solution was delivered either in an anterograde mannered via the aortic root till arrest started, then separately inside each coronary ostium.
An intra-aortic balloon pump (Data scope Corporation) was inserted percutaneously in patients who had difficulty in weaning from cardiopulmonary bypass or in whom inadequate cardiac performance was developed in the intensive care unit. Patients with less severe hemodynamic compromise received inotropic medication.

Postoperative variables measured:

Postoperative low cardiac output syndrome (LOS) was diagnosed if a patient required either intra-aortic balloon pump or inotropic support for greater than 30 minutes in the intensive care unit to maintain a systolic blood pressure greater than 90 mm Hg and a cardiac index greater than 2.2 L/ minute per square meter despite an adequate preload and correction of any existing electrolyte disturbances. In patients who received an intra-aortic balloon pump prior to surgery for either ischemic chest pain or hemodynamic compromise, the diagnosis of LOS was made if, in addition to intra-aortic balloon pump, inotropic medication was also required.
Perioperative myocardial infarction was documented when a new Q wave was found on the postoperative ECG. A perioperative myocardial infarction was also diagnosed with the presence of a new left bundle branch block, loss of R wave progression, or new ST and T wave changes if accompanied by a rise in the level of Troponin.

Postoperative renal insufficiency was diagnosed if the serum creatinine rose above 2.0mg/dl at any time during the hospital admission. Postoperative renal failure was documented if the patient required CVVHD, peritoneal or hemodialysis. Hemodialysis during CBP was not considered as a renal failure.
Cerbrovascular stroke was defined as focal brain lesion confirmed with clinical findings and / or computed tomography scan.
Hospital mortality was defined as any death that occurred within 30 days of the operation or during the same hospital admission.

Statistical Analysis:

Data were collected and managed in Microsoft Access database. All statistical analyses were performed using the SAS (Version 8.2) software for Windows. Univariate analysis of the data was performed using x2 analysis or Fischer's exact test where appropriate for categorical variables. Analysis of continuous variables was carried out by unpaired Student's t test.
Variables that had a univariate p value of <0.25 or those judged to be clinically important were submitted into a logistic regression model by stepwise selection. Multivariate logistic regression methods were used to calculate risk-adjusted mortality and calculate factor-adjusted odd ratio.
Model discrimination was evaluated by the area under the receiver-operator-characteristic (ROC) curve and calibration was assessed with the Homer-Lemeshow goodness-of-fit statistic. For goodness of fit, the null hypothesis is that the model fits the data. Therefore, an insignificant p value is desired because a p-value of less than .05 would indicate a poor fit between predicted and observed results. All continuous variables are expressed as mean±SD. Statistical significance was assumed if $p < 0.05$.

Results:

Age, sex, and body surface area (BSA) showed no significant changes between the studied groups (control and renal groups). Also, both groups showed no significant changes in the preoperative characteristics (Table 1).

Operative Data:

Table (2) summarizes the operative data for both groups and showed no statistically significant difference.

Table (2): Operative Data: Data are presented as (%)ormean ± SD.

	Control Group (n=30)	Renal Group (n=30)
X-clamp time (minutes)	72±26	76±32
CPB Time (minutes)	102±46	108±45
CABG	40%	47%
Mitral valve replacement	27%	23%
Aortic valve replacement	20%	20%
Combined procedures	13%	10%
Operation Time (minutes)	200±55	206±68

Clinical outcome:

Tale (3) shows the results of surgery in both renal and control group. There was no significant difference between both groups regarding the perioperative myo-

cardial infarction, the incidence of Low cardiac output syndrome, stroke and the incidence of re-exploration for bleeding.

Table (3): Clinical outcome: Data are presented as (%) or mean ± SD.

	Control group (n=30)	Renal group (n=30)	P value
Perioperative MI	3%	3%	0.67
Low Cardiac Output Syndrome	7%	10%	0.8
Stroke	3%	3%	0.77
Re operation for bleeding	13%	10%	0.8
Postoperative renal failure	3%	17%	0.0001*
Ventilation hours	9±4.8	25±7	0.0001*
ICU stay (days)	4±1.9	7.1±2.9	0.01*
Hospital stay (Days)	10±4.6	21±9.8	0.01*
Hospital mortality	3%	10%	0.01*

**** P < 0.05 Significant when compared with the control group***

However, patients in the renal group were more likely to develop postoperative renal failure (p=<0.0001). The ventilatory support time and the intensive care stay were significantly higher in the renal group (Table 3). The ventilatory support time was approximately three times as long for patients with renal dysfunction as for patients without. The mean length of stay in critical care units and hospital wards were approximately twice as long for patients with renal dysfunction as for patients without. In the renal group; three patients died compared to only one patient in the control group (Table 3). Multivariate logistic regression analyses revealed that renal dysfunction (Odds Ratio =3.5), timing of surgery (Odds Ratio =5.6), and peripheral vascular disease (Odds Ratio =3.4) were independent predictors of adverse events. So, renal dysfunction was the second most important predictor of operative mortality (OR=3.5) after timing of surgery (OR = 5.5).

Discussion:

Our study shows that patients with preoperative renal dysfunction undergoing cardiac surgery are at higher risk for prolonged intensive care unit and hospital stays, and significant increases in mortality. Previous studies have been found that patients with renal insufficiency were associated with poor outcome following the cardiac surgery 2-14. due to preoperative risk factors as old age, diabetes mellitus, hypertension, peripheral vascular diseases and left ventricular dysfunction2, 13,

In the present study, the preoperative risk factors are matched between the control group and the renal insufficiency group as regard the age, gender, body mass index, presence of diabetes mellitus, hypertension and peripheral vascular diseases, left ventricular dysfunction and the incidence of urgent operation. Also, the intraoperative risk factors are matched between both groups as regard aortic cross clamp time, total cardiopulmonary bypass, and operative times. The postoperative risk factors for renal dysfunction are also cross matched as regard low cardiac output, myocardial infraction, hemorrhage and stroke. In addition, no therapies with potentially nephrotoxic medication (such as aminoglycosides antibiotics, nonsteroidal anti-inflammatory drugs or angiotensin-converting enzyme inhibitors) were used before, during and after surgery. In spite of the similarity of the preoperative, intraoperative and postoperative risk factors between both groups, patients with preoperative renal impairment were associated with a significantly increased morbidity in comparison with the control group as regard the postoperative renal failure, postoperative ventilation, ICU and hospital stay. This is in accordance previous studies following CABAG 6,13 and valve replacement surgery14.

In the present study, the postoperative renal failure was significantly greater in the renal group. This is in accordance with previous studies 6-14. This can be explained by the lack of increase in the glomerural filtration rate and the associated depression of renal function reserve and reduced numbers of functioning nephrons in the early postoperative period in patients with normal renal function 13. In patients with preoperative renal insufficiency, it is likely that the renal function reserve is substantially more reduced than in patients with normal renal function in early postoperative period this results in poor outcomes after cardiac surgery.

In this study, the development of postoperative acute renal failure in patients with preoperative renal insufficiency was associated with poor outcome after cardiac surgery. It was associated with a greater morbidity and mortality. This in accordance with previous studies 17,18. They found that the development of acute renal failure was accompanied with a marked increase in the perioperative mortality17,18.

The hospital mortality in this study was higher in the renal group than in the control group (10%, 3% respectively). This in accordance with Samuels et al, 199612 and Hayashida et al,200113. Also, Yamamura et al, 2000, found that serum creatinine level greater than 1.6

mg.dl-1 is the most important predictor of in hospital mortality after CABG surgery in patients aged 70 years and over19.

In this study, multivariate analysis showed that renal dysfunction was the second most important predictor of operative mortality (OR=3.5) after time of surgery (OR= 5.5). In addition, Hayashida et al, 200113, found that renal dysfunction was the second important predictor of total mortality after poor left ventricular function.

In conclusion, preoperative renal dysfunction increases the morbidity and mortality in patients undergoing cardiac surgery. Renal dysfunction and timing of surgery were independent predictors of the clinical outcome after cardiac surgery (CABG or valve replacement and combined procedures). A careful perioperative management and the proper choice of therapeutic strategies may be useful for improvement of the outcome. Our data are limited to the early postoperative hospitalization stay, the effect of cardiac surgery in patients with preoperative renal dysfunction on long term outcome need further investigations.

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Clinical and Histological Study of Radial (Artery) for Cabg after two Methods of Harvesting

Elsayed M. Elmistekawy , MD

Objectives: **Use of the radial artery (RA) is currently getting more popular for coronary artery bypass grafting .Improvement of harvesting technique is an important factor in avoiding graft spasm and improving quality of conduit. Use of the ultrasonic dissecting scalpel in RA harvesting is thought to minimize harvesting time, improve graft quality and reduce wound complications. The aim of this work is to evaluate the radial artery after harvesting using Harmonic scalpel compared with conventional method .**

Methods: **The radial artery was harvested with informed consent , from the non dominant forearm in patients undergoing coronary artery bypass grafting (CABG) for the first time .The patients were assigned to one of two groups .In group I conventional harvesting of the radial artery using clip and scissor method (25 patients) .In group II RA harvesting was done using Harmonic Scalpel (Ethicon Endo-Surgery, Inc., Cincinnati, OH) (29 patients).The two groups were compared regarding harvesting time , incidence of spam , the number of hemostatic clips used , the incidence of forearm and hand complications , and histopathological examination.**

Results: **RA dissection with the Harmonic Scalpel had a significantly shorter harvesting time (23.86 ± 3.32 versus 54.08±7.44 minutes) and required a significantly smaller number of haemostatic clips (0.58 ± 1.05 versus 34.72±9.42 clip) compared with the conventional technique. There was no forearm wound infection in both groups. There was no histological evidence of thermal injury to the radial artery .There was no graft failure, reoperation for bleeding or hand ischemia with the use of either technique.**

Conclusion: **Harvesting the Radial artery using the Harmonic Scalpel allow rapid and safe harvesting of the radial artery with decreased use of haemostatic clips .**

Kay wards: **Radial artery, Harmonic Scalpel, CABG**

Radial artery was first used as a conduit for coronary artery bypass grafting in 1973 by Carpentier (1). However, because of RA stenosis , which induced a 35% incidence of vessel occlusion, he later abandoned this procedure (2). The vasospasm was thought to be a consequence of the trauma of the harvesting procedure and/or thermal injury resulting from electrocautery (3) (4). Graft occlusion

resulting from subintimal hyperplasia was another cause that militated against the use of RA (5).
Carpentier et al revised radial artery grafts again in 1989, 15 years after, radial artery grafts were found patent in control angiography, subsequently, in 1990 Acar et al recommended radial artery grafting (3) .
Acar (3) ,Calafiore (6) and Possati (7) reported superior long term patency rates for radial artery grafts compared to saphenous vein grafts perhaps because the radial artery is of good size and easier to anastomose sequentially than several of the other conduits .
Improvement of harvesting and preparing radial artery and new pharmacological antispasmodic agents have resulted in enhanced arterial patency and a resurgence in the use of RA grafts for CABG (8) (9) (10).
The ultrasonic Harmonic Scalpel (HS) (Ethicon Endo-Surgery, Inc., Cincinnati, OH) is used as an adjunct to or substitute for electrocautery , lasers, and steel scalpels. The quality of radial arteries for CABG procedures has improved as a result of using the HS rather than blunt and sharp dissection procedures(11). Because this technique obviates the use of electrocautery, the possibility of thermal damage is reduced. Furthermore, while the surgeon is able to identify nerve structures, the use of the HS minimizes trauma to these structures, which could result in vessel spasm. (12)

HARMONIC SCALPEL DEVICE

The Harmonic Scalpel is an ultrasonic instrument for cutting and coagulating tissue that operates at a frequency of 55.5 kHz. It consists of a generator, hand piece, and disposable blade. The 10cm or 14cm disposable blade accomplishes tissue dissection coagulation by delivering heat generated by ultrasonic vibration of tissues. Bleeding is controlled by coaptive coagulation, in which vessels are tamponaded and sealed by protein coagulum. The electrical energy provided by the microprocessor controlled-generator is converted into mechanical energy by the hand piece through a piezoelectric crystal system. This form of mechanical energy produces less heat and less smoke during tissue dissection than does regular electrocautery. (12)
This prospective case series study was designed to compare to HS and the conventional technique (clips and scissors) for the harvesting of radial arteries for CABG procedures.

Material and Methods :

Patient population:

Fifty four patients who were scheduled for elective first time CABG were enrolled in this prospective comparative non randomized study .Patients older than 60 years , required emergency CABG ,patients with positive Modified Allen test ,patients with ejection fraction less than 30% , past history of peripheral vascular disease , creatinine more than 200 mmol/l and marked obesity were excluded from the study .The patients were categorized into two groups , group I in which radial artery was harvested using conventional scissor and clip method and group II in which the radial artery was harvested using Harmonic Scalpel.

Choice of the Radial artery:

Modified Allen test Allen's test was performed in the non dominant arm, the non dominant arm was the left in all the cases and Allen test was negative in all. (The collateral circulation to the hand was assessed by the surgeon) . Both the radial and ulnar arteries were occluded and the patient asked to tightly close his/her hand ("make a fist" for 30 seconds. The patient then relaxed the tight fist, the ulnar artery was released (with the RA still occluded) and the time for complete capillary refilling of the palmar surface of the hand was measured (in seconds), with particular attention to the thumb. Refilling within 10 seconds was acceptable for harvesting).No bilateral radial arteries were used in this series of patients. Radial artery was used in young patients to bypass target coronary vessels when the occlusion is more than 70 % with angiographyically good flow in the distal segment

Harvesting technique:

Initial steps of harvesting:

The supinated arm was extended at 900 from the body prepared, and drapped. In both groups a 4-5 cm straight skin incision was made by a knife 2-3 cm proximal to the wrist to expose the radial artery, when the radial artery is found smooth and has good caliber, the process of harvesting is completed otherwise it is abandoned which happened in one case .The incision extends to 2-3 cm distal to the anticubital fossa to overlie the radial artery. Thereafter the dissection was carried down to the fascia overlying brachioradilais with electrocoagualtion diathermy except in the distal part where the artery is superficial scissor is used .A self retaining retractor was placed to distract the brachioradilais and flexor carpi radialis thereby revealing the entire course of the radial artery with its two satellite veins in the forearm .

Technique of radial artery harvesting:

1- Harvesting with the conventional method: hemoclips and scissor

The patients in the conventional harvest group(25 pa-

tients)underwent mobilization of the RA pedicle using a combination of blunt and sharp dissection with control of vessel branches using metallic clips (Liga Clip Extra .Ethicon –Endo-Surgery .Inc, USA) and division of the branches with scissors between small clips. After the desired length of the RA had been mobilized, it was sharply divided at each end. The radial artery was irrigated very gently with heparinized saline solution and stored in a heparnized saline solution containing papaverine until used at room temperature.

2-Harvesting with the Harmonic scalpel (Ethicon Endo-Surgery, Inc, Cincinnati, Ohio) :(Figure 1)

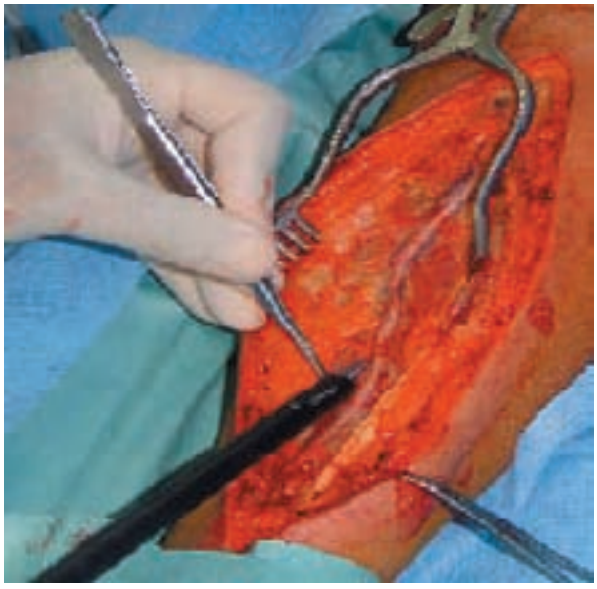

Figure 1 :
Harvesting Radial artery (thin arrow) using the harmonic scalpel (Thick notched arrow)

The mid-pedicle (artery, veins, and areolar tissue) was encircled with a silastic loop and dissection initiated with gentle traction on the loop. The HS with the blade was used to dissect the artery and its branches; clips were used only if a branch bled on its proximal side. A self-retaining retractor was placed between the brachioradialis and flexor carpiradialis muscles. Careful retraction of these muscles reveals the entire course of the radial artery in the forearm. Initial dissection was started from the medial side of the artery. The two satellite veins and the surrounding adipose tissue were left attached to the radial artery to preserve its blood supply as much as possible and prevent spasm. First, the radial artery and the satellite vein side branches along the entire length of the radial artery were dissected. After that, the medial side was freed from adjacent tissue using the dissecting device. Subsequently minimal upward traction was applied to the underside of the radial artery with the dissecting device. Finally, the lateral side was dissected without exposure of any branches. To avoid spasm , The radial artery was irrigated very gently with heparinized saline solution and stored in a heparnized saline solution containing papaverine until used.

Closure of the forearm wound:

Hemostasis was obtained carefully by electrocautery. The antebrachialis fascia was approximated with few interrupted 3/0 absorbable sutures to avoid the compartment syndrome. The subcutaneous layer then closed with interrupted 3/0 absorbable sutures. Skin was closed using skin clips and dressed, an elastic bandages from finger tips to mid arm were applied, the arm was repositioned parallel to the patient's body. The arm and hand again were examined carefully before leaving the operating room.

Preparation of radial artery for grafting:

After the radial artery was procured, a solution prepared by adding 60 mg Papaverine to 100 ml of normal saline at room temperature was introduced at it's proximal end using 22 gauge angiocath with low pressure for filling and bleeding control purposes .Then the radial artery graft was put in the same solution until use. Neither Calcium channel blocking agents nor hydrostatic dilation were used for management of RA spasm. Radial artery was anastomosed with it's volar side facing the myocardium which gives good exposure of the dorsal surface from which most side branches originate thus can be controlled in case of bleeding after anastomosis.

Study parameters:

1)Radial artery harvest time –the time from radial artery skin incision to the final arterectomy.

2)Number of clips used during the procedure – a count of the clips used to control bleeding from time of harvesting until end of the procedure including the need for clipping RA branches during later stages of the operation.

3)The quality of the RA and its pedicle for anastomosis – assessed after harvesting and after anastomosis, prior to closing of the chest. These were visual assessments to determine the adequacy of the arteries for anastomosis and to confirm the absence of spasm and hematoma; and success of the coronary artery bypass graft anastomosis-assessed intra-operatively and confirmed by lack of clinical evidence of myocardial ischemia necessitating angiographic evaluation.

4)Frequency of spasm (the disappearance of visible and palpable pulsation, constriction of the radial artery diameter which is clearly seen with the eye, and the color change from dark red to white).

5)Flow measurement:
A) While RA is in situ but completely mobilized with distal division. Blood was collected for one minute and measured with a syringe
B) Intraoperative after anastomosis using the flow meter with the Veri Q System (CM 4008, Medi Stem AS, Oslo, Norway).
6)Histological examination:
A section from the distal segment of radial artery was sent for histopathological assessment by pathologist blinded to the clinical data .Multiple transverse sections were processed in paraffin wax. Sections were cut at 5 um, and all were stained with Hematoxylin –Eosin stain .Injury, intimal hyperplasia and atherosclerosis were recorded.
7)Neurological status was evaluated clinically by assessing the finger strength and sensation to define abnormalities such as tingling, numbness or pain in either dorsal or palmar surface of the hand.
8)Forearm wound complications such as infection , hematoma , seroma , separation were recorded.
Statistical analysis:
Values are expressed as mean + standard deviation (SD). Comparisons between the two groups were performed using Student's t-test. A P-value of 0.05 or less was considered significant. Analysis was done using SPSS program (SPSS, 7.5 for windows, Minu Tab, USA).

Results :

Patients Characteristics:

Preoperative clinical characteristics of patients who underwent CABG using radial artery , harvested with the conventional versus Harmonic Scalpel Technique are shown in table No.1.

Table 1 Patient Characteristics

Characteristics	Group 1 (Conventional)	Group 2 (HS)	P-value
Number of Patients	(n = 25)	(n = 29)	NS
Age (years)	53.60+9.80	52.86+10.49	NS
Male Patients	21 (84%)	24(83%)	NS
Female Patients	4 (16%)	5 (17%)	NS
Smoking	9 (36%)	10(34.5%)	NS
Hypercholesterolemia	13(52%)	15 (51.2%)	NS
Diabetes Mellitus	11(44%)	13 (44.5%)	NS
Hypertension	10(40%)	11 (41%)	NS

Preoperative characteristics of the patients, no statistically significant difference between the two groups regarding demographic and preoperative risk factors

No significant difference was found between the two groups regarding preoperative clinical characteristics .The median time to harvest the radial artery and the median number of clips used during the procedure are summarized in table (2). The median number of clips required to control bleeding when the procedure was performed with HS was 0.58 ± 1.05 (range of 0-8),

Table 2 Intraoperative Data

Parameter	Group 1 (Conventional)	Group 2 (HS)	P-value
Off Pump	6 (24%)	7(24.2%)	NS
No. of distal anastomosis	3.55±1.02	3.6±1.08	NS
Time of harvesting	54.08±7.48 (45-60)	25.86±3.32 (20-30)	0.002
Number of clips used	34.72± 9.42 (23-50)	0.58 ± 1.05 (0-8)	0.00
Spasm	0	0	NS
In situ flow	90.34±26.25 (60-120)	83.6± 21.96 (70-140)	NS
TTF	41.27±22.39 (21-75)	44.76± 22.19(18-76)	NS

Statistical significant difference was found in between the two groups regarding time foe harvesting and number of clips used , otherwise no statistical difference was found regarding incidence of spasm , flow either in situ flow or transient time flow(TTF) after completion of the grafting .

which was significantly less (P<0.001) than the median of clips used when the procedure was performed with the conventional technique (34.72± 9.42, range of 23-50). Sixty five % of the patients whose radial arteries were harvested by the HS did not require any clips; whereas all 25 patients whom RAs were harvested using the conventional method required at least 23 or more clips. Harvesting time with HS (25.86±3.32 min.) was less than the time needed in the conventional method (54.08±7.48 min) and the difference was statistically significant (P= 0.006). Intraopertaive flow measured either directly or by flowmetry did not show significant difference between the two groups.
Post-operative complications: Table 3

Table 3: Complications relating to harvesting

COMPLICATION	Group 1	Group 2	P value
Infection	0	0	NS
Hematoma	0	0	NS
Numbness	3(12%)	3(10%)	NS
Swelling	0	0	NS

No significant difference was found in between the two groups regarding harvesting site complications NS= P>0.05

There was no evidence of lack of collateral blood flow in the hand, ischemia, or nor infection in the arm after RA harvesting . In addition, no wound morbidity, as indicated by the presence of cellulites, hematoma, separation, or draining , was observed. Sensation abnormalities were observed in 3 patients in each group and the most commonly reported complaints were parasthesia numbness, tingling, and pain on the palmar surface of the hand .No mortality was encountered in these cases .No reexpolration was required for bleeding related to radial artery grafts.

Histopathological evaluation: (Figure 2 A&B)

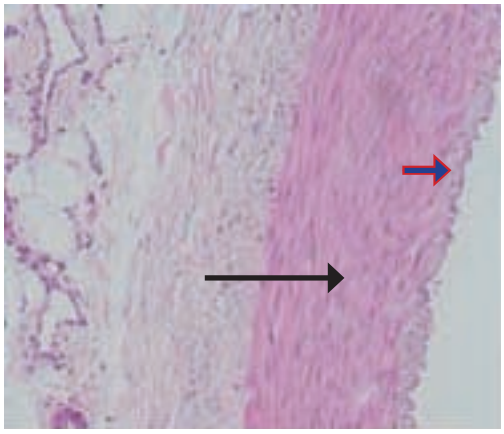

Figure 2 A:radial artery spicemen; harvested conventionally

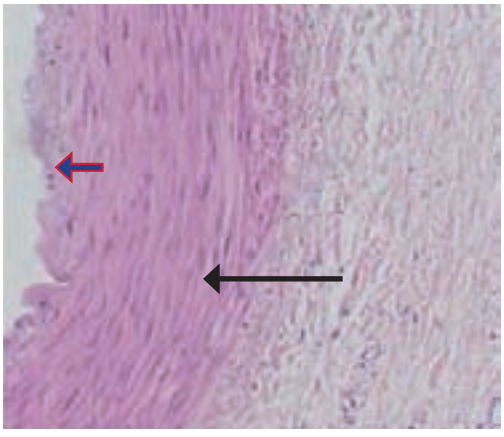

Figure 2 B :radial artery spicemen; harvested using harmonic scalpel

Figure 2:

Histologically; intact intima (thick arrow), and no signs of injury to the artery was detected in both groups. Thin arrow point to the muscle layer of the Radial artery

No signs of thermal or traumatic injury were noticed in the entire radial arteries specimen. Two RAs specimen showed thickened intima and atherosclerotic plaque in group I while these changes were found in three RAs in group II.

Discussion :

A recent review of RA grafting reported an early patency rate between 92.7% and 100% and mid term patency rate between 87.5% and 100% (13). The radial artery has a large luminal diameter and thick muscular wall which facilitates construction of anastomosis (14).So it is recently used more frequently despite of concerns of vasospasm .Usually the main reasons of spasm occurring with harvesting of arterial and venous conduits appear to be related to mechanical and thermal trauma.

Recent reports have suggested that the use of the harmonic scalpel during radial artery harvesting may be less traumatic compared with conventional techniques . Although ultrasonic dissection is associated with transformation of mechanical to thermal energy and protein denaturation ,there is less heat generated than with electrocautery thereby decreasing spasm of this delicate conduit (15) (16).

In this study as well as other studies (12)(15); harvesting of the radial artery with Harmonic scalpel was compared with the conventional scissor and clip technique .It is found that the use of harmonic scalpel resulted in significantly less metallic clip use and less harvesting time; however this may not reflect clinical significance as the harvesting process occur concurrently with harvesting of other conduits and initial stages of surgery.

Numbness and parathseisa are most common complication post RA harvesting but usually these complications are mild and transient (17).In this study the incidence of numbness and pain post harvesting were 11 % , there was no difference in the incidence of these complications in respect to harvesting technique .

Meharwal and Trehan (17) reported a 28% incidence of hand numbness or parathesia in 3,977 patients immediately after radial artery harvesting. Deton and associates (18) similarly reported a 30% incidence of hand complaints in 615 patients immediately postoperatively with most patients reported resolution by 9 months. Budillon and colleagues (19) reported sensory complaints in 9% at the time of hospital discharge, which decrease to only 4% at 8 weeks. This is also in agreement with Hata et al (20) in their study which included 90 patients who randomized into 3 groups , group 1 radial artery was harvested using electrocautery, group two , RA was harvested using ultrasonic scalpel and group 3 in which RA artery was harvested using sharp scissor and hemoclips.They found no differences among the 3 methods with respect to incidence of pain , swelling and discomfort after harvesting as well as late forearm circulation .However they commented that sharp dissection may be better than both diathermy and harmonic scalpel for early forearm circulation and can decrease

the incidence of hand numbness.

In this study , no difference in the radial artery flow was detected in both groups measured either directly or using transient time flowmeter.This is in contrary to Onorati et al (21) who found that the mean flow measured by transient time flowmetry method was more in radial artery grafts harvested using harmonic scalpel compared with electrocautery or sharp dissection (mean flow was :Harmonic scalpel 23.4 +/- 17.3 vs sharp dissection 10.2 +/- 5.7 ml /min, p = 0.001; vs electrocautery 11.6 +/- 8.9 ml/min, p = 0.001).This can be attributed to small number of patients in the current study .

The present study confirms these earlier findings that the HS can be used successfully to harvest radial arteries for CABG procedures.

Conclusion :

From this study one can conclude that the harmonic scalpel is as effective as conventional method for harvesting of the radial artery .Harmonic scalpel method reduces harvesting time and number of clips during harvesting process. Further large studies using additional objective measures are required to confirm these findings

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The Title: Influence of Left Ventricular Systolic Dysfunction on the Outcome of Valve Replacement for Mitral Stenosis

Mohamed Essa , MD
Mostafa Abd El Sattar , MD
Ehab Yehia , MD
Ahmed Abd El Aziz , MD

Background: **Little information has been available regarding influence of left ventricular (LV) systolic dysfunction on the outcome of mitral valve replacement (MVR) for mitral stenosis (MS).**

Methods: **This prospective study included 26 consecutive patients with isolated rheumatic valvular MS and LV systolic dysfunction (low (< 0.50) LV ejection fraction) who underwent isolated MVR (Group I). Another 28 patients with MS and LV ejection fraction ≥0.50 who underwent isolated MVR, matched for time of surgery were selected as control group (Group II). Complete Preoperative, postoperative, in-hospital and follow up evaluations were done for all patients. All data were collected and analyzed.**

Results: **There was one in-hospital death in Group I. The mean duration of follow-up was 17 ± 4 months in both groups. Mean New York Heart Association (NYHA) class improved from 2.5 vs. 2.3 to 1.6 in both groups (P = NS). During follow up, Group I had higher incidence of hospital readmissions for LHF (15.3% vs. 3.6%, P < 0.05) and LHF mortality (7.7% vs. 0%, P< 0.05). There was significant difference in overall LHF mortality between both groups (11.5% vs. 0%, P< 0.01), however, there was no significant difference in overall mortality (11.5% vs. 7.1%, P = NS).**

Conclusion: **Patients with MS and LV systolic dysfunction are at higher risk for LHF after MVR but overall mortality is not different from that with normal LV function. LV systolic dysfunction should not be considered as a relative contraindication to mitral valve surgery for MS.**

Address Departement of cardiothoracic surgery – Zagazig University- Zagazig-Egypt

Mobile: 0121724750

E-mail: messacts2@yahoo.com

LV systolic dysfunction contributes to the pathophysiology of LHF in patients with MS. LV systolic dysfunction has been noted in up to half of patients with MS (1-4). LV systolic dysfunction in the presence of MS has been variously attributed to impaired diastolic filling (i.e. inadequate preload) (5-8), impaired myocardial contractility, possibly resulting from rheumatic myocarditis (9-11), excessive LV afterload (5, 12), distortion, immobility, and rigidity of the postero-basal LV myocardium (1-4), right ventricular enlargement (2), or a combination of these factors. Little information has been available regarding outcome following MVR in patients with MS and LV systolic dysfunction. The purpose of this study was to assess the influence of preoperative LV systolic dysfunction on operative outcome of MVR for patients with MS.

Patients and Methods :

This is a prospective study included 26 consecutive patients with isolated rheumatic valvular MS and LV systolic dysfunction (low (< 0.50) LV ejection fraction) (Group I). Another 28 patients with MS and LV ejection fraction ≥0.50 who underwent isolated MVR, matched for time of surgery were selected as control group (Group II). Patients in group I and II were all admitted, underwent elective isolated MVR and followed up at Cardiothoracic surgery Departments in Zagazig University Hospital and Ain Shams University Hospital from October 2004 to July 2006.

All patients in group I and II had no significant mitral regurgitation (≤+1) or tricuspid regurgitation (≤+2), tricuspid stenosis, LA thrombus, aortic valvular disease, or coronary artery disease.

In all patients a median sternotomy was performed. Standard moderate hypothermic (28-30°C) cardiopulmonary bypass was performed with a membrane oxygenator and by ascending aorta and bicaval cannulation. Aortic cross-clamp and antegrade intermittent cold (4oC) crystalloid cardioplegic solution infusion was done through the aortic root with topical hypothermia. Reinfusion of cardioplegia was done every 20 minutes. Mitral replacement with mechanical bileaflet prosthesis (St. Jude Medical valve) was performed with the standard routine technique in all patients. Chordal preservation was not performed in any patient in this series. Deairing, weaning from cardiopulmonary, decannulation and chest closure were conducted in the usual manner.

Complete Preoperative, operative, postoperative intensive care (ICU), in-hospital and follow up examinations and investigations were done for all patients and all data were collected and analyzed. Preoperative variables included items regarding demographic, clinical history, physical findings, laboratory data, electrocardiography, chest radiograph, echocardiogram, and cardiac catheterization if done. Operative variables recorded included aortic cross-clamp, cardiopulmonary bypass times and requirements for inotropic drugs support during separation from bypass. Postoperative ICU variables recorded included period of mechanical ventilation, requirements for inotropic drugs support, morbidity, mortality and period of stay in ICU. In hospital variables recorded included specific complications, mortality and the period of stay in hospital. Follow-up data of the functional status, echocardiography, morbidity (cardiac and non-cardiac complications of MVR) and mortality were collected.

Complete echocardiography studies were performed 1.6 ± 1.4 months before and 10.3 ± 5.2 months after surgery using Toshiba Instrument either with 3.75 or 5 MHz transducer according to the adequacy of the resolution. The examination included 2-Dimensional, M-mode and Doppler studies (pulsed, continuous, and colored) as per standard protocol. Standard left parasternal, apical, right parasternal, subcostal and suprasternal views were obtained in step by step successive pattern of interrogation. The mitral valve area was calculated. LV ejection fraction was calculated from echocardiograms using end-diastolic and end-systolic diameters with a correction factor for apical contraction (13).

Statistical analysis :

Data are presented as the mean ± SD. The means of normally distributed continuous variables were compared between groups by Student's r-test. Rates and proportions were compared by the Fisher exact test. Survival analysis was performed by the Kaplan-Meier method. P values less than 0.05 considered statistically significant.

Results :

Preoperative demographic, clinical, and echocardiographic data and intraoperative data of all operated patients are shown in Table 1. Age, gender, duration of symptoms, NYHA class, and prevalence of atrial fibrillation were very similar for the two groups. Nearly one third of the patients in both groups had had prior mitral commissurotomy. All patients in both groups had within normal preoperative liver and kidney function tests except one patient in group II had borderline kidney function tests(P = NS).

Group I had higher LV end-diastolic diameter (56.4 ± 13.3 vs. 43.2 ± 12.1 mm, p <0.005). LV ejection fraction was 41.8± 8.1 (range 37%-48%) in Group I and 58.4 ± 7.3 (range 52%-68%) in Group II. Other preoperative echocardiographic data including mitral valve area, tranasvalvular gradient and the mean pulmonary artery pressure were similar for the two groups.

Aortic cross-clamp (64 ±34 vs. 61 ± 22 min) and bypass times (107 ± 37 vs. 98 ± 29 min) were similar in the two groups. Gross pathological examination of the stenotic mitral valve specimen revealed similar prevalence of calcification (76.9% vs. 78.6%), commissural fusion (88.5% vs. 85.7%), and chordal tethering (61.5% vs. 57.1%) in both Groups. Valve size 25 was used in one patient in group I and 2 patients in group II and valve size 29 was used in 5 patients in group I and 3 patients in group II. The remainder of the patients in both groups used valve size 27(P = NS). Twenty patients (76.9%) in Group I and 19 patients (67.9%) in Group II required the use of intravenous inotropic drugs support during weaning from cardiopulmonary bypass (P = NS). There were no operative deaths in both groups (Table 2).

Table 1. Preoperative demographic, clinical, and echocardiographic data.

Variable	Group I (n=26)	Group II (n=28)	P-value
Male/Female	9/17	10/18	NS
Age (ys)	28.8±6.2	27.6±5.3	NS
Prior commissurotomy	9patients (34.6%)	11 patients (39.3%)	NS
Duration of symptoms (y_s)	11.4±1.2	13.2±1.6	NS
NYHA (median±SD)	2.5±0.3	2.3±0.4	NS
Heart rate (beats/min)	88±21	73±16	NS
AF	19patients (73.1%)	20patients (71.4%)	NS
Echo data:			
Mean orifice area (cm^2)	0.8±0.06	0.9±0.05	NS
Mean mitral gradient	16±8	16±7	NS
LA dimension (mm)	57±3	53±2	NS
LVESD (mm)	40.9±9.8	34.6±8.3	NS
LVEDD (mm)	56.4±13.3	43.2±12.1	<0.05
LVEF (median±SD)	41.8±8.1	58.4±7.3	<0.05
MPAP (mmHg)	62±6.9	69±9.1	NS

NYHA, New York Heart Association classification; AF, atrial fibrillation; LA, left atrium; LVEDD, left ventricular end-diastolic diameter; LVESD, left ventricular end-systolic diameter; LVEF, left ventricular ejection fraction; MPAP, mean pulmonary artery pressure ; NS; not significant.

Postoperative ICU, in hospital and follow up data of all operated patients in both groups are shown in Table 3. In the postoperative ICU period, 19 patients (73.1%) in Group I and 18 patients (64.3%) in Group II required the use of intravenous inotropic drugs support (P = NS). Postoperative mechanical ventilation period was 4.3±2.1 hours in Group I vs. 4.1±1.9 hours in Group II (P = NS). One patient from group II (3.6%) needed prolonged ICU stay because he developed postoperative renal failure (RF) (the same patient with preoperative borderline kidney function tests). There was one postoperative ICU death in Group I patients (3.8%). This patient had prolonged postoperative inotopic support and mechanical ventilation and died from low cardiac output syndrome. The length of hospitalization was 14 ± 7 days in Group 1 and 12 ± 5 days in Group II (P = NS). Six patients in group I and two patients in group II had manifestations of LHF and needed medical treatment during hospitalization before discharge. So patients in Group I had a higher incidence of in-hospital postoperative LHF (23.1% vs. 7.1%, P < 0.05).

Table 2. Intraoperative data of mitral valve operated patients.

Variable	Group I (n=26)	Group II (n=28)	P-value
Cross clamp time (min.)	64±34	61±22	NS
Total CPB time (min.)	107±37	98±29	NS
Gross pathological examination of the stenotic mitral valve:			
Calcification	20 patients (76.9%)	22patients (78.6%)	NS
Commissural fusion	23patients (88.4%)	24patients (85.7%)	NS
Chordal tethering	16patients (61.5%)	16patients (57.1%)	NS
Size of valve used:			
Size 25	3.8%	7.1%	NS
Size 27	76.9%	82.1%	NS
Size 29	19.2%	10.7%	NS
Inotropic support during weaning from CPB	76.9%	67.9%	NS

CPB, Cardiopulmonary bypass; NS; not significant.

The mean duration of follow-up was 17 ± 4 months in both groups. Mean NYHA class improved from 2.5±0.3 to 1.6±0.1 in Group I and from 2.3±0.4 to 1.6±0.2 in Group II at follow-up (P = NS). Spontaneous cardioversion of AF occurred in 2 patient in group I and 3 patients in group II during hospitalization and follow up period (P = NS). Follow up echocardiography showed that Group I still had higher LV end-diastolic diameter (55.2±12.7 vs. 42.8±11.6 mm, p <0.005) and lower LV ejection fraction (40.9±7.8 vs. 57.7±6.9, p <0.005). Hospital readmission for cardiac causes was needed for four patients with LHF in Group I and for two patients in Group II, one with endocarditis which needed repeat MVR and another one with LHF (P = NS). During follow up, death occurred in two patients in Group I from LHF; and in two patients in Group II, one from endocarditis which needed repeat MVR and another one from RF (the same one who developed postoperative RF). So Group I patients had higher incidence of hospital readmissions for LHF (15.3% vs. 3.6%, P < 0.05) and

LHF mortality (7.7% vs. 0%, P< 0.05) during follow up. There was significant difference in overall LHF mortality between both groups (11.5% vs. 0%, P< 0.01), however, there was no significant difference in overall mortality (11.5% vs. 7.1%, P = NS).
*Table (3):

Table 3. Postoperative ICU, in hospital and follow up data of mitral valve operated patients.

Variable	Group I (n=26)	Group II (n=28)	P-value
1] ICU			
Inotropic support	73.1%	64.3%	NS
Ventilation period	4.3±2.1	4.1±1.9	NS
Morbidity	0%	3.6%	NS
Mortality	3.8%	0%	NS
2] In- hospital			
Length of hospitalization	14 ± 7	12 ± 5	NS
LHF	23.1%	7.1%	<0.05
3] Follow up			
NYHA class	1.6±0.1	1.6±0.2	NS
Spontaneous cardioversion of AF	10.5%	15%	NS
Echo data:			
LA dimension (mm)	4.3±4	4.1±3	NS
LVESD (mm)	40.1±8.3	34.1±7.9	NS
LVEDD (mm)	55.2±12.7	42.8±11.6	<0.05
LVEF (median±SD)	40.9±7.8	57.7±6.9	<0.05
MPAP (mmHg)	38±5.7	39±7.3	NS
Hospital readmissions for LHF	15.3%	3.6%	<0.05
Mortality from LHF	7.7%	0%	<0.05
4]Overall LHF mortality	11.5%	0%	<0.01
5]Overall mortality	11.5%	7.1%	NS

ICU ,intensive care unit; LHF, left sided heart failure; NYHA, New York Heart Association classification; AF, atrial fibrillation ; LA, left atrium; LVEDD, left ventricular end-diastolic diameter; LVESD, left ventricular end-systolic diameter; LVEF, left ventricular ejection fraction; MPAP, mean pulmonary artery pressure, NS; not significant.

Discussion :

LHF in patients with MS, results predominantly from resistance to LV filling associated with a diastolic gradient across the mitral valve. In a sizable subset of patients with MS, however, LV systolic dysfunction contributes to the pathophysiology of LHF (1-4). LV systolic dysfunction in patients with MS was definitively demonstrated in 1970 by Heller and Carleton (1). LV systolic dysfunction in patients with MS has been observed in a number of other studies (2-12). Most recently, Snyder et al. (14) reported LV ejection fraction <0.50 in 21 of 72 patients undergoing cardiac catheterization for MS, while Choi et al. (8) found LV ejection fraction <0.45 in 18 of 36 patients by a radionuclide technique.

LV systolic dysfunction has traditionally been attributed to depressed myocardial contractility resulting from a 'myocardial factor' associated with rheumatic myocarditis. Hemodynamic studies have not, however, demonstrated impairment of myocardial contractility in patients with MS (5, 12). Gash et al (5) have reported that patients with MS usually exhibit reduced ejection phase indices of LV performance because of reduced preload. Also, Gash et al (5) postulated that patients with MS have an increased afterload because of reduced wall thickness, and that this relative increase in afterload is not adequately balanced by the Frank-Starling mechanism because of reduced LV diastolic filling.

An alternative explanation for LV systolic dysfunction has been abnormal function of the myocardium in the region of the mitral valve. The posterior wall or inflow tract of the LV is markedly shortened in many patients with MS (15, 16). In a study done by Grant (17), he concluded that the shortening was due to atrophy of the myocardium adjacent to the posterior rim of the mitral annulus and he hypothesized that thickening of the mitral valve leaflets and fibrosis of the chordae tendineae convert the valve apparatus into a rigid cylinder of dense scar tissue, immobilizing the posterior wall of LV and causing muscular atrophy. In another study by Heller and Carleton (1), 20 of 25 patients with MS had abnormal regional LV contraction, with distortion and rigidity of the postero-basal myocardium. Postero-basal wall motion abnormalities were also observed by other investigators (3). Sunamori et al. (9) found fibrosis in the myocardium at the base of papillary muscles removed at the time of MVR. Right ventricular enlargement has also been blamed for regional abnormalities of LV contraction in patients with MS.

Little information has been available regarding influence of LV systolic dysfunction on the outcome of MVR for MS. Sunamori et al. (9) reported that LV ejection fraction was unchanged after MVR in patients with marked myocardial fibrosis, but improved in those with lesser degrees of fibrosis. Snyder et al. (14) found that preoperative LV ejection fraction did not influence perioperative mortality and short-term symptomatic response in patients undergoing surgical commissurotomy or MVR for MS. Mangoni et al. [18] described a consecutive series of 16 patients with MS and moderately reduced

LV ejection fraction undergoing MVR, and compare their short- and long-term outcome to that of 64 subjects with normal LV ejection fraction. The analysis shows that, while patients with MS and moderately reduced LV ejection fraction are at higher short- and long-term risk for LHF, short- and long-term mortality is similar to that of patients with normal preoperative LV ejection fraction.

In our study, there was no operative death in both groups. Group I patients had a higher incidence of in-hospital postoperative LHF (23.1% vs. 7.1%, P < 0.05). Mean follow-up was 17 months in both groups. Mean NYHA class improved from 2.5 vs. 2.3 to 1.6 in both groups (P = NS). During follow up, Group I patients had a higher incidence of hospital readmissions for LHF (15.3% vs. 3.6%, P < 0.05) and LHF mortality (7.7% vs. 0%, P< 0.05). There was significant difference in overall LHF mortality between both groups (11.5% vs. 0%, P< 0.01), however, there was no significant difference in overall mortality (11.5% vs. 7.1%, P = NS).

The data in our study do not demonstrate a deleterious effect of preoperative LV systolic dysfunction in patients with MS on mortality after MVR. This finding is in contrast to the adverse effect of low preoperative ejection fraction on postoperative mortality in patients undergoing surgery for mitral or aortic regurgitation (19, 20).

According to our results, we concluded that, patients with MS and LV systolic dysfunction are at higher risk for LHF after MVR but overall mortality is not different from that of patients with MS and normal LV function. LV systolic dysfunction should not be considered as a relative contraindication to mitral valve surgery for MS.

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Early Results of Extracardiac Fontan Procedure for Single Ventricle

Tarek S. AbdAllah, MD
Waleed G. Abo-Senna, MD
Mohamed Helmy, MD
Hesham Shawky, MD

Background: **The idea of Fontan procedure in single ventricle pathology was based on the concept that an elevated systemic venous pressure is an adequate driving force for pulmonary blood flow, and that a pumping right ventricle is unnecessary.**

Methods: **Eleven extracardiac Fontan procedures were done in the period between Jan 2005 to Dec 2005. There were 5 males and 6 females with a mean age of 4.7 years (3-7.5 years) and a mean weight of 14.7 Kg (11-17 Kg). All patients had bidirectional Glenn shunts prior to the extracardiac Fontan procedure and underwent preoperative echocardiography and cardiac catheterization.**

Results: **All patients had extracardiac Fontan procedure through median sternotomy. The mean CPB time was 89 min (80-100 min). Fenestration using gortex graft size 4 was used in 4 patients out of 11. The average conduit pressure after weaning from CPB was 15.4 (12-18 mmHg). The mean oxygen saturation was 89% (85-92%). Patients' rhythms were recorded after weaning from CPB and after sternal closure. There was one mortality due to direct injury of the RV during sternal opening. All patients were extubated within 24 hours from the operation. The mean chest tube drainage duration was 10 days (4-20 days). One patient had prolonged pleural effusion (more than 14 days) in the form of chylothorax which was managed conservatively. The mean hospital stay was 18.2 days (12-25 days). One patient developed superficial wound infection which was managed conservatively by antibiotics and frequent dressing.**

Conclusion: **The technique of extracardiac Fontan procedure decreases the cardiopulmonary bypass time and the incidence of atrial arrhythmias. The marked improvement of survival associated with this approach has been attributed to the hemodynamic benefits of lateral tunnel, which provides the least obstruction to systemic venous drainage, and maximal energy transfer to the pulmonary circulation.**

In normal hearts the systemic and pulmonary circulations are arranged in series, while in single ventricle hearts, the pulmonary and systemic circulations are arranged in parallel. The idea of Fontan procedure in single ventricle pathology is to separate the pulmonary, and the systemic circulations, which will improve the arterial oxygen saturation, and decrease volume overload on the ventricle. This was based on the concept

that an elevated systemic venous pressure is an adequate driving force for pulmonary blood flow, and that a pumping right ventricle is unnecessary. The first total right heart bypass was done in 1971 with the first successful Fontan procedure by Fontan and Baudet (l). The most widely used of the modifications of this procedure is the total cavopulmonary connection which maintains laminar flow (2). De Leual, and his colleagues in 1988 described an intracardiac or "lateral tunnel" technique which provided laminar, and efficient flow, minimizing energy loss within the venous pathway, Thus in theory it decreases the risk of thrombus development within the fontan circuit. However, this technique required the use of cardioplegic or fibrillary arrest, intracardiac manipulations, and atrial incisions, which may induce arrhythmias, hemodynamic instability, and thromboembolic complications(3).

The aim of this work is to evaluate the early results of extracardiac Fontan procedure using polytetrafluoroethylene (PTFE) graft.

Methodology:

Eleven extracardiac Fontan procedures were done in the period between Jan 2005 to Dec 2005. There were 5 males and 6 females with a mean age of 4.7 years (3-7.5 years) and a mean weight of 14.7 Kg (11-17 Kg). Primary diagnoses are shown in table (1).

Table (1): Primary diagnosis

Primary diagnosis	Number of patients
Tricuspid atresia	4
Double inlet left ventricle	1
Pulmonary atresia-intact septum	3
Pulmonary atresia with VSD	3

All patients had bidirectional Glenn shunts prior to the extracardiac Fontan procedure and underwent preoperative echocardiography and cardiac catheterization.

Preparation of the PA confluence.

There were some special steps done in the primary operation (BDG) In order to prepare the PA confluence for the following Fontan procedure in patients planned for completion Fontan procedure.

First the pericardium was opened only over the SVC and the Rt PA .this step was very important in order to avoid adhesions between the RV & the sternum which will decrease the incidence of RV injury during sternal re opening in the fontan procedure.

Second the BDG procedure was done without using CPB in order to avoid cannulation of the IVC which will decrease the incidence of adhesions around the IVC.

Third after anastomosis was done between the SVC & the Rt PA, The forward flow to the pulmonary arteries was interrupted on the expense of the oxygen saturation, to avoid elevation of the pulmonary pressure & the pulmonary vascular resistance which may affect the future fontan procedure.

Interruption of the forward pulmonary flow must be done in a way so as not to distort the PA anatomy so as to facilitate the future planned fontan procedure.

The oxygen saturation and the pressure in the PA were measured using arterial extension line. PA pressure less than 20 mmhg will be accepted. Temporary clamping of the PA was done using side occlusion vascular clamp and the PA pressure was then measured again and its decrease was weighed against drop in the oxygen saturation (85% will be accepted).

If the decision was taken to clamp the PA, vascular clamp was put on the junction of the PA with the Rt ventricle and 5/0 prolene suture was used to secure the RV above the clamp. The PA was then completely excised above the clamp after putting side occlusion clamp on the PA confluence but not obstructing the SVC to Rt PA anastomosis, which is now the only source of blood flow to the lung. The proximal end of the PA which was incised from the ventricle was closed using circular pericardial patch to avoid distorting the PA which will be used in the future for distal anastomosis of the extra cardiac fontan .

Operative technique

Operation was performed through median sternotomy incision using CPB using standard aortic cannula, and two metal tips right angled cannulae for SVC and IVC cannulation. Special attention must be paid for lower cannulation as much as can in the IVC to allow for better and easy anastomosis of the conduit to the IVC later on. Snares were used around the SVC and IVC cannulae for better drainage of the heart. Mild hypothermia (32-34°c) was used. Dissection of the IVC was the key for this operation. Every effort must be paid to completely free the IVC from the surrounding pericardial reflection allowing for sufficient length of the IVC.

The RA-IVC junction was clamped and the IVC was incised completely from the Rt atrium and the cavoatrial junction was sutured using 5-0 polypropylene suture followed by removal of the clamp. Direct end to end

anastomosis was done between a PTFE conduit size 20 mm and the IVC free edge using gortex 6-0 suture starting from the inferior wall and passing forward anti-clockwise.

Next the superior anastomosis between the conduit and the pulmonary artery was done. But before this, an important step should be done which is complete dissection of the back of the aorta from the right pulmonary artery. This important step allows extra mobilization of the pulmonary artery confluence which led to better and easier anastomosis of the conduit with the pulmonary artery. The inferior

aspect of the Rt pulmonary artery should be opened but not immediately opposite to the anastomosis of the SVC to the pulmonary artery, it should be opened medially to it to avoid turbulence of blood in case the two anastomoses were opposite to each other, that's why complete separation of the back of the aorta from the right pulmonary artery was a mandatory step to facilitate the application of the side occlusion clamp over the right pulmonary artery to do the anastomosis. The pulmonary artery was opened in an inverted V fashion to allow for wider anastomosis between the PTFE conduit and the right pulmonary artery.

Both superior and inferior anastomoses were sized using Hegar dilators to assure a diameter equal to or slightly greater than the IVC (median size, 14 mm; range 12-18 mm).

After weaning from CPB, the operation was assessed by directly measuring pressures in the IVC, the conduit, the right pulmonary artery and the atrium. Fenestration was selectively performed if conduit pressures were elevated (≥ 17 mmHg) or if hemodynamics were suboptimal after weaning from CPB. In these cases the CPB was resumed and fenestration was done using a 4- mm coronary punch in the PTFE conduit, then a 4 mm gortex graft was anastomosed to the conduit end to side using prolene 7-0. Another opening was made also in the right atrial wall opposite to the 4 mm gortex tube using the punch, and then the gortex tube was anastomosed to the atrium in a way to avoid kinking during a brief period of fibrillation.

All patients were weaned form CPB on low dose of dopamine (3-5 mcg/kg/min) and milrinone (0.25-0.5 mcg/kg/min).

Postoperative Care:

Post operative goals were early extubation, early detection of arrhythmias and follow up of chest tube drainage.

All patients were given oral Captopril on day one postoperatively (0.5-1 mg/kg, every 8 hours) before discontinuing inotropic support. Postoperatively digioxin, diuretics and ACE inhibitors were discontinued from the third month. All patients received warfarin for 6 month for anticoagulation to maintain an INR between 2.5 and 3.0. In addition they were given aspirin (5mg/kg/day).

Assessment of Operative Outcome:

Outcome variables were Fontan failure and postoperative pleural effusion. Fontan failure was defined as those who needed Fontan takedown or death occurred within 30 days of operation. Postoperative pleural effusion was defined as effusion of more than 14 days duration or recurrent pleural effusion after removal of chest tubes.

Results:

Intraoperative Results:

All patients had extracardiac Fontan procedure through median sternotomy after previous BDG shunt. The mean CPB time was 89 min (80-100 mm). Fenestration using gortex graft size 4 was used in 4 patients out of 11. This was based on suboptimal hemodynamics after weaning from CPB. PTFE conduit size 20mm was used on all patients. This was based on the average size of the adult IVC size, to avoid the problem of fixed size of the graft in relation to the expected growth of the child. The average conduit pressure after weaning from CPB was 15.4 (12-18 mmHg). The mean oxygen saturation was 89% (85-92%). Patients' rhythms were recorded after weaning from CPB and after sternal closure (Table 2). Two patients were in transient junctional rhythm and were put on demand temporary pacemaker. One patient developed complete HB and required pacing intraoperative which remained for 3 days in the ICU then the patient regained sinus rhythm.

Table (2): Patient's rhythm postoperative.

Patients rhythm	Number of patients
Sinus rhythm	8
Transient junctional rhythm	2
Complete HB	1

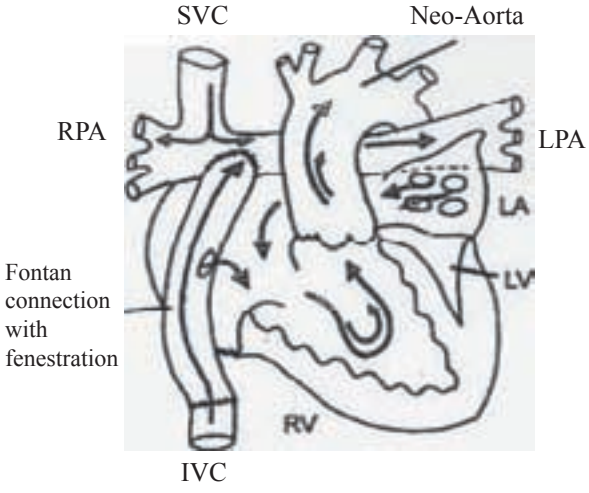
Postoperative Results:

There was one mortality due to direct injury of the anterior surface of RV during sternal opening. Rapid preparation of cardiopulmonary bypass was done, and the injured area was secured. The procedure was completed, and the patient went out to the ICU on small dose of

inotropic support. The problem in the ICU was delayed recovery and prolonged ventilation. Death occurred on the 11th postoperative day.

All patients were extubated within 24 hours from the operation. The mean chest tube drainage duration was 10 days (4-20 days). One patient only had prolonged pleural effusion (more than 14 days) in the form of chylothorax which was managed conservatively. This patient had conduit pressure intraoperatively 17 mmHg and had fenestration done. Another patient was reopened 12 hours postoperatively for bleeding with no cause related to the suture lines. The mean hospital stay was 18.2 days (12-25 days). One patient only developed superficial wound infection which was managed conservatory by antibiotics and frequent dressing.

Operative Technique: (Fig. 1):



Limitations of the Study:

Because of the transient nature of some arrhythmias their incidence may be underestimated. Supraventricular arrhythmias after extra cardiac Fontan procedure are probably multifactorial and mandate continuous surveillance. The incidence of thromboembolism complications is probably underestimated because only clinically suspected cases were investigated.

Discussion:

Humes and his colleagues (3) described the technique of prosthetic extracardiac conduit trying to decrease the incidence of atrial arrhythmias, and the cardiopulmonary bypass time. The marked improvement of survival associated with this approach has been attributed to the hemodynamic benefits of lateral tunnel, which produces the least obstruction to systemic venous drainage, and maximal energy transfer to the pulmonary circulation.

Ventricular performance and maintenance of normal sinus rhythm are the critical determinants of the overall optimal circulation after total right heart bypass (4).

The extracardiac total cavopulmonary anastomosis provides many advantages(4):

(1) It avoids using aortic cross clamping which helps to preserve ventricular function.

(2) It helps to separate the high pressure conduit from the thin atrial wall.

(3) No atrial incision or intra-atrial sutures which reduce the incidence of arrhythmia. In this study there was no significant arrhythmia (i.e. affecting the hemodynamics).

Laschinger and his colleagues proved that this technique helps in preservation of sinus rhythm without arrhythmia for two years at follow Up (4).

Staged surgical correction of the functionally univentricular heart with addition of an intermediate Bidirectional Glenn exposes the sinoatrial node area to dissection twice which increases the incidence of supraventricular arrhythmias (5).

Abnormalities of the conduction system are known to exist in patients with heterotaxy syndrome which may provoke tachyarrhythmia or bradyarrhythmia irrespective to the type of fontan procedure (5).

(4) The coronary sinus now drains to the low pressure atrium, as the coronary sinus will be now the only draining system in the Rt atrium.

(5) Allowance for early or late fenestrations which significantly reduces chest tube drainage, as mentioned by Lemler and his colleagues (6). However, in the present study the patient who had prolonged chest tube drainage (more than 14 days) had fenestrations in his conduit.

Shirai and his colleagues advised to do fenestrations for any combination of the following factors: elevated pulmonary artery pressure or abnormal pulmonary artery anatomy, systemic right ventricle or significant atrioventricular valve regurgitation(7). (6) Prevention of baffle leaks, and intra-atrial obstruction.

As regards the function of the systemic ventricle in these patients, it is essential to have an intact systolic and diastolic ventricular performance for the successful establishment of such circulation. Chowdhurry, and his colleagues (8), demonstrated that there is transient significant depression of ejection fraction in all patients in the immediate postoperative period. This could be related to a decrease in left ventricular end-diastolic volume from preoperative to postoperative measurements, mostly because of elimination of systemic-pulmonary shunts or pulmonary artery band, and improvement in myocardial oxygen supply. The varying ventricular morphologies in

the Fontan circulation make calculation of ejection fraction by conventional echocardiogram unreliable.

However, there are multiple concerns regarding this procedure (8):

(1) The prosthetic tube lacks growth potential. An adult sized conduit (20-22 mm) may avoid reoperations, and may accommodate flow rates necessary for exercise. This limits the operation to patients of a minimum age, weight, and size. We selected patients older than 4 years of age, and weighing more than 15 Kg to avoid reoperation, and achieve adequate exercise tolerance.

(2) Prosthetic conduits in the venous circulation carry the risk of thrombosis, and obstruction however the preliminary data are encouraging.

Recently, Rosenthal, and his colleagues showed a high incidence of thrombus formation in patients undergoing the Fontan operation irrespective of the modification used (9).

Minoo and his colleagues proved that Coumadin is the most effective prophylactic therapy in preventing thromboembolism (10).

Thrombosis of Fontan pathway is often silent, and may remain undetected until there is significant elevation of venous pressures. Radionuclide studies may be useful for early detection of this complication.

Prolonged cardiopulmonary bypass time used to be claimed as a risk for complications in patients undergoing the Fontan procedure. The use of the off-pump Fontan procedure was introduced in 1996. Not unexpectedly, a temporary bypass was placed at that time from the inferior vena cava to the atrium during isolation of the IVC orifice as well as anastomosing it to the extracardiac conduit.

To place a temporary bypass efficiently, extensive dissection is carried out around the inferior venoatrial connection. Even with such a well-arranged maneuver, a tube placed for temporary diversion of blood may interfere with making a smooth anastomosis in a limited operative field. Shuichi et al (11),introduced an alternative method of simple cross-clamping the IVC to achieve the anastomosis with no technical difficulty at all. Its efficacy is more obvious when the Fontan procedure is established in smaller children.

To simply cross-clamp the inferior vena cava, some native bypasses are indispensable for diversion of the inferior vena caval drainage. Several venovenous collaterals are known to be present between the regions of the superior and inferior venae cavae, such as those through the veins within the thoracic wall and those through the venous network around the vertebrae . The azygous and hemiazygous

venous system is unequivocally one of these collaterals, if these veins are patent at the time of cross-clamping of the inferior vena cava. A certain preparation may be needed ,such as preservation of the Azygos vein at the time of BDG operation.

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Caudal Analgesia as a Supplement to General Anesthesia for Pediatric Patients undergoing Cardiac Surgical procedures

Ghada Ali, MD
Hany A. Maboud, MD

Background: **Recent history provides prospective on the need for the development of regional techniques in pediatric cardiothoracic surgery. Theoretical advantages include the attenuation of the neuroendocrine response to surgical stress, facilitation of rapid extubation with subsequent improved ventilatory mechanics, and the possibility of decreased intensive care unit and hospital length of stay. The debate about regional adjuvants in pediatric cardiothoracic surgery is stimulated by the perceived risks of these techniques in patients who will be anticoagulated.**

Aim of the work: **The purpose of this study was to evaluate the use of mixture of bupivacaine and morphine to supplement general anesthesia in pediatric patients undergoing congenital heart disease repair requiring cardiopulmonary bypass (CPB).**

Methods: **Prospective study of (50) patients undergoing corrective repair of atrial septal defect (ASD) [26 patients] and ventricular septal defect (VSD) [24 patients]. Patients were monitored and anesthetia was induced with fentanyl, thiopental sodium and pancuronium. Patients were randomly allocated to two equal groups. In group I (25 patients), patients received bupivacaine 0.25% 4 mg/kg (1.6ml/kg) and preservative-free morphine 100 µg/kg by the caudal route. After a 20 minutes period for the block to take effect, isoflourane, fentanyl and pancuronium were administered for maintenance of anesthesia. In group II (25 patients), the anesthetic technique was the same as in group I, without a caudal block.**

Results: **Cardiovascular and hemodynamic responses of patients receiving caudal block showed minor variations during the 20 minutes following the caudal block. Peri-operative fentanyl requirements were lower in patients with caudal block than patients in the other group. VAS at rest and after cough was significantly lower in the caudal group 2, 6, and 12 hours after extubation. Extubation time and PICU stay were shorter in the caudal group. There was no statistical difference in hospital length of stay between both groups.**

Conclusion: **This prospective study demonstrated that, post-induction placement of caudal block with bupivacaine 0.25% 4 mg/kg (1.6ml/kg) and morphine 100 µg/kg was safe and effective for pediatric patients undergoing cardiac surgery. It reduced fentanyl requirement and facilitated tracheal extubation in shorter time.**

An ideal anesthetic for cardiac surgery should provide intra-operative cardiovascular stability and a stable and pain-free recovery. High-dose narcotics, whether given as an initial bolus or by the continuous infusion method, certainly have brought current practice closer to this ideal 1. Regional anesthesia is effective and safe if used in pediatric surgery, and morbidity if the central block is performed by properly trained anesthesiologists is low 2, 3. Central neuroaxial analgesia is an alternative to high-dose narcotics, but its use has long been an issue of debate and concern in cardiac surgery 4. The debate about regional adjuvants in pediatric cardiothoracic surgery is stimulated by the perceived risks of these techniques in patients who will be anticoagulated5.

Early studies reported that bupivacaine 0.25% administered at doses of 3-5 mg/kg is considered safe 6,7 but the presence of cardiac and neurotoxicity 8-11 even at doses of 3.1 mg/kg has prompted a careful use of high doses of bupivacaine 12. However recent study documented successful experience with caudal block with a single shot of bupivacaine 0.25% 4 mg/kg (1.6 ml/kg) in children undergoing surgical correction of congenital pyloric stenosis 13. Another study performed at Stanford University demonstrated the safe and effective use of regional anesthesia in the management of pediatric patients undergoing cardiac surgery 14. Epidural administration of morphine can provide effective and prolonged analgesia in children. However, it may be associated with prolonged respiratory depression and urinary retention 15.

This prospective randomized study was conducted to evaluate the use of mixture of bupivacaine and morphine to supplement general anesthesia during pediatric cardiac surgery.

Patients and methods :

After approval of the study design by the Hospital Ethics Committee, this prospective randomized study was conducted on 50 children of both sexes with age range of 7-11 years, scheduled for elective corrective ASD (26) and VSD (24) with cardiopulmonary bypass.

Patients with clinically identified sacral anatomical abnormalities, abnormal coagulation tests, hemodynamic instability or if already intubated, were not included. Patients with post-operative complications (e.g. pneumonia, sepsis, diaphragm paralysis, pulmonary hypertension requiring nitric oxide treatment and patients who left the operating room with an open chest) were excluded.

On the night prior to surgery, the patients were visited where a thorough medical examination was performed and all the preoperative investigations were checked.

Thirty minutes before the anesthetic induction, patients received pre-medication with oral midazolam 0.5 mg/kg. On arrival to the operating room, patients were monitored with electrocardiogram, and pulse oximetry. An 18 gauge cannula was inserted into a peripheral vein and Ringers' infusion was started. After 3 minutes of preoxygenation, induction of anesthesia was accomplished with fentanyl 5 μg/kg, a sleep dose of thiopental sodium and pancuronium bromide 100 μg/kg (I.V.). Patients were ventilated with 100% O2 and approximately 3 minutes later, intubation was performed. Controlled ventilation was adjusted to maintain end tidal Co2 at 35-40 mmHg. Capnography, radial arterial blood pressure and central venous pressure were connected. Baseline values were recorded and baseline activated clotting time (ACT) was measured. Caudal block was performed in group I with bupivacaine 0.25% 4 mg/kg (1.6 ml/kg) and preservative-free morphine 100 μg/kg according to a standard procedure: patients were placed in a lateral decubitus position and with aseptic conditions, a 25 gauge, short level needle was inserted through the sacrococcygeal membrane until loss of resistance occurred. Repetitive gentle aspiration was performed to confirm absence of either vascular cannulation or cerebrospinal fluid. The total volume was administered over a period of 60-90 seconds. After a 20 minutes period for the block to take effect, general anesthesia was maintained by 1 Mac isoflurane in O2/air mixture. Pancuronium and fentanyl were given as needed to maintain intra-operative muscle relaxation and analgesia respectively. In group II, the anesthetic technique was the same as in group I, without a caudal block. Activated clotting time (ACT) was used to monitor anticoagulation during CPB. Heparin (3-4 mg/kg) IV was injected 3-5 minutes before cannulation and every 30 minutes during CPB to ensure an ACT $\geq$ 400 seconds. During the CPB, anesthesia was maintained with boluses of thiopental sodium, pancuronium and fentanyl directly administered to the CPB pump as needed in both groups. Protamine sulfate 3-4.5 mg/kg was given to antagonize heparin to bring ACT down to control levels. After the end of surgery, patients were transferred to the PICU and they were extubated after fulfilling the criteria of extubation. In PICU, analgesia was provided as needed by boluses of fentanyl. The following data were collected:

I-Data collected in the operating room (OR) included:

Heart rate, blood pressures, oxygen saturation, central venous pressure and intra-operative fentanyl requirements (μg/kg).

II-PICU data included:

* Total fentanyl consumption (µg/kg).
* Extubation time (time from arrival to PICU till extubation) (hours).
* Visual analogue scale (VAS) (cm) 2, 6, 12, 18, and 24 hours after extubation.
* Side effects complications: such as respiratory depression, pruritis, sweating, nausea, vomiting, and urine retention were recorded for each group.
* PICU stay (hours).
* Hospital stay (days).

VAS consists of a vertical straight line. The line is typically 10 cm long. It is drawn with a red and white terminal ends (the white for no pain and the red edge for severe pain). Children were asked to indicate on the line how much pain they had.

Statistical analysis :

Numerical data were presented as mean ± standard deviation (SD) and were compared using the independent-samples student-t test. Non-numerical data were compared using Chi-square test. A p value < 0.05 was considered statistically significant and a p value < 0.01 or < 0.001 was considered statistically highly significant.

Results :

Patients' ages, sexes and weight were not statistically different between the two groups (table I).

Table I: Demographic data and duration of major surgical procedures

	Group I (25 patients) Mean ± SD (ranges)	Group II (25 patients) Mean ± SD (ranges)	P value
Age (years)	9.4 ± 2.2	9.16 ± 1.8	> 0.05
Sex (M/F)	14/11	13/12	> 0.05
Weight (kg)	20.92 ± 3.4	25.24 ± 2.6	> 0.05
Surgical procedures (ASD/VSD)	12/13	14/11	> 0.05
Duration of aortic clamping (min)	25.4 ± 10.8	29.9 ± 8.6	> 0.05
Duration of CPB (min)	45.7 ± 12.4	47.6 ± 9.8	> 0.05
Duration of surgery (min)	125 ± 18.9	138 ± 20.6	> 0.05

Distribution of surgical procedures, the CPB, aortic clamp and surgical times were similar (p > 0.05) between the two groups (table I).

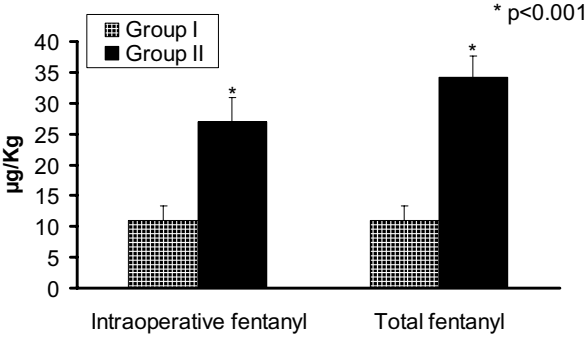
Heart rate, Spo2, systolic blood pressure and diastolic blood pressure of patients who received caudal block showed no statistically significant variations over the 20 minutes period after caudal block. Fentanyl requirements during surgery were lower (p <0.001) in patients with caudal block than patients in group II (table II) (figure 1). Total fentanyl consumption (intra-operatively and PICU) was significantly lower (p < 0.001) in the caudal group than the other group (table II) (figure 1). Post-operatively extubation time was significantly shorter (p <0.001) in the caudal group than the other group (table II) (figure 2).

There was no difference in fluid management and in percentage of patients whom received blood transfusions between group I and group II.

Table II: Outcomes of the study

	Group I Mean ± SD (ranges)	Group II Mean ± SD (ranges)	P value
Fentanyl requirements intra-operative (µg/kg)	11 ± 2.36	27 ± 3.84	< 0.001
Total fentanyl requirement (µg/kg)	11 ± 2.36	34.2 ± 3.43	< 0.001
Extubation time (hours)	1.68 ± 0.39	6.5 ± 2.4	< 0.001

Fig 1. Fentanyl Requirements



There was no difference in the percentage of patients whom received inotropic support between the two groups.

The mean visual analogue score (VAS) values at rest and after cough were significantly lower in group I (caudal group) than group II that 2, 6, and 12 hours after extubation (table III) (figures 3 & 4). The mean VAS did not show significant difference between the 2 groups during rest and after cough at 18 and 24 hours after extubation

(table III) (figures 3 & 4).

Fig 2. Extubation and PICU Stay Times

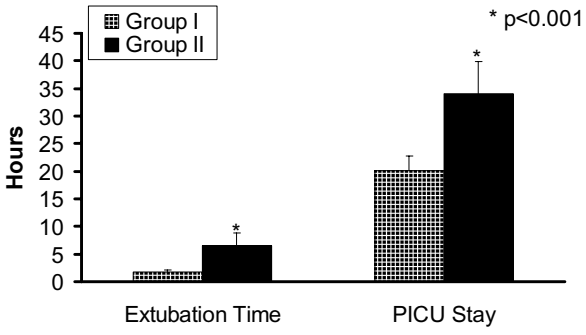


Fig. 3: VAS at Rest

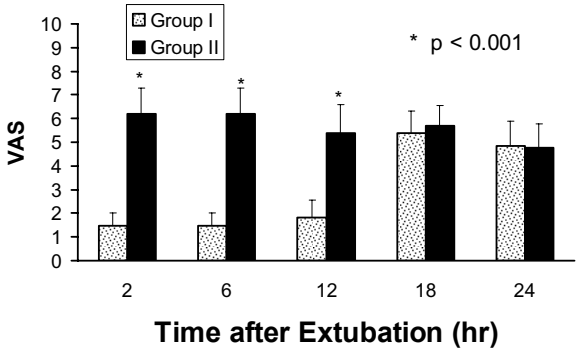


Table III: Visual analogue score (VAS) (cm)

Time after full recovery		Group I Mean ± SD (ranges)	Group II Mean ± SD (ranges)	P value
2 hours	Rest	1.49 ± 0.52	6.2 ± 1.07	< 0.001
	Cough	1.94 ± 0.58	7.8 ± 1	< 0.001
6 hours	Rest	1.49 ± 0.52	6.2 ± 1.07	< 0.001
	Cough	1.94 ± 0.58	7.8 ± 1	< 0.001
12 hours	Rest	1.81 ± 0.75	5.38 ± 1.2	< 0.001
	Cough	2.22 ± 0.77	7.02 ± 1.14	< 0.001
18 hours	Rest	5.39 ± 0.91	5.71 ± 0.84	0.20
	Cough	6.83 ± 0.81	7.24 ± 0.86	0.08
24 hours	Rest	4.83 ± 1.07	4.78 ± 0.99	0.80
	Cough	5.97 ± 1.06	6.14 ± 1.1	0.60

There was highly statistical difference (p < 0.001) between both groups in the length of stay of PICU (table IV) (figure 2). However, there was no statistical difference as regards hospital stay between the two groups (table IV).

Fig. 4: VAS after Cough

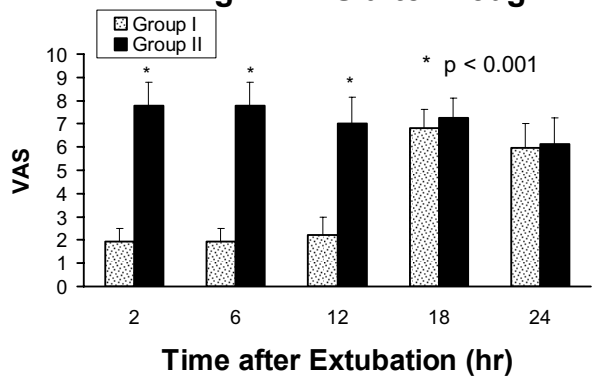


Table IV: Post-operative data

	Group I Mean ± SD (ranges)	Group II Mean ± SD (ranges)	P value
PICU stay (hours)	20.12 ± 2.59	34.12 ± 5.83	< 0.001
Hospital stay (days)	2.90 ± 2.10	3.10 ± 1.80	> 0.05

No patient experienced respiratory depression, nausea, vomiting, or urine retention in the two groups.
One patient in group I experienced pruritis. Another patient in the same group experienced sweating.

Discussion :

Anesthesiologists and cardio-surgeons do recommend early extubation following pediatric cardiac surgery, since, this can minimize pulmonary complications, decrease pediatric intensive care unit (PICU) length of stay and possibly decrease hospital length of stay. When early tracheal extubation is planned, the anesthesia technique is adjusted for the so-called fast-track management 14.

Regional anesthesia in combination with general anesthesia may be valuable in congenital heart surgery, because it can decrease intra-operative opioid requirements and facilitate early extubation 16.

In pediatric cardiac surgical patients, 2 studies of regional techniques reported how the problems are uncommon. Hammer et al., 2000 16 reported no incidence of bleeding in 50 patients. Peterson et al., 2000 14 studied 220 pediatric patients undergoing cardiac operations with

spinal, epidural and caudal anesthesia, they noted one case of intravascular puncture occurred during attempted lumbar epidural access for single-shot dosing. There were no cases of identifiable peridural hematoma, as evidenced by post-operative neurological examination
Rosen et al., 1989 17 performed a prospective, randomized, controlled study to determine the effect of caudal analgesia administered after the surgical procedure in 32 children for ASD, VSD and TOF repair. Pain scores were decreased post-operatively in the study group. And these patients received fewer opioids post-operatively.
The Mexican experience of more than 30 years with caudal block has been stimulating because the very low rate of anesthesia-related complications when used for patients undergoing surgical correction of congenital pyloric stenosis, an upper-abdominal procedure. They did not quantify the extubation time, but found that patients receiving general anesthesia had a longer post-operative fasting period and hospital stay 2.
In 2003, some investigators 18 reported bupivacaine administration for caudal block in cardiovascular surgical pediatric patients. Dose and volume of bupivacaine were modified in order to provide a useful level of analgesia (T1). However, operative analgesia was limited to 1-1.5 hours. Therefore they combined bupivacaine 4 mg/kg (1.8 ml/kg) plus morphine (150 μg/kg) and obtained adequate hemodynamic and analgesic conditions. Tracheal extubation in these patients was performed earlier than in patients undergoing general anesthesia.
The administration of morphine 150 μg/kg will maintain a prolonged, high post-operative analgesic level but increases the risk of urinary retention and respiratory depression that indicate maintenance of intubation and urinary catheter for longer time 14.
The results of the current study showed that, caudal plus general anesthesia were efficient for pain relief as evidenced from intra-operative fentanyl consumption, total fentanyl consumption and VAS recorded 2, 6, and 12 hours after extubation in PICU. The results of the current study showed no statistically difference in VAS at 18, and 24 hours, which may be explained by previous demonstration that morphine 100 μg/kg provided an analgesic duration of approximately 15 hours 19.
The concept of early extubation (within 6 hours post-operatively) following congenital heart is not new. Changes in health care have generated increasing interest in this technique. Some of the problems following surgery are related to the endotracheal tube and mechanical ventilation, and the interventions necessary to maintain them 20.
In the current study, extubation time wassignificantly shorter in the caudal group (1.68 ± 0.39 hrs) than in the other group (6.5 ± 2.4 hrs). Also the length of PICU stay was significantly shorter in the caudal group.
Nader et al., 2000 21 described multiple respiratory advantages of regional techniques. Peri-operative ventilatory depression was lower. They reported a 6-fold increase in early extubation and had lower partial pressures of carbon dioxide in patients in whom regional techniques were used.
Outcomes of 27 patients with congenital heart repairs given general anesthesia and lumbar epidural morphine infusion were compared with those in 27 similar patients given intravenous opioid medications. They reported that patients receiving lumbar epidural morphine were more quickly extubated and transferred from the PICU 22.
Pediatric cardiac surgical patient comfort was studied at the University of Michigan and West Virginia University, where regional techniques were compared with intravenous techniques. Nurses documented that, patients receiving regional techniques had better analgesia, allowing for easier care of these patients 23.
As regards hospital stay, our study showed no statistical difference between the two groups which may be explained by the simple pathology and exclusion of complicated cases.
A very recent study examined the influence of caudal anesthesia on outcomes in 107 patients with ASD, VSD, and TOF undergoing repair requiring CPB. They decided that intra-operative fentanyl administration was significantly larger ($p < 0.001$) in the non-caudal group. Post-operative mechanical ventilation time was significantly shorter in the caudal versus non-caudal group in patients with ASD and TOF. There was no difference between both groups in PICU and hospital stay. This controversy in the results may be due to the retrospective design and different pathology which allows a small number of patients for analysis24.
The results of the current study showed no statistical significant post-operative anesthesia related complications; emesis, urinary retention, respiratory depression and pruritis. This was in agreement with the study of Pérez and his colleagues 2003 18.
Other investigators recorded the benefits of regional techniques would likely be subtle. Studies found free radical scavenging and thyroid hormone levels to be preserved better with regional techniques compared with intravenous opioid anesthesia 25 & 26.
Two large reviews of regional anesthesia in pediatric cardiac surgery by Hammer et al., 2000 & 1999 16, 27 focused on the decreased stress response, improved pulmonary and gastrointestinal function, and resultant potential for cost reduction when regional techniques

are used. The subsequent large series by Rodgers et el., 2000 28 reported further small but significant reductions in mortality and morbidity with the inclusion of regional techniques. Jonathan and Wilson 2000 29 concluded that when neuro- endocrine factors are the primary mediator of stress response, regional techniques have their greatest benefit. This advantage is found in cardiac surgical patients.

In conclusion, post-induction placement of caudal block with bupivacaine 0.25% 4 mg/kg (1.6 ml/kg) plus morphine 100 µg/kg was a safe and effective supplementary technique to general anesthesia for pediatric patients undergoing cardiac surgery. It reduced fentanyl requirement and facilitated tracheal extubation in shorter time.

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Assessment of the Cardioprotective Effect of Trimetazidine During Coronary Artery Bypass Grafting

Ezzeldin T H , Mostafa, EA
Ali, AM

Back ground and objectives: **Trimetazidine (TmZ) is a metabolic agent with a myocardial anti- ischaemic effect achieved independently of changes in the oxygen supply-to- demand- ratio.**

The aim of the present study was to evaluate potential myocardial proetection of trimetazidine by measurement of the cardiac markers troponin T (TnT) and creatininkinase (CPK MB) with haemodynamic assessment by cardiac index (CI).

Methods: **In a non-randomized prospective comparative study on 60 patients who had CABG. Divided into two groups. Group A: Control group (30 patients). 23 males and 7 females with mean age (48.2±± 8.7). they were not receiving trimetazidine. Group B: Trimetazidine group (30 patients) 24 males and 6 females with main age (51±±8.5). Pretreatment was started 2 weeks pre opeatively with trimetazidine (60mg orally per day). cardiac (TNT) and serum (CPK MB) were withdrawn in five phases phase (I) before surgery. Phase (II): 5 minutes after completion of bypass. Phase (III) 12 hours after completion of bypass. Phase (IV) 24 hours and phase (V) 48 hours after completion of bypass. Also CI was measured pre operative and 30 minutes postoperative.**

Results: **The preoperative serum concentration of TnT was (0) to (0.33)ng/mL in all patients. The mean TnT level were mesured (5) minutes after completion of crdiopulmonary bypass (4.2 ±± 0.5), and (12) hours (5.1 ±± 0.4), (24) hours (3.1 ±± 0.5), and (48) hours postoperatively (0.73 ±± 0.15) in the control groups. TroponinT levels in the trimetazidine group measured at the same time periods were (1.41 ±± 0.33), (1.56 ±± 0.27), (0.85 ±± 0.22) and (0.52 ±± 0.24)ng/mL. In the trimetazidine group, TnT level were significantly less than those of the control group (P < 0.001). The levels of TnT were tested by cretinine kinase MB level of both groups. Mean cardiac index was evaluated in all patients preoperatively and postoperatively. There was no significant difference in perioperative hemodynamics between groups.**

Conclusion: **Pre treatment with trimetazidine reduces ischaemic reperfusion damage during CABG but did not affect postoperative hemodynamic status.**

Key words**: CABG-trimetazidine- troponin**

During cardiac surgery two consecutive sequences may damage the myocardium. Ischemia during cross- clamping of the aorta and reperfusion after aortic unclamping. Despite surgical and pharmacological advances in myocardial preservation myocardial reperfusion damage remains the most uncontrolled aspect of cardic operations. Reperfusion is frequently accompanied by various symptoms grouped under the heading of reperfusion. Syndrome or reperfusion injury. Functional recovery therefore is not immediate but usually appears after a period of contractile dysfunction (Myocardial stunning). This phenomenon may lead to cellular injury cellular injury can be followed by the release of markers. So we follow the release of troponin T and CPK MB during (CABG) operation as cardiac markers to assess trimetazidine as myocardial protection troponin T measurement may be considered a specific and sensitive method for the early and late diagnosis of Acute myocardial infarction and also for the assessment for reperfusion injury(28).

Trimetazidine (TmZ) is a metabolic agent with a myocardial anti- ischaemic effect achieved independently of changes in the oxygen supply-to- demand- ratio.

Patients And Methods :

A prospective non-randomized study was done at the cardio thoracic surgery department in Ain Shams university Hospital.

(60) patients were included between Jan. (2001) and Dec. (2004) Aged from (35) to (60) years old with a mean (49 ±± 8.7). (13) females patients (21.7%) and (47) males patients (78.3%).

They had ischemic heart disease and they were prepared for coronary artery bypass grafting.

Inclusion criteria :

Sex : both males and females are included

Age : adults between 35 and 60 years

Lesion: 2 to 4 vessels diseased

Fractional shortening > 30 as an index to moderate ventricular contractility.

Physical status: according to new York-heart association functional class II or III.

Exclusion criteria :

General condition: renal or hepatic dysfunction late cases of COPD.

Cardiac condition: Extensive M I with poor ventricular function F S <30%

Preoperative Evaluation: includes

(a) General Assessment

Preoperative assessment included history of past and present illness.

Examination of the chest, abdomen for associated diseases or chest infection.

The Weight in Kilograms and The height in centimeters

Recent laboratory studies about: full blood picture and blood group. Coagulation profile recording the prothrombin time and concentration, INR and platelet count. Liver function tests. The kidney function tests

A plain X-ray (P-A view) chest is routinely done.

On basis of these data, patients could be included or excluded

(b) Cardiac Assessment

Each patient is examined for sings and the presence of cardiac dysrhythmias or heart failure

Recent preoperative E.C.G. and Echo was performed two evaluate the condition of the myocardium and any other associated lesion or complication (e.g.septal defects or myocardial aneurysm)

The coronary angiogram data would also be assessed .it comments on the following; lesion of the coronary vessels and its extent and distal run off, vessel graftability.

Study Design :

This comparative prospective design was non randomized, parallel study after a baseline evaluation of all inclusion and exclusion criteria,

Patients divided into tow groups :

Group A (control group): including 30 patients they did not received trimetazedine before operation.

Group B (trimetazidine group): including 30 patients they received trimetazidine (20) mg three times daily for 15 days.

The cardiac enzymes (CPK MB, troponin T) were monitored at the following times.

(1) Immediate after induction.
(2) 5 minuets after cardia pulmonary bypass.
(3) 12 hours after surgery
(4) 24 hours after surgery
(5) 48 hours after surgery

Hemodynamic measurements:

Standard monitoring techniques included arterial, central venous inserted preoperatively and swanganz catheters was also inserted.

Measurement of the cardiac output was performed before and 30 minutes following bypass using the thermodilution technique.

Derived haemodynamic measurment included cardiac index calculated by standard formulae. C I =C O / BSA

Operative procedure:

All operations were done using fentanyl anaesthesia and a standard cardic pulmonary by pass technique with median sternotomy and moderate hypothermia (25o to 28oC) myocardial protection as achieved with blood cardioplegia. Glucose, insulin, and potassium (GIK) solution (500ml D5W + 80IU regular insulin + 40 m EqKCL) 30ml/hour the GIK was begun at anesthestic induction and continued for 12 hours postoperatively (30).

Myocardial revascularization was done by grafting the internal mammary artery and when necessary by saphenous veins grafting. Grafts were putted in (V-G solution) which contain 30 Umol/L verapamil and 30umol/L nitroglycerne for preservation (31).

Internal mammary arteries are mobilized from their orgin at the subclavian artery to their bifurcation at the level of the xiphoid process.

The pericardium is incised an retracted and after the systemic administration of heparin (4mg/kg) to achieve an activated clotting time of greater than 400 seconds. ACT was checked frequently (q20-30minutes). Cannulation of the ascending aorta and right atrium is performed.

The coronary arteries to be bypassed are identified, systemic cooling is initiated and the distal ascending aorta is cross clamped topical cold saline is poured over the heart cold cardioplegia is infused antegrade the distal anastomosis are constructed with running sutures of 7-0 polyprophylene most of cases left internal mammary artery to left anterior descending artery anastomosis. The heart is placed on pads to elevate the anterior wall and bring the left anterior descending coronary artery medially and then the aortic cross clamping is removed and then the proximal anastomsoses can be constructed to the aorta using partial exclusion clamp. This is usually an astomosis for graft to the right main coronary artery or posterior descending branch. The partial occluding clamping is placed on the right side of the aorta. A circular or elliptical portion of arorta excised an aortic punch can facilitate this procedure the graft is oriented longitudinally or to the right.

The heart may remain asystolic for a short period of time after unclamping and then gradually resume activity.

Sometime the heart fibrillate and require defibrillation and two pacing wires are placed once systemic normothermia has been achieved CPB is weaned using pharmacologic support as necessary to maintain satisfactory haemodynamic performance.

The heart is then decanulated protamiene is administered to counteract the effect of administered heparin- hemostasis is achieved, chest tubes are palced in the mediastimum and pleural spaces and the chest is closed.

Myocardial protection protocol in our study was

Preoperative:

Trimetazidine 20mg TID for 2 week.

Operative:

Glucose insulin potassium (GIK)(30).

Cardioplegia solution which contain

Basic solution	Blood ± normal sol
HCT	10 –15
K^+ (meq/L)	20
HCO3 (meq/L)	20
Lidocaine (mg %)	0.01
Others	Manitol (43.59/L) Ca channel bloker Nitrate

Systemic hypothermies.

Topical hypothemia(5).

Postoperative drug therapy(32):

Patients started on a:

Statins, (Atrovastatin, fluvastatin, lovastatin, pravastatin and simvastatin) with the goal of maintaining a low density lipopation cholesterol level of 100mg /dL or less (33).

Aspirin (75mg daily) should be prescribed routinely except in patient with an allergy or gastric intolerance in case clopidogrel (75 mg daily) can be used.

An angiotensin converting enzyme inhibitor (ACEIS) (captopril, Benazepril, Enalapril, Lisinopril, perndopril, Ramipril or Fosinopril).

Beta blockers (BB) should be started for all patients but we restricted to one patient who had heart block (HB).

Laboratory analysis :

Determination of Troponin T (TnT), and MB CpK were done as follows:

Troponin T determination:

Agents used for TnT analysis were diamino-benzidine, and dithiothreitol were from Serva, Heide/berg, F.R.G.; bβ-mercaptoethanol and sodium perborate were from Merck, Darmastat, and all other chemicals, immunoreagents, and streptavidin- coated tubes. (Boehringer, Mannheim Gmb,H, Mannheim, F.R.G.). The TnT assay kit contains 100 strepavidin- coated plastic tubes (binding capacity > 14 ng of biotin), incubation buffer (per

liter, 10mmol of citrate and 47 mmol of phosphate, Ph: 6.3, biothinylated anti- troponin T antibody (1.25mg/L), anti- troponin T antibody labeled with horseradish peroxidase (> 40 U/L), substrte buffer (100 mmol/L phsophate- citrate buffer, Ph: 4.4, containing sodium perborate (3.2mmol/L), substrate 2.2-azinobis (3-ethylbenzothiazoline –6- sulfonate), and six standards of bovine cardiac TnT (0-15 mμg/L) in human matrix.
Cardiac TnT is measured by a newly developed immunometric one- step sandwich assay. In this assay, an affinity purified, cardiospecific anti- troponin T fraction of polyclonal antibody is immobilized on polyvinylchloride test tubes. TnT standards or serum samples and peroxidase labeled monoclonal anti- troponin T antibody is added to these antibody – coated test tubes.

During the incubation period, the troponin T molecule is bound on different etpitopes by both the solid–phase polyclonal antibody fraction and by the liquid–phase monoclonal antibody- enzyme complex. After the unbound peroxidase-labeled monoclonal antibodies were removed by washing, the antibody- enzyme complex adhering to the assay tubes corresponds to the amount of troponin T recognized by the polycolonal and monoclonal anti-tropnin T antibodies. The amount of enzyme immobilized, as a direct measure as peroxidase substrate conversion at a wave length of 405 nm (28).

TnT assay procedure:
Serum samples and standard (200mμL) in duplicate were incubated with conjugate solution (1000mμL) in the streptavidin coated tubes for one hour at room temperature. The tube content were aspirated and the tubes were rinsed 3 times with tap water. the substrate solution (1000mμL) was added to the tubes and incubated for half an hour at room temperature. Absorbencies were redat 405nm and TnT values were calculated for the calibration curve. The measuring range for TnT was (0-15ng/ml) and the reference range for healthy subject was (0-0.2ng/ml).

CPK MB determinations:
We measured CK- MB activities at 25oC by means of an N-acetylcysteine activated, optimized ultraviolet test (Merck CD armstadt, F.R.G.). CK-MB activities were determined by immunoinhibition, based on the presence of CK-MB submit antibodies (20).

CPK MB assay procedures:
Serum samples (50mμL) were added to 2.5 ml of substrate, then the samples were red by spectrophotometer (4010) at wave length 340lλ three times; then the average of readings were taken and multiplied by the factors of 8255 (20).

Results :
Morbidity :
Two patients (3.3%) out of (60) get leg wound infection.
One patient (1.6%) get post operative mediastinal bleeding and he had to be Explored. There was bleeding vessel in LIMA ped and secured.
Two patients (3.3%) get renal failure and need peritoneal dialysis and they improved.
Four patients (6.6%) get ventricular arrhythmias and treated by cordaron.
Mortality:
Two out of 60 patients died (3.3%). One in group (A) died early post operative (1st 24 hours) cross clamping time for this patient was over one hour due to technical problem as there was bleeding from heal of the distal anastomosis with RCA and he need to be explored after shifting to ICU. He died on the theater.
The second was in group (B) also he needed reanastomosis for the LIMA to LAD cross clamping time was 50 minutes. He get stroke and died on the 4th day post operatively.
Cardiac enzymes troponin t and CPK MB was followed:

Mean troponin t in group A was (0.3 ±± 0.04)ng at before operation which is normal then it started to increased to (4.2 ±± 0.5)ng. At 5 min. and (5.1 ±± 0.4)ng at 12 hours after. By pass then it started to decrease (3.1 ±± 0.5) at 24 hours and (0.73 ±± 0.15)ng at 48 hours after by pass time.

Table: TNT in group A:

Parameters	Mean	Minimum	Maximum	Chi square	P value
TNT 0 min.	0.3 ± 0.04	0.21	0.45		
TNT 5 min.	4.2 ± 0.5	2.89	4.95		
TNT 12 hours	5.1 ± 0.4	4.1	5.9	119.1	<0.001
TNT 24 hours	3.1 ± 0.5	2.3	4.4		
TNT 48 hours	0.73 ± 0.15	0.45	0.98		

This table shows that there was a statistically significant variation of the various reading of TNT by time (P value < 0.001)

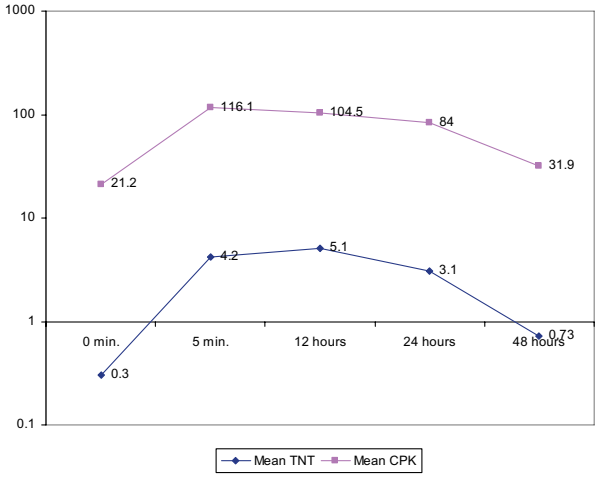
Mean CPK MB in group A was (21.2 ±± 3.3)ng before operation which is normal and started to increase 5 minutes after bypass to became (116.1 ±± 0.9)ng and (104.5 ±± 6.7) at 12 hours after bypass time then it started to decreased (84 ±± 4.7)ng at 24 hours and (31.9 ±± 4.6)ng at 48 hours after bypass time.

Table CPK in group

Parameters	Mean ± SD	Minimum	Maximum	P value
CPK MB 0 min	21.6 ±4.4	10.4	29.3	<0.001
CPK MB 5 min	47.3 ±7.2	30.2	59.2	
CPK MB 12 hours	39.38 ±6.7	30.1	49.2	
CPK MB 24 hours	33.07 ±3.9	25.5	39.5	
CPK MB 48 hours	28.64 ±2.5	23.5	34.5	

This table shows that there was a statistically significant variation of the various readinin g of CPK by time (P value < 0.001)

Figure ( ): TNT and CPK in group A



In group B (trimetazidine group)
Mean TNT before bypass was (0.33 ±± 0.05)ng which is also normal at 5 minutes after bypass it increased to (1.41 ±± 0.33)ng and at (12) hours after bypass it was (1.56 ±± 0.27)ng then it started to decrease at (24) hours after bypass to became (0.65 ±± 0.22)ng and 48 hours after bypass it was (0.52 ±± 0.24).

Table : TNT in group B:

Parameters	Mean ± SD	Minimum	Maximum	P value
TNT0 min.	0.33 ± 0.05	0.18	0.40	
TNT 5 min.	1.41 ± 0.33	0.89	1.92	
TNT 12 hours	1.56 ±0.27	1.11	1.92	<0.001
TNT 24 hours	0.85 ±0.22	0.37	1.21	
TNT 48 hours	0.52 ±0.24	0.21	1.11	

This table shows that there was a statistically significant variation of the various reading of TNT by time (P value < 0.001)

SMean CPK MB in group B was (21.6 ±± 4.4)ng, before which also normal it became (47.3 ±± 7.2) ng at 5 minutes after bypass then (39.38 ±± 6.7)ng at (12) hours after bypass and then it became (28.64 ±± 2.5) ng. At (48) hours after bypass.

Table : CPK in group B

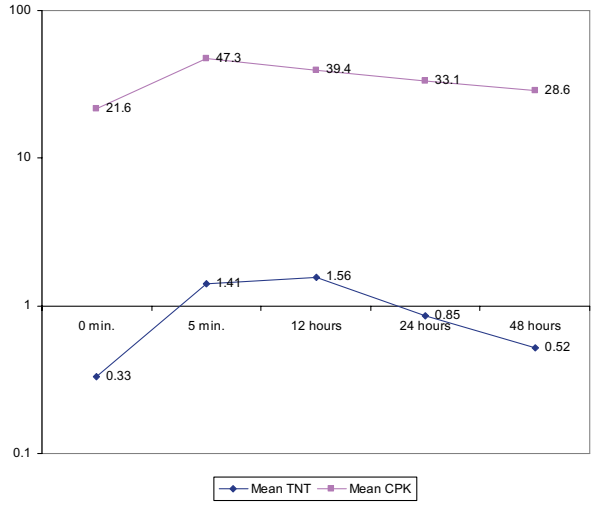
Parameters	Mean ± SD	Minimum	Maximum	P value
CPK MB 0 min	21.6 ±4.4	10.4	29.3	
CPK MB 5 min	47.3 ±7.2	30.2	59.2	
CPK MB 12 hours	39.38 ±6.7	30.1	49.2	<0.001
CPK MB 24 hours	33.07 ±3.9	25.5	39.5	
CPK MB 48 hours	28.64 ±2.5	23.5	34.5	

This table shows that there was a statistically significant variation of the various reading of CPK by time (P value < 0.001)

Sex distribution in the two groups

	Group I (Non-metazedine)	Group II (metazedine)	Total	Chi square	P value
Female	7 (11.7%)	6 (10%)	13 (21.7%)	0.1	> 0.05
Male	23 (38.3%)	24 (40%)	47 (78.3%)		
Total	30 (50%)	30 (50%)	60 (100%)		

Figure ( ): TNT and CPK in group B



Comparison between the two groups

As regarding sex distribution in the two groups. We found that there was insignificant difference between the two groups.

And as regarding risk factors in the two groups. There was insignificant difference between the two groups regarding family history of ischemic heart disease, smoking, hypertension diabetes millets and hypercholerterolemia.

Risk factors in the two groups

Parameters	Group I (Non-metazedine) N (%)	Group II (metazedine) N (%)	Chi square	P value
Family history of IHD	14 (23.3%)	15 (25%)	0.07	>0.05
Smoking	19 (31.7%)	23 (38.3%)	1.2	>0.05
Hypertension	20 (33.3%)	21(35%)	0.07	>0.05
Diabetes	15(25%)	18 (30%)	0.6	>0.05
Hypercholeste-rolemia	20 (33.3%)	23 (38.3%)	0.7	>0.05

Cardiac index in the two groups before operation there was insignificant difference and so cardiac index (30) minutes after bypass- there was no significant difference. Also by comparison of cross clamping time between two groups there was insignificant difference.

TNT in group A and group B

There was insignificant difference between the two groups regarding TNT before bypass and it was normal values in both groups but there were a statistically significant difference regarding TNT.

At 5 minutes, (12) hours, (24) hours and (48) hours. Post bypass time although in both group TNT started to increased at 5 minute reach its maximum value at (12) hours and then started to decrease again at (24) hours and reach near its normal value at (48) hours but with much less values in trimetazidine groups.

CI and cross clamping time in group A and group B:

Parameters	Group I (Non-metazedine) Mean ± SD	Group II (metazedine) Mean ± SD	Unpaired t	P value
Cardiac Index Before Operation	3.12±0.38	3.01±0.39	1.1	>0.05
Cardiac index 30 min. after operation	2.7±0.34	2.7±0.4	0.7	>0.05
Cross clamping time	43.3±5.7	41.1±4.9	1.7	>0.05

This table shows that there was insignificant difference between the two groups regarding CI and cross clamping time

TNT in group A and group B:

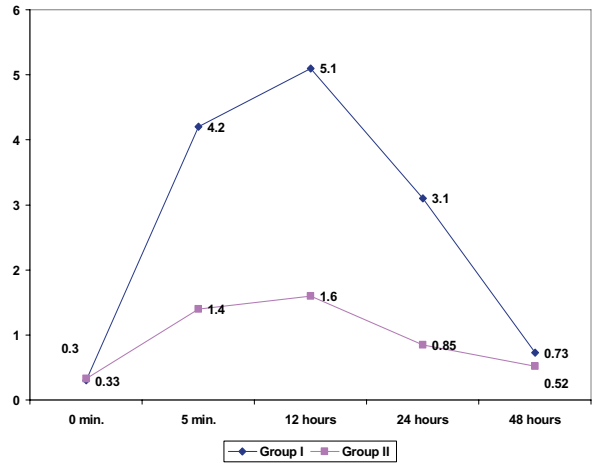
Parameters	Group A (Non-metazedine) Mean ± SD	Group B (metazedine) Mean ± SD	T	P value
TNT0 min.	0.33±0.04	0.33±0.1	-0.5	>0.05
TNT 5 min.	4.2±0.5	1.4±0.3	24.8	<0.001
TNT 12 hours	5.1±0.4	1.6±0.3	38.1	<0.001
TNT 24 hours	3.1±0.5	0.85±0.2	21.5	<0.001
TNT 48 hours	0.73±0.1	0.52±0.2	4.2	<0.001

This table shows that there was insignificant difference between the two groups regarding TNT at 0 minute but there were a statistically significant differences regarding TNT at 5 minutes, 12,24 and 48 hours postoperatively.

According to CPK MB in group A and group there was in significant difference between the two groups. Regarding CPK MB before bypass and it was normal values in both groups but there were a statistically sig-

nificant difference regarding CPK MB at (5) minutes, (12) hours, (24) hours and (48) hours post bypass time although it started to increase at 5 minutes post bypass and reach its peak and started to decrease at (12) hours to reach near its normal values at (48) hours post bypass with significant less values in trimetazidine group.

Figure ( ): TNT in the two groups



CPK in group A and group B:

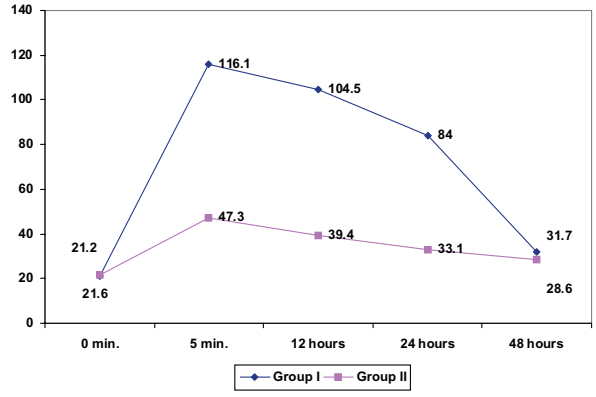
Parameters	Group A (Non-metazedine) Mean ± SD	Group B (metazedine) Mean ± SD	t	P value
CPK 0 min.	21.2±3.3	21.6±4.4	0.5	>0.05
CPK 5 min.	116.1±6.9	47.3±7.2	37.6	<0.001
CPK 12 hours	104.5±6.7	39.4±5.7	40.5	<0.001
CPK 24 hours	84±4.7	33.1±3.9	45.7	<0.001
CPK 48 hours	31.7±4.6	28.6±2.5	3.3	0.001

This table shows that there was insignificant difference between the two groups regarding CPK level at 0 minute but there were a statistically significant differences regarding CPK at 5 minutes, 12, 24 and 48 hours postoperatively.

As regarding correlation between cross clamping time and TNT and CPK MB levels in groups A.

There was direct correlation between TNT and cross clamping time at 5 minutes and at (12) hours, post bypass –and inversely correlation at (24) hours and (48) hours. But it was insignificant correlation and there was direct correlation between CPK MB and cross clamping time but it was insignificant.

Figure ( ): CPK MB in the two groups



Correlation between cross clamping time and TNT levels in group A

TNT	0 min	5 min	12 hours	24 hours	48 hours
Pearson Correlation(r)	0.107	0.345	0.170	- 0.089	- 0.074
P value	>0.05	>0.05	>0.05	>0.05	>0.05

This table shows that there was insignificant correlation between the TNT levels an cross clamping time

Correlation between cross clamping time and CPK levels in group A

CPK	0 min	5 min	12 hours	24 hours	48 hours
Pearson Correlation(r)	-.150	0.048	0.083	0.201	0.131
P value	>0.05	>0.05	>0.05	>0.05	>0.05

This table shows that there was insignificant correlation between the CPK levels an cross clamping time

Also, correlation between cross clamping time and TNT level in group B showed that there was insignificant direct relation at (5) minutes, (12), (24) AND (48) hours post bypass according TNT. And insignificant inversely correlation at (5) minutes post bypass according to CPK MB and insignificant direct correlation at (12), (24) and (48) hours post bypass.

Correlation between cross clamping time and TNT levels in group B:

TNT	0 min	5 min	12 hours	24 hours	48 hours
Pearson Correlation(r)	-0.238	0.204	0.292	0.084	- 0.128
P value	>0.05	>0.05	>0.05	>0.05	>0.05

This table shows that there was insignificant correlation between the TNT levels an cross clamping time

Correlation between cross clamping time and CPK levels in group B:

CPK	0 min	5 min	12 hours	24 hours	48 hours
Pearson Correlation(r)	-.113	- 0.018	0.005	0.023	- 0.044
P value	>0.05	>0.05	>0.05	>0.05	>0.05

This table shows that there was insignificant correlation between the CPK levels an cross clamping time.

Cross clamping time calculated for every patient in both groups.
(Mean cross clamping tine in group A (43.3 ±± 5.7) minutes, and mean cross clamping time in group B was (41.1 ±± 4.9).

Cross clamping time in group A:

Parameters	**Mean**	**Minimum**	**Maximum**
cross clamping time	43.3 ±5.7	37	60

Cross clamping time in group B:

Parameters	**Mean**	**Minimum**	**Maximum**
Cross clamping time	41.1 ± 4.9	33	51

Also cardiac index before and (30) minutes after bypass was calculated.
In group A mean CI before, bypass was (3.1 ±± 0.4) and it was (2.7 ±± 0.3) , (30) minutes after bypass.
In group B mean CI before bypass was (3.01 ±± 0.4) and it ws (2.7 ±± 0.4) (30) minutes after bypass.

CI before and 30 minutes postoperatively in group A

Parameters	Mean	Minimum	Maximum	Paired t	P value
Cardiac index before operation	3.1 ±0.4	2.5	4		
Cardiac index 30 min. after operation	2.7 ±0.3	2.1	3.5	12.6	<0.001

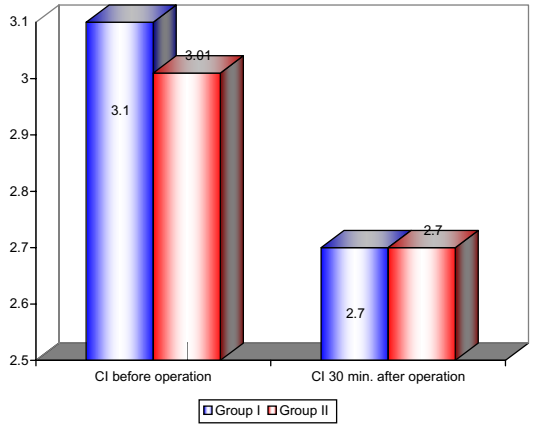
This table shows that there was a statistically significant difference between CI before and 30 minutes postoperatively (P value < 0.001)

CI in group B:

Parameters	Mean	Minimum	Maximum	Paired t	P value
Cardiac index before operation	3.01± 0.4	1.9	4	6.6	< 0.001
Cardiac index 30 min. after operation	2.7± 0.4	2	3.2		

This table shows that there was a statistically significant difference between CI before and 30 minutes postoperatively (p value < 0.001).

Fig ( ): Cardiac index pre and 30 minutes postoperative in group I and group II.



Discussion :

During cardiac surgery two consecutive sequences may damage the myocardium. Ischemia during cross- clamping of the aorta and reperfusion after aortic unclamping. Despite surgical and pharmacological advances in myocardial preservation myocardial reperfusion damage remains the most uncontrolled aspect of cardic operations. Reperfusion is frequently accompanied by various symptoms grouped under the heading of reperfusion. Syndrome or reperfusion injury. Functional recovery therefore is not immediate but usually appears after a period of contractile dysfunction (Myocardial stunning). This phenomenon may lead to cellular injury cellular injury can be followed by the release of markers. So we follow the release of troponin T and CPK MB during (CABG) operation as cardiac markers to assess trimetazidine as myocardial protection troponin T measurement may be considered a specific and sensitive method for the early and late diagnosis of Acute myocardial infarction and also for the assessment for reperfusion injury(28). And so we measured levels of serum cardiac markers (TnT, CPK.MB.). Before surgery 5 minutes after By pass 12 hours after by pass 24 hours and 48 hours, after by pass. Considering cross clamping time in minutes also in our study we measure CI before and 30 minutes after. Bypass as hemodynamic assessment for the patients.

In our study there were no significant differences in age or body surface area between the two
group as shown in Table (3,4) and Fig. (3).

The cross-clamping time was around (43±±5.9) minutes in group A with Exception of two cases, it was over 50 minutes due to technical problem during surgery. One of the two cases died early post operative (first 24 hour) in the ICU by massive MI and it was around (41 ±± 4.9) minutes in group B with exception of one case it was over one hour, as it was three grafts one of them needed reanastomosis Table (7, 8).

In Bulent Tunerir and Coworkers study, they conducted a double placebo study on 30 randomized patient who had CABG. The trimetazidine group was composed of 15 patients and the placebo group 15 patients. Pre treatment was started 3 weeks pre operatively with trimetazidine. The mean cross clamping time was (42 ±± 2.4) minutes in placebo group and was (44 ±± 1.8) minutes TMZ group. They measure troponin T as metabolic assessment(1).

They found in the trimetazidine group TnT were significantly less than those of the placebo group.

Troponin T in these study started to rise at 5 minutes after completion of cardio pulmonary by pass- and reach peak at 12 hours and then started to went down 24 hours. This went with our study as there was increase in serum TnT concentration after surgery in all patients which probably reflects reversible ischemic damage to the myocardial all during the cardioplegic period (24). However, we conducted our study on 60 patients and pre treatment in our study was started 2 weeks pre operatively with trimetazidine the serum TnT was significantly less in trimetazidine group. Than in placebo group Table (11, 18) and Fig. (5, 7).

We tested the TnT by CPK.MB. Levels in both groups.

We found (1) there was no difference in MB- CPK levels between the two groups pre- operatively and it was of normal value– these indicate that there was no pre- operative. Infarction so the only cause of increase serum level of TnT or CPK MB- during operation or after the operation is only due to ischemia during cross clamping or due to reperfusion injury.

(2) MB- CPK started to increase at 5 minutes post- by pass and increase to its peak at 12 hours post bypass and then started to decrease at 24 hours Table (12, 14).

(3) TnT started to increase at 5 minutes after by pass and reached its peak at 12 hours post bypass started to decreased at 24 hours post bypass Table (11, 13) and Fig. (5).

So TnT increase like CPK MB with high significant value at 12 hour for TnT (Fig. 13, Table 19).

So TnT is high sensitive to detect minor myocardial cell damage during CABG and can be used to assess myocardial state-before during and after CABG.

In another study J.N. Fabiani and Coworkers tested myocardial protection. By trimetazidine in double blind placebo to controlled study on 19 patients undergoing CABG (19).

The trimetazidine group was composed of 10 patients and placebo group of 9 patients. In this study pre treatment started three week also. Before surgery with trimetazidine 20mg Tid and the same drug was added to the carbioplegic solutions.

Which was difficult in our study to use trimetazidine as cardioplegic solutions. As trimetazidine solution is unstable formula with short half life. It was available only during industrial processing for the drug so it was easy for J.N. Fabiani and Coworkers, to use it in cardiovascular surgery department. Hospital Broussais, Paris, France (19).

In these study metabolic assessment of myocardial protection was done by measurement of malondialdehyde (MDA) in the coronary sinus 20 minutes after reperfusion- (MDA) is a major by product of lipid per oxydation of cellular and subcellular membranes induced by free radicals reflects the level of free radicals generated during reperfusion which was significantly less in the

trimetazidine groups. This showed another role for trimetazidine in myocardial protection.

Assessment of CPK – MB in this study also is to rule out preoperative myocardial infarction. He found CPK- MB increase after the 2nd post operative hour and reach peak values by the 6th hour. So kinetic release of CPK MB in this study differ from the kinetic release for CPK MB in our study and that may be because we take our sample in different time than them.

Although we used trimetazidine 2 weeks before operation our results come also with the protective affect of trimetazidine to myocardium during surgery.

So, we can say from our study that 2 weeks pre treatment with trimetazidine is too enough to reach myocardial protection during surgery.

There was another more study. Which proved that we can reach to the myocardial protection effect of trimetazidine by a single dose of 60mg once before the procedure(35). This study evaluated acute effects of trimetzidne by exercise testing as a single dose of 60mg trimetazidine (the normal daily dose) improved exercise capacity in angina pectoris, as reflected by an increase in the duration of exercise, total work performed, and improvement in ECG signs of ischemia. All these effects occurred without any detectable chronotropic or vasomotor effect. The importance of this study is to demonstrate that these beneficial effects, already well-recognized after chronic administration of 20mg three times a day, also occur after a single administration equivalent to the normal daily dose.

There is still one point important which is the effect of cross clamping time on the result of the study.

Cross clamping time in Bulent Tunerir and Coworkers study, was (44 ±± 1.8) minutes in placebo group, (42±±2.4) minutes in trimetazidine group (1).

In Fabiani and Colleagues study, it was (39.8 ±± 2.3) minutes in placebo group, (41.1±±3.8) minutes in trimetazidine group (19).

In our study it was (43 ±±5.4) in group A (placebo group), and (41±±4.9) minutes in group B (trimetazidine group),

So as we say before that (troponin T release is higher with prolonged periods of aortic cross clamping(28) we found. Direct insignificant correlation between cross clamping time and serum troponin level and serum CPK- MB Table (20, 21, 22 and 23) respectively. So the procedure of operation technique which reflect on the across clamping time may became an important factor for myocardial protection and the outcome results of CABG(36).

Hemodynamic assessment in our study was done by measurement of cardiac index. Pre operatively and post operatively like Bulent Turnerir and Colleagues study. In our study group A CI was (3.1 ±± 0.4) pre operative and decreased to (2.7 ±± 0.3) 30 minutes post bypass time with no significance difference ($P < 0.001$) in group B CI was (3.01 ±± 0.4) pre operative. (2.7 ±±0.4) post operative with non significant deference ($P < 0.001$).

There was no significant difference in pre operative and post operative CI in both group A and group B (Fig. 11, Fig. 12).

From this result we can say that trimetazidine as a myocardial protection has no significant changes in myocardial function, which came with Bulent Tunerier and Colleagues study, we can explains this conclusion. As the early post operative course is characterized by temporary depression of left ventricular function that often requires inotropic support to obtain a satisfactory cardiac out put. This probably result from more than one factor not only from ischemic/ reperfusion injury (stunning). But also from myocardial oedema and decreased compliance also incomplete revascularization or prolonged coronary vasospasm. So myocardial function will return to base line within 6 to 8 hours although it may take several days.

But in Fabiani and Colleagues study they use stroke work index (SWI) as Hemodynamic measurements.

They found that patients pretreated with trimetazidine had a better ventricular function as (SWI) significantly higher in the trimetazidine group than in placebo group(19).

They attributed the difference in the pre and post assessment of the left ventricular function to the drug and they explained this result as the mechanisms of the protection afforded by trimetazidine during ischemia and reperfusion seems to be at different levels. So beside its protective effect on energy metabolism during hypoxia trimetazidine has also been shown to preserve cellular homeostasis. Altered by triggers such as calcium over load potassium free medium acidosis and exposition to oxygen free radicals and it may help in ventricular function.

Still further investigation are needed to assess. The role of pretreatment with trimetazidine as myocardial protection with long term study recently like this study done by Romano et al., to assess anti- ischemic efficacy of trimetazidine in patients with a history of surgical developing myocardial revascularization and at high risk of developing heart failure. They studied 30 out patients with exercises – induced myocardial ischemia and left ventricular dysfunction (LVEF= 35- 45%) having previous history of myocardial infarction and coronary artery by pass grafting from (7 to 20 years) were randomized to trimetazidine or placebo on top of the standard treat-

ment measurement were preformed at base line and after 12 months.

Exercise time was improved in both controls and treatment group ($P < 0.05$ and $P < 0.01$), respectively with trimetazidine the treatment group had reduced ST segment depression ($P < 0.05$), increased left ventricular ejection fraction and peak filling rate (EDV/sec) ($P < 0.01$ and $P < 0.05$) respectively (37).

conclusion :

Trimetazidine is a novel anti- ischemic agent has demonstrated beneficial effects on the ischemic heart without altering hemodynamics or base line contractile parameter.

Pre treatment with trimetazidine at least for 2 weeks reduces ischemic reperfusion damage during coronary artery bypass perations but did not affect postoperative he

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Surgical management of multi-drug resistant pulmonary tuberculosis: 7 years experience.

Tarek A Mohsen, MD
Amany Abou Zeid, MD

Background: **Tuberculosis is a disease that is mainly treated with chemotherapy. Surgical resection remains an important tool to manage patients with multi-drug resistance. The purpose of this study was to analyze the indications, outcome after resection and follow up of these patients.**

Methods: **A retrospective study was performed in 23 patients undergoing pulmonary resection for human immunodeficiency virus (HIV)-negative multi-drug resistant tuberculosis. There were 20 males (86.9 %), and 3 females (13 %), the average age being 24.4 years. All patients were resistant to a median of 4 drugs including isoniazid and refampin, and had received for 3 months before surgery a second line drugs given according to culture and sensitivity. 15/23 patients (65.3 %) were sputum negative at operation, while 8/23 patients (34.7 %) were still positive sputum at operation. Indication for surgery was to patients who failed to convert or for those who had negative sputum but were at risk of relapse due to extensive parenchymal lesion. Pneumonectomy was done in 11 patients (47.8 %), lobectomy in 12 patients (52 %).**

Results: **There was one hospital mortality (4.3 %), Morbidity occurred in 8 patients (34.7 %); prolonged air leak in four patients, empyema in three, and re-exploration for bleeding in one. All patients attained sputum –negative after the operation (range 1 –5 months), only one patient developed relapse after 12 months of retreatment. All patients had treatment for 18-24 months and follow up ranged from 14–27 months.**

Conclusion: **Our results emphasized the crucial role of surgery as an adjunct to medical therapy and should encourage more referral by physicians. The morbidity in this series was acceptable.**

Keywords: **Multi-drug resistant tuberculosis; pulmonary tuberculosis; surgery**

The incidence of tuberculosis in Egypt is 27 / 100 000 pop / year. The success of the current government service adopting directly observed treatment (DOT) in controlling the disease reaches 80 %. The estimate prevalence of multi-drug resistance tuberculosis of the new diagnosed cases reaches 2.2 %, while those under treatment reaches 7.1 % [1]. Surgery for pulmonary tuberculosis was important form of therapy until the introduction of antibiotics in the 1960s. The use of appropriate chemotherapy outweighed surgery and a cure was achieved in all tuberculosis patients [2,3]. Emergence of resistant strains to refampin and isoniazid rendered medical treatment to be ineffective alone and surgical option is once again a necessary treatment modality [4]. In this study we retrospectively analyzed the indications, surgical outcome, complications and follow up of patients with multi-drug resistant tuberculosis.

Patients and Methods :

Between 1999 and 2005, 23 patients underwent pulmonary resections at Cairo university hospitals for human immunodeficiency virus (HIV)-negative multi-drug resistant tuberculosis patients. There were 20 males (86.9 %) and 3 females (13 %), the average age being 24.4 years (range 7 – 48 years).

Preoperative evaluation included clinical examination where any co-morbidity was addressed and managed particularly diabetes, anaemia and hypoalbuminaemia, chest radiograph, computed tomography, bronchoscopy to rule out the rare endobronchial tuberculosis, pulmonary function tests and echocardiography to rule out pulmonary hypertension.All patients received antituberculous chemotherapy before surgery and according to culture and drug susceptibility test using BACTEC TB 460®. All patients were resistant to a median of 4 drugs (range 2–6 drugs), including refampin and isoniazid. In the preoperative period all patients were placed on multi-drug therapy with a median of 4 drugs (range 3-6 drugs) based on drug susceptibility test. Drugs used include pyrazinamide, ethambutol, streptomycin, para-aminosalicylic acid. Flouroquinolones in particular ofloxacin, levofloxacin and gatifloxacin were used in 15/23 patients (65.3 %) in this study. The regimen was given at least for 3 months (range 3-6 months). The inclusion criteria for indication and choice of patients for resection were (i) drug resistance including at least 2 drugs (isonaizid + Refampin); (ii) failure to convert sputum or previous relapse while insuring patient compliance; (iii) sputum negative with high probability of relapse due to considerable parynchymal destruction (cavitary lesion or destroyed lung); (iii) availability of adequate drug efficacy to provide rapid healing of the bronchial stump; (iv) sufficiently localized disease providing the resection of great preponderance for radiographically visible disease, leaving an adequate cardiopulmonary capacity; (v) operation were done 3 months (range 3- 6 months) after starting chemotherapy.[5]

In this study, 11 pnemonectomies were done 10 were on the left and only one on the right. 12 lobectomies were done 8 on the right and 5 on the left. Under general anesthesia using double-lumen endotracheal tubes, patients were approached through standard posterolateral thoracotomy, muscle sparing was particularly planed in patients undergoing pneumonectomy. Dissection of dense adhesions in some patients was not possible and an extrapleural approach was used to avoid opening cavitary lesions and reduce blood loss (7/11 pneumonectomies). The use of Harmonic scalpel (Ethicon, Inc, Somerville, NJ) also contributed in reduction of blood loss. All bronchial stumps were sutured and reinforced with pleural flap or pericardial fat pad. Warm saline was used to irrigate the pleural cavity together with povidone iodine. Specimens were sent to pathological and bacteriological evaluation (Table 1).

Patients returned on their preoperative multi-drug regimen as soon as they resumed their oral feeding. They were sent to the chest department after the removal of the chest drains. No change in preoperative regimen was done in any patient as all specimen cultures and drug susceptibility agrees with the preoperative results. The follow up period extended from 14 - 27 months and all the patients had there drugs for 18-24 months except one for 12 months.

Results :

There was one operative death (4.3 %), where the patient had undergone right pneumonectomy for a destroyed lung. On the fifth day postoperative the patient developed high fever and empyema was diagnosed, food particles were seen from the drains and esophageal injury was confirmed. On the 11th day bronchopleural fistula developed and the patient was ventilated. The patient suffered malnutrition and died out of electrolyte imbalance on the 17th day postoperative.

Complications following surgery occurred in 8 patients (34.7 %), the major complication was prolonged air leak more than 7 days (range 11 day – 7 months) in 4/8 patients (50 %). One had incomplete fissure and air leak was inevitable, he then developed failure of lung expansion and re-operation was done 10 days later. The other three were treated conservatively two had responded to repeated autologous blood. The last was discharged with a hemelich valve and her air leak stopped 7 month

later. Three patients developed empyema excluding the mortality case. One following left pneumonectomy and responded to thoracostomy tube and antibiotics. The second needed debridment and decortication after 1 months of the first operation, the third responded to thoracoscopic placement of more dependant tube, lavage which was repeated for 5 days as 2 liter of normal saline given 3 times daily with antibiotic given according to culture and sensitivity. One patient was re-explored after 24 hours due to high drainage and at operation no source of bleeding was found and a large hematoma was evacuated.

Table 1. Clinical profile of 23 multi-drug resistant tuberculosis patients.

Age	**Average 24.4 (7-48) years**
Gender	20 M/3 F
Origin	9 from Egypt, 7 from Yemen, 4 from Sudan and 3 from Libya.
Associated complications	4 had hemoptysis, 3 had fungal ball.
X-ray finding	Cavity 9 (39.1 %), bronchiectasis 3 (13 %), destroyed lung 11 (37.8 %) and bilateral lesions in 4 (17.3 %).
No. of drug resistant	Median of 4 (3-6) drugs
Duration of medication (preoperative)	At least 3 (3-6) months
Positive sputum (Preoperative)	8/23 patients (34.7 %)
Postoperative conversion time	Median 3 (1-5) months
Procedure	
-Pneumonectomy	
a)Right	1
b)Left	10
-Lobectomy	
a)Right	8
b)Left	5
Complications	
-Mortality	1
-Air leak > 7 days	4
-Empyema	3
-Re-exploration for bleeding	1

15/23 patients (65.3 %) were sputum negative at operation, while 8/23 patients (34.7 %) were still positive sputum at operation. All patients 22/23 excluding the mortality were culture negative after the operation with a median of 3 months (range 1-5 months). We had one relapse after 12 months of re-treatment, the patient discontinued the treatment and returned with symptoms. Culture was positive and we lost him in follow up.

Discussion :

The emergence of multi-drug resistant tubercle bacilli is a global problem [6]. The rising incidence of multi-drug resistant tuberculosis in developed countries is attributed to immigration, homelessness, intravenous drug abuse, and acquired immunodeficiency syndrome. On the other hand the problem in the developing countries is attributed to poor patient compliance, iletracy and inadequate follow up thus allowing drug resistance and progression of the disease to occur [7]. It has been estimated that the cost of treating drug sensitive tuberculosis may range from $ 2,000 - $ 15, 000. This pales in comparison with the treatment of drug resistant tuberculosis which may approach $ 200, 000 [4].

To date there is no randomized controlled study to compare the efficacy of surgical treatment plus chemotherapy with the efficacy of chemotherapy alone, however the failure rate of medical therapy is over 40 %, and a poor long term survival is reported [8]. The cure rate with surgical resection as an adjunct to medical therapy reached 83 - 93 % cure in some series [8,9]. The purpose of such surgical treatment is to reduce the bacterial burden by resecting cavitary lesions or destroyed lobes. The introduction of fluoroquinolone antibiotics has raised hopes of improving the current dismal prognosis for multi-drug resistant tuberculosis. However, antituberculous chemotherapy containing fluoroquinolones are not panaceas [9].

Our current indications agree with others [10-15]. In the setting of localised disease, persistent sputum positivity, or patient intolerance of medical therapy, or relapse; pulmonary resection should be undertaken. It must be underlined that all kinds of patients with tuberculosis must be treated medically by pneumologists. Teamwork has a paramount importance in the management of multi-drug resistant tuberculosis: the better the cooperation between thoracic surgeon and chest physician is the better results of treatment are. Surgery is indicated when pneumologists consider that the patient cannot be cured by medical therapies. The role of the surgeon in this circumstance is to look for whether indications exist for surgery and to decide if the patient is a suitable candidate for resectional surgery.

There are four main indications for surgery [5]; all presume that there is adequate cardiopulmonary reserve. It is important to note that at least three months of treatment should be given before surgery if at all feasible [4,9,16]. (i) Failure to convert (failure of anti-

tuberculous drug regimen to convert sputum from positive smear to negative smear): sputum smear or culture positive within two months before operation despite at least four to six months treatment with an adequate drug regimen. Presence of destroyed lobe or lung (with cavitation, bronchiectasis and bronchostenosis) is associated with high risk of treatment failure or relapse. (ii) Previous relapse(s): previous tuberculosis history of two or more relapses and/or one or more relapses during the multi-drug resistant tuberculosis treatment course. If relapse did occur it may be difficult to re-establish sputum culture conversion. (iii) High profile of drug resistance: infection with strains of Mycobacterium tuberculosis resistant to four or more drugs. (iv) High or potential risk of relapse: patients not falling in the previous categories but considered likely to relapse despite conversion as gauged by the presence of a destroyed lung or a lobe.

When the probability of negative bacteriological conversion of sputum seems high (i.e. less destroyed lung; initial resistance to isoniazid and refampin; only resistance to isoniazid and rifampin), chemotherapy is continued for additional two to three months. Should any significant change occur clinically then chemotherapy continues; while 'no change' or worsening in clinical, radiological or bacteriological finding indicates surgery.

In this study our mortality was 1/23 patients (4.3 %). The Denver group reported 6/180 patients (3.3 %)[4], however other groups, Japanese 30 patients[9], Turkish 27 patients[2] and Korean 27 patients[16] reported no early mortality.

Fluoroquinolones, particularly moxifloxacin and gatifloxacin are believed to have the most activity in vitro against M. tuberculosis, followed by levofloxacin and ofloxacin [17, 18, 19]. Fluoroquinolones were used in 2/3 of our patients (15/23). Levofloxacin and gatifloxacin were used mostly. 2/3 of our patients could be converted to sputum negative preoperatively. These results agree with Shiraishi and associates [9] who reported a high conversion rate with levofloxacin used in multi-drug regimen.

Major complications following surgery for multi-drug resistant tuberculosis were reported between 15 and 40 % [2, 3, 4, 9]. In our series major complications were 34.7 % (8/23 patients). Half of our complications were prolonged air leak that except for one patient were managed conservatively. We like others [2] did not use any muscle flaps to secure bronchial stumps but pleural flaps or pericardial fat pad were used in our pneumonectomy patients. Except for our mortality patient, we though did not encounter any bronchopleural fistulae in the survivors. We attribute this to our policy in avoiding extensive bronchial dissection and manipulation.

Our success in this series reaches 91 % if we consider one patient with relapse and another died after surgery. The success rate in other series was reported to range between 83 and 93% [4, 9].

Surgery remains an important adjunctive tool in the management of patients with multi-drug resistant tuberculosis. The success of surgery depends on, cooperation – teamwork (chest physicians & thoracic surgeons), Patient compliance to complete the drug regimen, which lasts 18-24 months postoperatively, familiarity of surgeon with the surgery for tuberculosis disease, adherence to preoperative and postoperative precautions and careful follow-up by chest physicians.

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Pneumonectomy In Children For Inflammatory Lung Disease; Risk Factors Affecting Surgical Outcome

Hatem Y El Bawab, MD
Tarek A. Abdel Aziz, MD
Saeed M. R. El Assy, MD
Ahmed El Nori, MD

Background: **Surgical literature caries relatively scant information on pneumonectomy in children. The presence of specific risk factors can affect the surgical outcome after pneumonectomy for inflammatory lung disease.**

Methods: **We reviewed our experience over 8 years, in 58 pneumonectomy procedures in children for destroyed lung. Retrospective analysis of specific risk factors affecting the postoperative outcome was carried out. The significance of tuberculosis, preoperative empyema, right pneumonectomy, and duration of illness were evaluated against the surgical outcome after pneumonectomy.**

Results: **Fifty-eight children underwent pneumonectomy. Bronchiectasis and tuberculosis were the most common underlying diseases for destroyed lung, 28 and 21 children respectively. The combined morbidity and mortality rate was significantly higher in children with preoperative tuberculosis (P<0.03), preoperative empyema (P<0.003), and right pneumonectomy (P<0.03).**

Conclusions: **Pneumonectomy for destroyed lung can be carried out safely in children with acute or chronic pulmonary infections refractory to conservative medical therapy. Careful preparation, often including anti-tuberculous cover, and timing of pneumonectomy are essential. The postoperative complication rate increased by preoperative empyema, tuberculosis and right- sided resection.**

Department of Cardiothoracic Surgery, Faculty of Medicine, Ain Shams University.

Pneumonectomy in children is an uncommon condition in children causing irreversible changes in lung parenchyma, and surgical intervention becomes essential. The literatures carry few separate reports of pneumonectomy of any number in children, most reports being series of mixed pulmonary resections including pneumonectomies. Information on pneumonectomy in childhood is limited; pneumonectomy being infrequently carried out in children. Some literatures considered pneumonectomy in childhood to pose grave problems and considered pulmonary resection for inflammatory lung disease to be hazardous.(1)

Destroyed lung in children is most often caused by inflammatory lung disease such as tuberculosis, whole lung bronchiectasis, necrotizing pneumonia, multiple or extensive lung abscesses, fungal infection, lung gangrene, and mycobacteria other than tuberculosis. Other important causes include bronchial stricture and congenital malformation. (2)

Surgical resection in destroyed lung is used to resolve complications and improve a patient's quality of life.(3) Children were noted to grow and develop normally after surgery, most of the small numbers of pneumonectomies followed up led vigorous and full lives. Stiles et al (4)noted that young children, with more potential for growth, tolerated pneumonectomy well, with less functional disability than adults.

Almost all of our patients who underwent pneumonectomy had undergone numerous treatments. However, irregular and inadequate treatment, the cessation of medication shortly after symptom improvement, and a lack of check-ups after treatment are among the factors that accelerate the need to perform pneumonectomy in children.

This retrospective study was undertaken to review our clinical experience and long-term results for pneumonectomy in children with destroyed lung.

Materials and methods:

This study conducted at the cardiothoracic surgery department, section of general thoracic surgery Ain Shams University. All the data for children operated upon for pneumonectomies in our center between January 1997 to January 2005 were reviewed.

The data obtained included age, sex, presentation, duration of symptoms, underlying disease, method(s) of diagnosis, treatment, operative procedures, postoperative course, and pathologic findings were reviewed, and the follow-up results were evaluated.

Fifty-eight patients, 36 boys and 22 girls, with an average age of 9.1 years (range 4-16 years), underwent pneumonectomy. The most common underlying disease was bronchiectasis (n = 28); other underlying diseases included tuberculosis (n = 21), necrotizing pneumonia (n = 4), and bronchial stenosis (n = 4) two of them was due to retained foreign body, and aspergilloma (n = 1) (table 1). Eight patients (44.4%) of the 18 patients with tuberculosis and 5 (12.5%) of the 40 non tuberculous disease had empyema in the preoperative period.

All patients, except 4, were hospitalized once or more to receive treatment from pneumonia. Sputum was the most common symptom (n = 40). Other symptoms including coughing (n= 28), growth retardation (n = 20), clubbing (n = 14), fever (n = 20), and hemoptysis (n = 8).

Preoperative assessment:

Severity of symptoms, co-morbid conditions, appearance of chest X-rays (CXRs) and respiratory status were all assessed. Rigid bronchoscopy was performed to all patients preoperatively to detect the presence of foreign bodies, stricture, and bronchial compression. It also determined the state of inflammation and quantity and source of pus in the bronchi. A foreign body (plastic materials) was detected in 2 patients. There was thickening in the main bronchus in 2 children as a result of external pressure, and intraluminal thickening and narrowing in the main bronchi of 5 patients.

Table 1. patients demographics

Patient demographics	No. (58)
Sex	
Male	36
Female	22
Age (y)	
Mean	9.1
Range	4-16
Underlying disease	
Bronchiectasis	28
Tuberculosis	21
Necrotizing pneumonia	4
Bronchial stenosis	4
Aspergilloma	1
Preoperative empyema	
Yes	13
No	45
Duration of illness	
>18 months	50
<18 months	8

Culture and sensitivity of tracheobronchial secretions were taken at bronchoscopy determined the antibiotic usage. Growths in culture were detected in only 10 patients (17.4%). The pathogens cultured were Staphylococcus aureus in 4 patients, Klebsiella pneumoniae in 2, and Pseudomonas aeruginosa in 2; 2 patients had a mixed bacterial structure.

There were no acid-resistant bacteria in the sputum and gastric fluids of patients who had tuberculosis or in whom tuberculosis was suspected. The tuberculin skin test was positive in 10 patients (17.4%) with tuberculosis; however, none of the patients had active tuberculosis. Further investigation was delayed in the face of clinically active disease (fever, malaise and changing serial CXRs), or when profuse purulent secretions were encountered at bronchoscopy in 9 patients (15.5%) with bronchiectasis.

Destroyed lungs were present on the left side in 50 patients (86.2%) and on the right side in 8 patients (13.8%). Radiologic diagnostic methods included chest radiography in all patients, chest computed tomography (CT) in all patients, bronchography in 4 patients, and

pulmonary ventilation-perfusion scan in 4 patients.
It was possible to perform pulmonary function tests in 32 of the older children and in those able to cooperate. The other 26 younger patients were evaluated by an exercise-tolerance test. The 6-minute walk test was performed along a level hospital corridor. Oxygen saturation (Sa O2) was measured by finger pulse oximetry before and during and at the end of the test. All patients were able to walk continuously for the 6-minute period. The lowest Sa O2 was used to calculate minimum Sa O2. Mean minimum Sa O2 was 95.3. Along with exercise, a 2% or more desaturation was considered to represent a risk.
Two patients (3.4%) seen to be at risk received 3 weeks of additional chest physiotherapy, incentive spirometry, nutritional support, and ambulation with physical therapy. The patient underwent operation after this course of treatment. No patient was observed to have effort dyspnea after the test.

Indication for surgery:

Symptoms of chronic lung disease and recurrent chest infections were indications for investigation and surgery in those suspected of and proven to have uni-lateral disease amenable to surgery. A persistently abnormal CXR in a relatively asymptomatic child led to investigation and surgery when destroyed lung was demonstrated.
In a few only, contra-lateral disease was accepted when it was thought that removal of the main burden of disease could significantly improve quality of life, and when the contralateral lung disease was limited to one segment or less.

Operative steps:

All of the operations were elective. Fifty (86.6%) underwent left pneumonectomy, and 8 patients (13.8%) underwent right pneumonectomy. A double-lumen endotracheal tube was used in older children (n = 14) to avoid the spillage of infected material into the contralateral bronchus. In most of the patients in which the double-lumen endotracheal tube was not used, rigid bronchoscopy was performed, and the bronchus of the side ready for resection was cleaned by aspiration before the introduction of an endotracheal tube. Frequent intraoperative aspiration was required for these patients. The standard posterolateral thoracotomy approach was used in all patients. Thoracotomy was performed in a way to conserve as much muscle as possible. All of the pneumonectomies were performed in the intra-pleural plane. Intrapericardial pneumonectomy was performed in 4 patients (6.9%). The main bronchus was closed by stapler in all patients. The bronchial stump was routinely covered by adjacent tissue; mediastinal pleura, intercostal muscle, or a combination of these. All patients underwent invasive blood pressure monitoring, which also allowed regular blood gas analysis during the intraoperative and postoperative period.
Every effort was made to remove the endo-tracheal tube either in the theatre or shortly after in the ICU. Post-operative bronchoscopy was carried out in order to check the bronchial stump and clear all secretions. The chest drain was almost always removed the following day.

Hospital stay and follow up:

Patients were only discharged once wounds were healed and any complication dealt with. Features of these children were their rapid mobility and shorter ICU stay than adults. The median length of hospital stay was 7 days (1-31 days). Thirty patients were up for 6 months in thoracic surgery outpatient clinic with repeated CXRs.
Twenty-three patients were followed in referral pediatrics hospital outpatient clinic. During the first post-operative months 6 patients (10.3%) were readmitted because of pneumonia, for which they received antibiotics and discharged in 1 to 4 weeks after admission. 6 patients were lost to follow up after discharge.

Statistical analysis :

Right pneumonectomy, tuberculosis, duration of illness, and presence of preoperative empyema were analyzed as risk factors. Duration of 18 months was selected arbitrarily in dividing patients into cohorts for duration of illness.
Data were collected from the patients' charts, operation notes, and pathology reports and entered into a single database. For univariate analysis of any association between the risk factors and the mortality and morbidity rates, Fisher's exact test or cχ 2 test was used, when appropriate. Because of the limited population size, multivariate analysis was not undertaken.

Results:

Because of the chronic nature of the underlying diseases, postoperative complications occurred in many instances later than 30 days. Therefore, postoperative complications were included on either a 60-day or in-hospital basis.

There were no intraoperative deaths. The combined postoperative morbidity and mortality rate was 17.2% (10/58). Three patients (5.1%) died, and 7 (12%) sustained major postoperative morbidity (Table 2). Correlative analysis of the postoperative morbidity and mortality rates with the risk factors displayed dissimilar results (Table 3).

Table 2. Major morbidity and mortality in 58 pneumonectomies

Morbidity and mortality	No. of patients (%)
Morbidity	7 (12)
Empyema	2 (3.4)
Bronchopleural fistula	3 (5.2)
Contralateral pneumothorax	1 (1.7)
Wound dehesence	1 (1.7)
Mortality	3 (5.2)
Bronchopleural fistula	3 (5.2)
Total	10 (17.2)

Table 3. Post-operative morbidity and mortality rates and risk factors.

Risk factors	Morbidity and mortality		Mortality	
	rate	p value	rate	p value
Underlying disease		<0.03		NS
Tuberculosis	6/21		2/21	
Others	4/37		1/37	
Side of operation		<0.03		NS
Left	7/50		2/50	
Right	3/8		1/8	
Preoperative empyema		<0.003		<0.05
Yes	5/13		2/13	
No	5/45		1/45	
Duration of illness		NS		NS
> 18 months	9/50		3/50	
< 18 months	1/8		0/8	
Total	10/58		3/58	

Nearly half of the combined morbidity and mortality (5/10) occurred in patients with preoperative empyema, a group comprising less than one fourth of the patients (13/58) (p<0.003). Similarly, the combined postoperative morbidity and mortality rate was significantly higher in patients with tuberculosis (p<0.03) and those with a right pneumonectomy (p<0.03). Postoperative morbidity occurred in only 1 of 8 patients who had had the disease for less than 18 months (p = not significant).

Although postoperative mortality was more common in patients with tuberculosis (p = not significant) and those who underwent right pneumonectomy (p = not significant), the most prominent increase occurred in patients with preoperative empyema (p<0.05). None of the risk factors was found to have a significant effect on morbidity.

Bronchopleural fistula was the most common postoperative complication; it developed within 3 weeks after pneumonectomy in 5 of 6 patients. The prevalence of BPF increased in patients with empyema (p<0.02) and patients with tuberculosis (p<0.03) (Table 4). Two patients with postoperative BPF died before surgical intervention could be attempted. One of 3 thoracomyoplasty procedures to close the BPF failed, and patient died of resultant sepsis and contralateral pneumonia.

Table 4. The prevalence of Bronchopleural fistula and risk factors.

Risk factors	Morbidity and mortality		
	rate	percent	p value
Underlying disease			<0.03
Tuberculosis	4/21	19	
Others	2/37	5.4	
Side of operation			NS
Left	4/50	8	
Right	2/8	25	
Preoperative empyema			<0.02
Yes	3/13	23	
No	3/45	6.6	
Duration of illness			NS
> 18 months	6/50	12	
< 18 months	0/8	0	
Total	6/58	10.3	

Empyema without BPF formation occurred in 2 patients (3.4%). After chest tube drainage and lavages, one myoplasty and one Eloesser procedure were performed to obliterate the infected postpneumonectomy space.

Contralateral pneumothorax developed in one patient (3.4%) in first postoperative day. Intercostal tube introduced and remained for two days. Patient was discharged after one week. Wound dehiscence occurred in one patient (3.4%) with pus discharge but there was no clinical or radiological evidence of empyema. Culture and sensitivity from the discharge and frequent dressing of the wound was performed. After two weeks, under local anesthesia, wound curettage and closure was performed.

Discussion:

Pneumonectomy is rarely indicated in the pediatric population. However, both acute and chronic refrac-

tory pulmonary infections do occur and may lead in the end to total destruction of lung parenchyma. Destroyed lung caused by benign inflammatory lung diseases is an end-stage phenomenon prone to serious complications. For destroyed lung, pneumonectomy proved to be the most expeditious and effective management for serious complications such as massive hemoptysis, secondary fungal infections, secondary amyloidosis, suppurative infections, and pulmonary-systemic shunting. (1, 5)

The most common cause of destroyed lung in our pediatric patients was bronchiectasis. The causes of bronchiectasis in children are numerous. Nevertheless, in our patients the most common causative factor was frequent pulmonary infection. Most of our patients had histories of insufficient and irregular antibiotic use during one or more admissions to pediatric hospitals. Enlarged parabronchial lymph nodes after pulmonary infections or narrowing secondary to thickening of the bronchial lumen in small airways in children, augment the progression of the bronchiectasis with pneumonia and destruction and may lead to total pulmonary bronchiectasis. (2) The same situation is considered to occur in children with tuberculosis. (6, 7) Invasive procedures, like bronchoscopy to obtain material for bacteriologic studies, remain controversial. (8) Emanuel and Shulman(9) emphasized the importance of early bronchoscopic evaluation of samples for bacteriologic studies. During bronchoscopy, there was thickening in the main bronchus in 2 children as a result of external pressure and intraluminal thickening and narrowing in the main bronchi of 5 patients. Neglected foreign body aspirations can also lead to whole lung bronchiectasis over the long term, as in 2 of our patients. (2)

The present study shows that the unfavorable outcome after pneumonectomy for destroyed lung in children is closely related to the presence of preoperative empyema, tuberculosis, and a right-sided resection. The greatest incidence of postoperative complications is observed in patients with preoperative empyema. The prevalence of postpneumonectomy BPF formation increases in patients with tuberculosis and in those with preoperative empyema.

There was high postoperative complication rate of pneumonectomy in patients with preoperative empyema. When removal of destroyed lung tissue becomes unavoidable because of life-threatening complications, all attempts should be made to reduce the empyema before the operation as by drainage.

The increased complication rate after right pneumonectomy in children as well as in adults has been well recognized.(10, 11) Total lung destruction is more common on the left side than on the right. In our series, 50 children had left while only 8 children had right lung destruction. There are a number of possible reasons for this. The left main bronchus is considerably longer and approximately 15% narrower than the right main bronchus, and the peribronchial space is limited by its proximity to the aorta; thus, it is more prone to obstruction by the enlargement of adjacent lymph nodes. In addition, the more horizontal course of the left main bronchus, compared with the right main bronchus, may have an effect on the drainage of secretions. (12, 13)

Pneumonectomy for tuberculosis is one of the highest risk operations.(6) The explanation for that lies in the facts that, tuberculosis commonly occurs in individuals with poor health status, but it progresses to destroyed lung in those in even worse general status. Preoperative empyema is much more commonly associated with tuberculosis than with other underlying diseases of destroyed lung. In most pneumonectomies, due to underlying tuberculosis, there are firm adhesions between the lung and chest wall, and the perforation of lung cavities during dissection commonly occur. This violation of the cavities will eventually lead to contamination of the pneumonectomy space and empyema, with its grave complications, becomes inevitable. (6, 7, 13)

Whether the space reduction procedure should be performed concomitantly with pneumonectomy or postponed until BPF develops in children who are at high risk for postoperative BPF is controversial. In adults with bulky muscles, myoplasty and space reduction is more effective than in children with thin small muscle mass.(5) The chance that a major postpneumonectomy BPF will result in death, in a severely ill child, before any surgical intervention can be accomplished may justify doing a space reduction procedure concomitantly with pneumonectomy. (13, 14)

In conclusion, pneumonectomy for destroyed lung can be carried out safely in children with acute or chronic pulmonary infections refractory to conservative medical therapy. Careful preparation, often including anti-tuberculous cover, good nutrition, good cardio-pulmonary reserve, and timing of pneumonectomy are essential. Several risk factors, such as, preoperative empyema, tuberculosis, and right-sided disease need to be considered before any surgical intervention is done.

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Comparative Study of Epidural Fentanyl-Bupivacaine Versus Patient-Controlled Analgesia with Fentanyl for Post-Thoracotomy Pain

Abdel Salam Elhenawy,
Ghada Ali,
Osama Hamza,
Husam Elshahawy,
and Salem Abo-Sabe.

Objective: **This study compared epidural and intravenous fentanyl infusions for pain relief for the first 72h after thoracotomy, in order to examine whether thoracic epidural fentanyl infusion offers clinical advantages over an intravenous infusion with respect to analgesic efficacy, respiratory functions and complications.**

Methods: **In this prospective randomized double-blind trial, 50 patients were included for post-thoracotomy pain management. The patients were divided into 2 groups. Group I (25 patients) received thoracic epidural analgesia (TEA group) with continuous thoracic epidural infusion of local anesthetic bupivacaine 0.2% and fentanyl 10µg/ml with a flow rate of 4-6ml/h and saline through their patient controlled analgesia. Group II (25 patients) (PCA group) received an epidural saline infusion at an initial rate 5ml/h and intravenous fentanyl 10µg per demand and 10 min lock-out interval and no background infusion.**

Results: **Spirometric pulmonary function was better after thoracotomy in TEA group than PCA group in all parameters which includes forced vital capacity (FVC) [3.49±0.4 and 3.1328±0.31 respectively], forced expiratory volume in first second (FEV1) [3.0128±0.4 and 2.598±0.30 respectively], FEV1/FVC% [84.36±2.826 and 82.4±3.829 respectively], peak expiratory flow rate (PEF) [3.95±0.9 and 3.55±0.87 respectively], and forced expiratory flow 25-75% of vital capacity (FEF 25-75%) [2.7068±0.26 and 2.31±0.297 respectively]. The pain scores were significantly lower in TEA group when compared to PCA group signifying better analgesia. No major complications related to TEA group or PCA group, and also the complications were lower in TEA group than the PCA group except pruritis which was higher in TEA group.**

Conclusion: **We conclude that epidural fentanyl-bupivacaine infusion is superior to that of PCA with fentanyl in the management of pain after thoracotomy.**

Thoracotomy is one of the standard approaches for pulmonary operations. However, this incision has often been reported to be associated with severe postoperative pain that may have deleterious effects on pulmonary function1, 2. As this pain causes ineffective chest expansion which may predispose to atelectasis, ventilation / perfusion mismatching, hypoxemia and chest infection 3, 4. Thus, the goal of

the clinician is to develop an analgesic regimen that provides effective pain relief to allow post-operative thoracotomy patients the ability to maintain their functional residual capacity by deep breathing5. Effective clearing of secretions with cough and early mobilization can lead to quicker recovery and shorter hospital stay6. Furthermore, inadequate acute postoperative pain management may contribute to the development of a chronic post-thoracotomy pain syndrome7, 8. Although pain control is an important issue after thoracotomy ideal methods should have a high success rate, with easy implementation and minimal complications9. Management of thoracotomy pain can be difficult, but the benefits of effective pain control, are significant. A variety of modalities for treating postoperative pain after thoracotomy are available, including systemic opiates, regional analgesics, and new oral and parenteral agents10. The most commonly used analgesic modalities for lateral thoracotomy are TEA, and PCA. Controlled intravenous opioid infusions, local anesthetic intercostal nerve blocks, non-steroidal anti-inflammatory drugs (NSAIDS), and paracetamol are frequently used in combination with those techniques. The combination of thoracic epidural opioid and local anesthetic is very effective at relieving post-thoracotomy pain11, improving the quality of epidural opioid analgesia and reducing the incidence of opioid side effects12. Continuous TEA and PCA are widely used for postoperative pain control. Studies indicate that both analgesic regimens provide good analgesia after major surgery. This prospective randomized double-blind study was designed to compare the efficacy and safety of the continuous thoracic epidural fentanyl-bupivacaine infusion versus PCA fentanyl intravenous infusion for the management of post-thoracotomy pain.

Materials and Methods:

The study was begun prospectively in December 2002, and terminated in January 2005. The study included 50 patients classified into two groups:

Group 1: Consisted of 25 patients whom received continuous thoracic epidural analgesia (TEA group), received continuous infusion of fentanyl-bupivacaine epidurally and saline through their PCA machine.

Group 2: Consisted of 25 patients whom received patient controlled analgesia (PCA group), received saline epidurally and fentanyl through their PCA machine.

The following were done for every patients: Full history taking to exclude patients with systemic diseases that contraindicate surgical interference, clinical examination which includes general and local examination, plain X-ray chest P.A and lateral views, C.T chest with C.T guided biopsy in some cases, bone scanning to exclude metastatic cases, abdominal ultrasonography to exclude metastatic cases, spirometric pulmonary function tests before and after thoracotomy using (schiller cardiovit AT-10 model 2-157) which includes the FVC, FEV1, FEV1/FVC%, PEF, FEF 25-75%.

All patients received a standardized anesthesia. All patients received the thoracic epidural before the induction of general anesthesia. This was inserted after local infiltration using 18 gauge Tuohy needle and a 20 G multiport epidural catheter inserted at T5-T7 interspace with loss of resistance technique and a negative test dose of lidocaine 2% 3 ml, placement of catheter was confirmed with local anesthetic testing before operation. In both groups anesthesia was induced by fentanyl (2mμ/kg) and thiopental sodium 3.5-5mg/kg intravenously. Tracheal intubation was facilitated by pancrunium (0.08mg/kg) intravenously. Anesthesia was maintained with nitrous oxide 50-60% in oxygen and pancrunium (0.02mg/kg) every 30 minutes, and 0.5-1.5% isoflurane according to blood pressure13. Ventilation was controlled mechanically.

Repeated doses of fentanyl were given during surgery 2μg/kg14, before skin incision and 1μg/kg thereafter every 20 min intravenously. Before extubation of the trachea intravenous neostigmine 0.05 mg/kg and atropine 0.01mg/kg were given as needed to antagonize neuromuscular block.

On arrival in the recovery room group I patients received epidural fentanyl-bupivacaine in titrated doses every 15 minutes until visual analogue scale was less than 4 or until a maximum fentanyl dose of 150 μg by bolus was reached, then epidural infusion, at an initial rate of 4-6 ml/h and a PCA device containing saline at 1ml per demand dose were started in patients in the epidural group. An epidural saline infusion at an initial rate of 5ml/h was started in patients in the PCA group. As soon as they were awake and experiences pain, they received fentany bolus 50 μg intravenously until they were comfortable (with maximum dose of 150 μg) and PCA was started at an initial setting of 1ml (containing 10μg of fentanyl) per demand and 10 min. lock-out interval. Subsequent adjustments of analgesic administration were performed by blinded physician investigators. When the patients deemed their pain relief inadequate or unsatisfactory, a 5ml bolus of solution was given in the epidural catheter and the infusion rate was increased by 1ml/h. simultaneously, the demand dose on the PCA was increased by 0.5ml per demand.

Blood pressure, heart rate, respiratory rate and SPO2 were monitored. Pain was assessed post-operatively using a visual analogue pain scale (VAS 0= no pain, to 10= worst pain) that was done at rest and during cough.

Adverse effects including nausea, vomiting, pruritis, urinary retention, sedation, motor block and respiratory depression (< 8 breaths per minute) were recorded every 2 hours from 7 am to 11 pm for 72 hours after surgery. Pulmonary functions were determined before surgery and 72 hours after surgery. We preoperatively included 50 adult patients scheduled for a classic posterolateral thoracotomy with a preoperative diagnosis of a lung cancer or solitary pulmonary nodule.

We excluded patients who had history of chronic pain with chronic opioid use, history of psychiatric problems such as depression, anxiety, schizophrenia or who were currently on psychotropic medications (as this may have affected their mental capacity to express perception of pain), and allergy to fentanyl or bupivacaine. Other exclusion criteria included pregnancy, patients undergoing lobectomy or bilobectomy in combination with pleurectomy, patients who required post-surgical mechanical ventilation, patients with a history of severe heart disease NYHA > II, or hepatic disease or renal insufficiency, patients with hemorrhagic diathesis or a medication of anticoagulants or acetylsalicylic acid within the last 10 days before admission or active infection or other systemic disease.

Results:

This study included 50 patients divided into two groups:

Group I: Includes 25 patients 17 were males and 8 were females, most of them ranged between 31-65 years.

Group II: Includes 25 patients 19 were males and 6 were females, most of them ranged between 30-64 years.

Pulmonary function tests were done before and 3 days after thoracotomy for both groups. There was no significant difference in epidural group than the PCA group.

S= significant; H.S= highly significant

Median pain scores (with 25th and 75th percentiles) from 0 hours to 72 hours (at 8 hour intervals) after initiation of analgesic therapy are shown in table III.

Side effects and complications tabulated in the two groups included nausea, vomiting, atelectasis, pneumenia (defined as the presence of fever, leukocytosis, purulent sputum, chest X-ray evidence of an infiltrate), pruritis, cardiac and neurologic (table IV).

No patient required bronchoscopy for lobar collapse and no patient developed respiratory failure. Additionally, there were no complications related to the placement of the epidural catheter (lidocaine test dose complications, epidural hematoma, epidural fine and catheter infections).

Discussion:

Analgesia after thoracotomy is of particular significant, as the experience of pain in human reflects a complex system of physiological and psychological processes resulting in endless qualities of pain15. So it is one of the hallmarks of optimal post-operative surgical and anesthetic management16.

The thoracic epidural analgesia and patient controlled analgesia routes of opiate administration have been major advances in analgesic therapy during the past decade. Epidural opiate administration is founded on a large body of knowledge concerning the existence and pharmacology of spinal opioid receptors, which provide an attractive possibility of achieving regional analgesia with minimal central effects. In an effort to improve pain management and bypass the will known problems associated with traditional intramuscular therapy17, both

Table I: Comparison between group I and group II three days after thoracotomy

Parameter	Group	Range	X	S.D±	S.E	t	P	S
FVC	I	1.6-4.3	3.49	0.4	0.08	3.519	<0.0005	H.S
	II	2.4-3.8	3.1328	0.3126	0.0625			
FEV_1	I	2.2-3.8	3.0128	0.4	0.08	4.148	<0.0005	H.S
	II	1.9-3.1	2.598	0.3039	0.0607			
FEV_1	I	78-89	84.36	2.826	0.56	2.067	<0.05	S
FVC	II	74-87	82.4	3.829	0.765			
PEF	I	3.2-6.8	3.95	0.9	0.18	1.66	<0.05	S
	II	2.1-6.2	3.55	0.87	0.174			
FEF	I	2.3-3.3	2.7068	0.26	0.0527	5.465	<0.0005	H.S
25-75	II	2.1-3.0	2.31	0.297	0.05			

the epidural and PCA routes of opiate administration have found wide spread use for postoperative analgesia. Both techniques provide superior analgesia when compared to intramuscular or intermittent intravenous opiate injection18.

Teng19 (2004) retrospectively retrieved data from 859 patients (mean age 64 ± 7 years) who received continuous epidural medication, either morphine or fentanyl-bupivacaine PCA, or intravenous morphine PCA for postoperative pain control after major elective surgery. Nausea and vomiting were most common in the epidural morphine group ($p<0.05$). pruritis occurred least often in patients who received epidural fentanyl-bupivacaine analegesia ($p<0.05$).

Also Macias and his colleagues20 (2002) studied a double-blind comparison of thoracic epidural ropivacaine, ropivacaine-fentanyl or bupivacaine-fentanyl for post-thoracotomy analgesia. They assessed pain scores (rest and spirometry), spirometry, hand-grip strength, PaCo2, heart rate, blood pressure, respiratory rate and side effects for 48 hours. They concluded that epidural ropivacaine-fentanyl offers no clinical advantage compared with bupivacaine-fentanyl for post-thoracotomy analgesia.

According to the pulmonary function in our results, there was no difference between both groups before thoracotomy (table I),

while after thoracotomy and administration of analgesic there was a difference in epidural group than the PCA group (table II).

These results were in agreement with Burgess and his colleagues21 (1994), who evaluated the potential fentanyl-sparing effect of a dilute local anesthetic, bupivacaine, administered in fixed combination with fentanyl for post-thoracotomy analgesia via a continuous thoracic epidural infusion. Their findings suggested that the combination of dilute bupivacaine with fentanyl for thoracic epidural analgesia for post-thoracotomy pain might have beneficial effects on pulmonary gas exchange. The same results recorded by 13,14,18.

Also Cicala et al.22 (1990) demonstrated significant improvements in vital capacity and forced expiratory volumes in patients who received thoracic epidural bupivacaine compared with those who received lumber epidural morphine.

In contrast to our study, although Wu CL et al.23 (1999) found that patients who received epidural analgesia had no difference in pulmonary complications as regard patients with rib fractures in comparison to intravenous PCA. This may be explained by that patients in the epidural group had significantly more rib fractures and were significantly older. Although they concluded superior analgesia in the epidural group than PCA with morphine.

Also Benzon and his collegues24 (1993) found no difference in post-operative forced vital capacity between the 2 groups of randomized double-blind comparison of epidural fentanyl infusion versus patient-controlled analgesia with morphine for post-thoracotomy pain. But they concluded that epidural fentanyl infusion is superior to that PCA in the management of pain, both at rest and during coughing, which assissed by VAS and Verbal Rating Scale (VRS) that were significantly lower and the total pain relief score was higher in the epidural group signifying better analgesia.

This was in agreement with our results, which indicate that for post-thoracotomy patients, an epidural bupivacaine-fentanyl infusion provides better pain relief than PCA fenytanyl (table III).

Table III:Median pain scores at 8 hour interval

Median Pain Scores (0)	Epidural Group Median (25%-75%)	PCA Group Median (25%-75%)	P value
Baseline	4 (3.4)	4 (3.2-5.4)	0.82
8h	2 (1.2)	3 (2.4)	<0.001
16h	1 (1.2 - 7.5)	3 (2.4)	<0.001
24h	1 (1.2)	3 (2.4)	<0.001
32h	1 (1.2)	3 (2.3)	<0.001
40h	1 (1.2)	3 (2.3-7.5)	<0.001
48h	2 (1.2)	3 (2.3)	<0.001
56h	2 (1.2)	2.5 (2.3)	0.005
64h	2 (1.2)	3 (2.3)	<0.001
72h	1 (1.2)	3 (2.3)	<0.001

This difference persisted throughout the 3 days of study.

Our findings are not in agreement with the results of Grand and his colleagues25 whom concluded that satisfactory patient-controlled analgesia can be achieved with both epidural and intravenous fentanyl after thoracotomy. This controversy may be explained by their using epidural fentanyl alone without local anesthetic. But Moon and others26 (1999), reported that epidural analgesia significantly reduced pain with chest wall excursion compared with PCA. The rout of analgesia did not affect the catecholamine response. However, serum level of IL-8, a pro-inflammatory chemoattractant that has been implicated in acute lung injury, were significantly reduced in patients receiving epidural analgesia on days 2 and 3. This may have important clinical implications because lower levels of IL-8 may reduce infectious or inflammatory complications in the trauma patient. Also, tidal volume and maximal inspiratory force were im-

proved with epidural analgesia by day 3. These results demonstrate that epidural analgesia is superior to PCA in providing analgesia, improving pulmonary function, and modifying the immune response in patients with severe chest injury. Also Salomaki's results27 (1993) indicated that pain relief with epidural fentanyl led to a smaller increase of some hormonal, metabolic, and physiologic responses after thoracotomy.

We noted also less complication related to epidural group in comparison to PCA group (table IV).

Table IV: Complications

Complication	Epidural Group	PCA Group
Nausea/vomiting	11 (44%)	7 (18%)
Atelectasis	14 (56%)	18 (75%)
Pneumonia	0	0
Pruritis	15 (60%)	6 (24%)
Cardiac	1 (4%)	4 (16%)
Neurologic	1 (4%)	5 (20%)

This was in agreement with Teng19 (2004) and Salomaki28 (1991).

Conclusion

In conclusion, we found that a thoracic epidural bupivacaine-fentanyl infusion was significantly better than intravenous PCA fentanyl in providing pain relieves after thoracotomy. The difference was noted both at rest and during coughing, and it was persistent throughout the 3 days of study. The degree of sedation was less severe in the patients receiving epidural fentanyl. Pulmonary function was better with epidural group with less frequent pulmonary complication than the PCA group. We therefore recommend that where personnel resources permit, thoracic epidural bupivacaine-fentanyl infusion should be used in the management of pain after thoracotomy because it is a superior mode of treatment.

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The Way I do it

ASUH Annuloplasty Rings, Novel Homemade Rings For Mitral & Tricuspid Valve Repair.

Ezzeldin A. Mostafa, MD

There are many kinds of prosthetic mitral & tricuspid annuloplasty rings. We report the technique of our Ain-Shams University Hospital (ASUH) homemade mitral & tricuspid annuloplasty rings.
A simple and quick technique to fashion a mitral ring was developed using a stainless steel wire covered by a . These homemade rings were implanted in 73 patients with atrioventricular valve (53 mitral & 20 tricuspid) insufficiency in a 4.5 year period, with similar results to commercially available rings.

The Technique

The ASUH homemade ring is then prepared according to the following five steps:

I. As soon as the chest is opened, a piece of pericardium, measuring 1 cm wide by 15 cm long, is harvested and treated with glutaraldehyde.

II. A thread of silk suture is used to measure the length of the wire needed, the same size of the selected conventional valve ring sizer (Carpentier-Edwards Classic annuloplasty ring sizers: 32 for the mitral and 34 for the tricuspid) (Edwards Lifesciences, California, USA) and then it is doubled in measure.

III. A 5 mm stainless steel wire, Ethicon Surgical Stainless Steel Sutures (Conventional Cutting, Sternum Suture, Size 5, Monofilament B&S20, 4-18", CCS, 1/2 Circle). (Ethicon Inc., USA) is measured (double the size of the selected measured ring) and twisted on itself to make solid support to the ring to obtain a stainless steel ring of the desired size. (Fig. 1)

IV. Once the mitral or the tricuspid valve is exposed, the anterior mitral leaflet is sized with a conventional anterior mitral leaflet sizer. The extra-length is trimmed by stainless cutter from the non-looped side.

V. The glutaraldehyde-treated pericardium is sutured around the formed metal (stainless steel) ring such that the joined strip ends lie on the opposite side of the metal ring extremities with interrupted 4/0 Ethicon Ethibond™ Excel Polyester sutures Taper Point, Size 4-0, Green Braided, 30", Needle RB-1, 1/2 Circle .(Ethicon Inc., USA) . That is, the metal ring extremities are in the annulus section along the anterior leaflet, while the pericardial strip ends are in the annulus section along the posterior leaflet to complete the ring. (Fig.

2&3)

Surgical insertion does not differ from commercially available rings. They are then implanted in the routine way with three notions: Firstly, the Ethicon Ethibond™ Excel Polyester sutures, (Taper Point, Size 2-0, Green Braided, 36", Needle SH SH,1/2 Circle). Ethicon Inc., USA) are inserted in an overlapping technique. Secondly, the free ends of the pericardial patch are placed in the anterior section of the annulus. Thirdly, the first commissural annular suture should pass through the terminal loop of the twisted stainless steel wire.

Mitral insufficiency was due to rheumatic disease in 30 patients, degenerative disease in 18 , endocarditis in 1, and congenital heart disease in 4 patients. A total of 34 patients were in NYHA functional class III or IV preoperatively. Midterm follow-up was available in 53 patients from 1 month to 4.6 years (average, 1.2 years). Three had a total of 5 successful pregnancies.

Twenty patients with tricuspid insufficiency underwent repair with homemade ASUH tricuspid annuloplasty rings. Tricuspid insufficiency was due to Ebstein's anomaly in 14 patients and rheumatic disease in 6 patients after mitral valve replacement. A total of 14 patients were in New York Heart Association functional class IV preoperatively. Midterm follow-up was available in 20 patients from 1 month to 4.6 years (average, 1.2 years).

For the mitral valve group, there was no operative mortality. At 4 years, survival and event-free survival rates were 92% and 80%, and freedom from thromboembolic complications and reoperation were 95% and 93%, respectively. Fifty patients (94%) were in NYHA functional class I, 3 patients (6%) were in class II.

For the tricuspid valve group, there was one operative mortality. At 4 years, survival and event-free survival rates were 92% and 80%, and freedom from thromboembolic complications and reoperation were 95% and 93%, respectively. Fifty patients (94%) were in NYHA functional class I, 3 patients (6%) were in class II. Echocardiography at follow-up showed satisfactory mitral and tricuspid valve function.

Comment :

Although refined technology and manufacturing methods are used in the fabrication of annuloplasty rings, such refinements have a direct impact on the prosthesis cost. These ring has several advantages. They are cheap and very economical and the technique is reproducible. They can be tailored at the operating table to each patient. Covering the ring with preserved pericardium, unlike other prosthetic material like polytetrafluoroethylene (PTFE) felt or Dacron, avoid the hemolysis that has been described in some reports. Our ring has the required rigidity but is somewhat flexible at the same time, which is unlike metallic rings. Use of a rigid stainless steel wire yields a rigid mitral ring that is compatible with the postoperative physiology of a mitral valve repair. Although some patients encountered are children and adolescents with a potential for further growth, the main cause of mitral valve disease is rheumatic fever. Annular dilatation was present in all patients. Implantation of a large size mitral ring therefore does not impair further heart growth.

Our ASUH handmade (mitral and tricuspid) annuloplasty rings are cheap and the technique is reproducible. They give excellent outcome comparable to the other commercially available rings.

Redo Cabg Off-pump Through Mini Left Anterior Thoracotomy; A Safer Alternative for Midline Sternotomy

Case Report

Ashraf Bassiony,FRCS
Morsy A Shahin, FRCS
Sami Shahin, FRCS
Yasser Hegazy, FRCS
Mohamed Amrani, FRCS

There is an increasing incidence of reoperative coronary bypass grafting that may be due to graft failure or the progression of new lesions. Lateral thoracotomy has been used successfully in the reoperative setting and provides a safe alternative to median sternotomy in selected cases (1), (6), (8). The source of inflow to the grafts in these cases can be the descending aorta, left subclavian artery or axillary artery; the free graft can be either saphenous vein or radial artery.

We report a case of three vessels disease which required redo CABG nine years following the first procedure.

Female patient 59 years old had a history of CABG nine years ago in the form of left internal thoracic artery to
left anterior descending and Diagonal branch sequentially. She started to develop chest pain and palpitation ,she
is not diabetic nor hypertensive. She had coronary angiogram which showed blocked flow to the LAD and minimal
flow to the diagonal branch, her echocardiography showed good ejection fraction (64%), Left Ventricular End Diastolic Diameter of (41) mm and mild left atrial dilatation, her laboratory investigations were within normal limits. In order to minimize the risk of right ventricle injury during re-entery through a midline sternotomy we elected to graft the left anterior descending artery using a piece of long saphenous vein anastomosed to the left subclavian artery proximally and distally to the LAD via a mini left anterior thoracotomy.

Operative Details :

The patient was anaesthetized generally ,lying supine, skin sterilized and draped .A small left anterior thoracotomy at the 4th space was performed to expose the LAD.

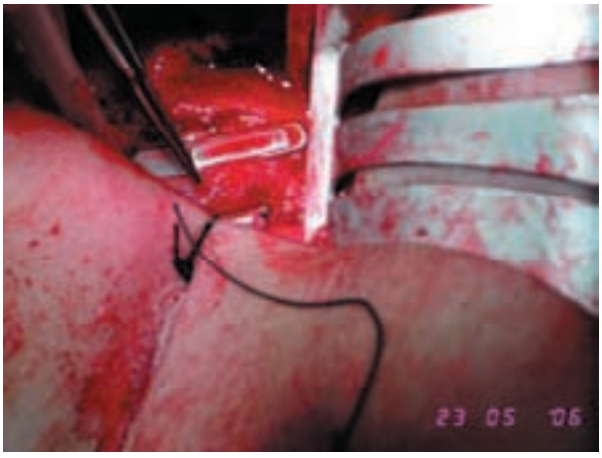
Another left subclavicular transverse incision for exposure of the left subclavian artery,proximal anastomosis was performed first end to side
between the SVG and the left subclavian artery and the vein passed through a tunnel constructed between the upper and the lower incision, the distal end
was performed end to side between the SVG and the LAD ; the anterior
surface of the heart was stabilized using Guidant retractor and stabilizer.
Haemostasis achieved, a drain inserted and wound was closed in layers.

Post operative period was smooth the patient stayed for one night at the ICU and transferred to the ward for four days and went home with complete relief of the anginal pain, she was seen in the outpatient clinic every month for three months and she was absolutely fine.

Discussion :

In the setting of reoperative coronary bypass surgery, access through median

sternotomy carries a high risk for injury of functioning grafts on the anterior surface of the heart as well as dealing with adhesions and calcifications of the aorta.(5)
A mini Lateral thoracotomy combined with an off-pump technique has been used as an alternative approach either for primary grafting or in reoperative cases in selected patients, for vessels on the left side of the heart. It avoids the hazards of median sternotomy and eliminates cardiopulmonary bypass and improves postoperative recovery. (2), (4) (6) (7). The use of left subclavian artery was chosen as an inflow source as it is more suitable for grafting the LAD and easily accessible through a mini thoracotomy approach.(1)



(fig. 1) A small left anterior thoracotomy at the 4th space was performed to expose the LAD. distal end anastomosis was performed end to side between the SVG and the LAD ; the anterior surface of the heart was stabilized using Guidant retractor and stabilizer

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Quiz

1- During cardiac arrest start with

(a) IV adrenaline.
(b) Precordial thumb.
(c) Check breathing.
(d) Consider amiodarone 300 mg in dextrose.

2- Compression:ventilation ratio is

(a) 30:2.
(b) 40:2.
(c) 30:3.
(d) 40:3.

3-During CPR all the following are true except

(a) Correct reversible causes.
(b) Check airway and oxygen.
(c)Give uninterrupted compressions when airway secure.
(d)Give interrupted compressions when airway secure.

4-During CPR all the following are true except

(a) Give adrenaline 1 mg every 3- 5 minute
(b)Consider: amiodarone 300 mg in dextrose, Mg++, K+
(c) Atropine 3 mg once/ pacing.
(d) Atropine 3 mg twice/ pacing.

5-All the following are reversible causes except

(a) Hypo/ hyperkalaemia.
(b) Metabolic.
(c) Toxins.
(d) Hypoalbuminaemia.

6-During rhythm assessment all the following are true except

(a)Shockable VF/ pulseless VT.
(b)Pulseless AF.
(c)Non - Shockable pulseless electrical activity (PEA).
(d)Non - Shockable asystole.

7- Patient with VT/ VF start with

(a) DC shock.
(b) IV adrenaline.
(c) IV atropine.
(d) Correct reversible cause.

8- During shockable VF/ pulseless VT we give 1 shock of

(a) 150- 200 J biphasic or 360 J monophasic.
(b) 100 J biphasic or 360 J monophasic.
(c) 150- 360 J biphasic or 300 J monophasic.
(e)150- 360 J biphasic or 260 J monophasic.

9- Percentage of patients surviving an in hospital cardiac arrest and going home according to the European Resuscitation Council is less than;

(a)30%
(b)50%
(c)20%
(d)10%

10- Regardless of the arrest rhythm give adrenaline utes ; this will be once every two loops of the algorithm. give adrenaline

(a)2mg every 1 min.
(b)1mg every 2 min
(c)1 mg every 3-5 min
(d)1mg every 1-2 min.

11- if VF/VT persists after three shocks ,give Amiodarone intravenous

(a)150 mg over one hour
(b)300 mg by bolus injection
(c)150 mg by bolus injection
(d)300 mg over one hour

12-if VF/VT is confirmed , charge the defibrillator and give shock;

(a)360 J monophasic once every CPR cycle
(b)150 J monophasic twice every CPR cycle
(c)360 J biphasic once every CPR cycle
(d)150J biphasic twice every CPR cycle.

1. b	2. a	3. d	4. d	5. d	6. b
7. a	8. a	9. c	10.c	11.b	12.a

Notes &Quiz