



Journal Homepage: - www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI: 10.21474/IJAR01/12100

DOI URL: <http://dx.doi.org/10.21474/IJAR01/12100>



RESEARCH ARTICLE

IMPACT OF THE PRESERVATION OF THE SUBVALVULAR APPARATUS OF THE ANTERIOR MITRAL LEAFLET ON THE LEFT VENTRICULAR FUNCTION AFTER MITRAL VALVE REPLACEMENT IN EARLY POST-OPERATIVE PERIOD

Mahmoud F. El-Safty, Hazem Gamal Bakr, Mohamed A. El Badawy, Mohamed Abd El-Hady and Yahia Mahmoud

Manuscript Info

Manuscript History

Received: 25 September 2020

Final Accepted: 28 October 2020

Published: November 2020

Key words:-

Preservation of Aml, Mitral Valve Replacement, Lv Function

Abstract

Background: Long-term morbidity and mortality appear to be associated with mitral valve replacement for mitral valve disease. The morbidity rate has not decreased dramatically over the years, despite enhancements in myocardial safety and prosthetic valves. Cardiac failure is the most common cause of death following MVR. Subvalvular apparatus preservation preserves LV function and thus improves survival. Repair, particularly with rheumatic valve disease in young patients and extremely disorganised valves, is not always feasible or effective. The use of smaller valve prosthesis was not only the argument of preserving the anterior leaflet, but also that it could cause LVOT obstruction.

Methods: A prospective controlled randomized study will include (sixty patients aged from 25 to 55 years of both sexes)

They will be divided into two groups of patients:

Group I: thirty patients who underwent MVR without preservation of The chordae tendinae of the anterior mitral leaflet and only preserving the posterior mitral leaflet.

Group II: thirty patients who underwent MVR with complete or partial Preservation of the chordae tendinae of the anterior mitral leaflet.

Results: The sixty patients were divided into two groups where 30 of them underwent preservation of AML,

These patients had a better LV function in the early and the short term postoperative period.

Conclusion: Results of this study concluded that preservation of the AML leads to better postoperative outcome. We recommend its application on a greater scale of cases of MVR.

Copy Right, IJAR, 2020,. All rights reserved.

Introduction:-

Although the optimum management of mitral valve insufficiency is valve repair, valve replacement is necessary when repair is impossible because of anatomical or aetiological considerations (33).

Initial experience with MVR was complicated by an increased incidence of low cardiac output syndrome and associated morbidity and mortality⁽¹⁾. Subsequently, several strategies were implemented to improve postoperative outcomes, including Sub-valvular Apparatus Preservation (SVP)⁽²⁾.

Lillehei started the concept of SVP from more than 40 years old⁽¹⁶⁾. Despite the publication of several studies since the late-1970s suggesting that left ventricular function and mortality were improved following SVP, particularly in patients with mitral regurgitation⁽²⁾.

The main cause of death after MVR is myocardial failure⁽³⁴⁾. Several animal and human echocardiographic physiological studies have shown better maintenance of left ventricular function following SVP⁽²⁷⁾. It is suggested that this is because papillary muscles are important to left ventricular contraction as they draw the mitral ring toward the apex, causing shortening of the long axis and sphericity of the chamber, thereby contributing to better ejection of blood⁽³⁰⁾.

Despite existing evidence suggesting that SVP reduces morbidity and mortality⁽¹⁸⁾, the sub-valvular apparatus is not always preserved often because it is not possible to preserve them. It is argued that the preserved sub-valvular apparatus prevent an adequately sized prosthetic valve from being used, and cause left ventricular outflow tract obstruction, by interfering with prosthetic valve function⁽⁴⁾.

Aim of the study:

Assessment of the immediate and short-term (6 months) changes in the LV performance after MVR with preservation of chordae tendinea of AML.

Patients and Methods

Study design:

1. A prospective controlled randomized study includes (sixty patients aged from 25 to 55 of both sexes).
2. They will be divided into two groups of patients:
3. **The first group:** thirty patients who underwent MVR without preservation of the chordae tendinae of the anterior mitral leaflet and only preserving the posterior mitral leaflet.
4. **The second group:** thirty patients who underwent MVR with complete or partial preservation of the chordae tendinae of the anterior mitral leaflet.
5. Patient will be followed up for left ventricular function after mitral valve replacement in both groups for the short term (6 months post-operative).
6. Informed consent was obtained from all patients before inclusion in the study.
7. Study made from June, 2019 to October, 2020, at National Heart Institute.

Inclusion criteria:

1. The patients who will participate in the study will sign a form of an informed written consent.
2. Patients aged from 25 to 55 years.
3. Elective primary cases of severe mitral valve disease due to rheumatic or degenerative origin which need mitral valve replacement.
4. Patients with ejection fraction above 40%.
5. Patients with only single valvedisease.
6. 1st do patients.
7. Not candidate for mitral valve repair.
8. Normal coronary angiography.

Exclusion criteria:

1. Associated CABG with valvular disease.
2. Redo surgeries.
3. Emergency cases of mitral valve surgery.
4. Patients with ejection fraction less than 40%.
5. Patients candidate for mitral valve repair.
6. Double or triple valve disease.
7. Patients with severe pulmonary hypertension (above 70 mmgh).
8. Patients with infective endocarditis.
9. Patients with liver, kidney and parenchymal pulmonary disease.

Patients were subjected to the following:

Preoperative evaluation:

History taking:

a thorough history was taken; as regards age, sex, and functional class according to the New York Heart Association (NYHA) classification.

Clinical examination:

A complete clinical general and local cardiological examination was performed including:

1. Heart rate.
2. Rhythm.
3. Blood pressure.
4. Chest and heart auscultation.

Investigations:

Laboratory investigations:

1. Liver function tests (total bilirubin, liver enzymes, serum albumin, total proteins, prothrombin time, and concentration).
2. CBC
3. Kidney function tests (serum urea and creatinin).
4. Fasting blood sugar.
5. Serum electrolytes.

Electrocardiogram:

12-leads ECG was done for all patients.

Radiological examination:

Plain chest x-ray postero-anterior and lateral views in the erect position were done to evaluate the cardiothoracic ratio, the different cardiac chamber, pulmonary vasculature, and signs of lobar collapse.

Echocardiography:

M-mode, two dimensional and Doppler echocardiography were done for each patient. Evaluation included assessment of the left ventricular end-diastolic diameter (EDD), left ventricular end- systolic diameter (ESD), fractional shortening (FS), ejection fraction (EF), and left ventricular wall motion.

Mitral valve pathology and morphology, left atrial (LA) dimension and the pulmonary artery pressure (PASP).

Intraoperative procedures:

Anesthetic techniques:

The intraoperative anesthetic technique was the same for all patients and consisted of Fentanyl 5-10 mic/kg, and endotracheal intubation was facilitated with the use of Pancromium 0.02 mg/kg and a supplemental hypnotic dose of Propofol 0.5-1 mg/kg. Additional dose of Fentanyl 100-200 mg was given in on need basis. After full muscle relaxation, the trachea was intubated orally with an appropriate sized endotracheal tube. Anaesthesia was maintained with Isoflurane 0.5-1%. After induction, a triple lumen central venous catheter plus a single lumen one were inserted. A urethral catheter, nasogastric tube and a nasopharyngeal temperature probe were inserted.

Cardiopulmonary bypass (CPB):

Heparin 350U/kg was administered prior to cannulation. After cannulation and institution of CPB, perfusion was maintained at a flow rate according to the patient's body weight and BSA. Myocardial protection was carried out through systemic cooling to 28 C, topical iced saline, and ante grade cold crystalloid cardioplegia. Cardioplegia (St Thomas solution) was infused into the ascending aorta at 4 °C with a pressure of 200 mmHg. Induced cardiac stand still was usually achieved within one minute. Cardioplegia was given in a dose of 15-20 ml/kg every 30-40 minutes.

Surgical techniques:

All patients were submitted to mitral valve replacement through median sternotomy. After connecting the patient to the CPB through Aorto-bicaval cannulation of the heart, Patients were operated by one of the following techniques according to the surgeon's decision:

Mitral valve was inspected through a left atriotomy or transatrial incision. A semi-elliptical-shaped piece of tissue was excised from the annulus of the anterior leaflet, leaving a 5–10-mm long rim of leaflet whose free edge remained attached to the primary and secondary chordae tendineae. The strip was detached only from the annulus at the anterolateral commissures and reattached to the annulus beginning at the posteromedial commissures in a counterclockwise fashion with mattress sutures that was also used for the valve replacement. Because the strip is not detached from the annulus at the posteromedial commissures, no additional sutures were placed in the annulus. The strip was usually shorter than the annulus, so it was rotated in a posteromedial direction as it was sutured and, as a result, did not protrude into the left ventricular outflow tract.

When the leaflet was found to be thickened and calcified, it was divided into 2 to 5 chordal segments depending on the size of the valvular leaflet. Each segment then was trimmed into chordal buttons and reattached to the annulus in an anatomic fashion. When the chordal buttons appeared to be excessive and couldn't be excised, a tonsil clamp was used to hold it on the atrial side of the annulus when the valve sutures were tied; this prevented it from protruding into the left ventricular outflow tract or interfering with prosthetic valve function.

The posterior leaflet, when pliable, was retained completely, together with the attached chordae tendineae. Redundant leaflet tissue was folded up into the annulus by placing the valve sutures through the annulus and bringing them through the leading edge of the leaflet tissue. Incisions or small wedge resections of the leaflet were performed if the posterior leaflet was thickened and fibrotic to allow implantation of a larger valve.

Replacement of the Mitral Valve without preservation of any of the chordae tendineae of the anterior mitral leaflet.

Operative Parameters:

The following data were recorded:

1. The state of the mitral valve, the leaflet, the subvalvular apparatus, whether there was calcification or not.
2. Cross clamp time: this is the ischemic time recorded from applying the aortic clamp until removal of the clamp.
3. Total bypass time.
4. Weaning of bypass was it eventless or complicated.
5. Inotropic support.

Postoperative Management:

All patients were transferred to the intensive care unit (ICU), where monitoring of the hemodynamic parameters were ensured.

Mechanical ventilation:

Patients were kept on mechanical ventilation and weaning was done gradually using continuous positive airway pressure (CPAP) and pressure support (10-15cmH₂O) modes. The criteria for extubation were:

1. Full recovery of sensorium.
2. Adequate minute ventilation.
3. Good arterial blood gases and acid base balance.
4. CPAP of 5 cmH₂O and pressure support of 5 cm H₂O.
5. Fractional inspired oxygen (FiO₂) of 40%.
6. Hemodynamic stability with or without physiological doses of inotropic support.
7. Minimal drainage from the chest tubes.

The time from arrival to the ICU until weaning from mechanical ventilation was calculated in both groups.

Continuous monitoring:

1. Electrocardiogram.
2. Invasive arterial blood pressure monitoring.
3. Central venous pressure.
4. Peripheral body temperature and oxygen saturation through pulse oxymetry.
5. Frequent arterial blood gases analysis.
6. Fluid chart and urinary output.

Antibiotic prophylaxis:

Which was started at the induction of anaesthesia, continued for 3 days postoperatively.

Anticoagulation:

Subcutaneous low molecular weight heparin injection, twice daily, started from the first post-operative day provided that there was no bleeding in the immediate postoperative period, and continued until Cumarin therapy established and the INR was between 2.5-3.5.

Ward stay:

Patients were transmitted to the normal wards after discharge from ICU. Patients were followed up during hospital stay with:

1. Physical examination.
2. Electrocardiogram.
3. Chest X-ray.
4. Echocardiography. M-mode, two-dimensional and Doppler echocardiography were performed for all patients before discharge and 6 months postoperatively.

Complications:

Either valve related or non-valve related complications:

1. Bleeding.
2. Valve thrombosis.
3. Cerebrovascular accident as occlusive (ischemic) or hemorrhagic in origin, in terms of transient ischemic attack (< 24h), reversible ischemic neurological deficit (RIND-minor stroke) (> 72h with complete resolution within 3 weeks), major stroke.
4. Systemic (non-cerebral) embolism.
5. Systemic (non-cerebral) bleeding.

Other complications such as wound infection, lung collapse, pleural or pericardial effusion, mediastinitis and others, were also evaluated.

Statistical Methods:-

Data were statistically described in terms of range, mean \pm standard deviation (\pm SD), frequencies (number of cases) and relative frequencies (percentages) when appropriate. Comparison of quantitative variables over the study period was done using repeated measure analysis of variance (ANOVA) test with posthoc multiple 2-group comparisons. For comparing categorical data, Chi square (χ^2) test was performed. Yates correction equation was used instead when the expected frequency is less than 5. A probability value (p value) less than 0.05 was considered statistically significant. All statistical calculations were done using computer programs Microsoft Excel version 7 (Microsoft Corporation, NY, USA) and SPSS (Statistical Package for the Social Science; SPSS Inc., Chicago, IL, USA) statistical program for Microsoft Windows.

Results:-**Preoperative Assessment:**

This study was conducted on 60 patients having rheumatic or degenerative mitral valve disease undergoing mitral valve replacement. All patients completed the study; there were no mortality among the patients.

The study included:**Demographic data:****Group A:**

17 females (57%) and 13 males (43%). The mean age was 31.53 ± 6.68 . The mean body surface area (BSA) was 1.6 ± 0.12 .

Group B:

18 females (60%) and 12 males (40%). The mean age was 31.47 ± 5.60 . The mean body surface area (BSA) was 1.5 ± 0.14 (Table -1).

Table (1):- Showing the demographic data.

	Group A	Group B
Males	13 (43%)	12 (40%)

Females	17 (57%)	18 (60%)
Mean BSA	1.6± 0.12	1.5± 0.14
Age	31.53±6.68	31.47±5.60

Clinical Presentation:

All patients presented with dyspnea. Patients were classified according to New York Heart Association (NYHA) classification;

Group A:

10 patients (33%) were in class II, and 20 patients (67%) were in class III.

3 patients (10%) had a history of thromboembolisation, 15 patients (50%) had AF, and 15 patients (50%) had sinus rhythm. The duration of symptoms was 3.5± 1.23 years.

Group B:

6 patients (20%) were in class II, and 24 patients (80%) were in class III. One patient (3%) had a history of thromboembolisation, 14 patients (47%) had AF, and 16 patients (53%) had sinus rhythm. The duration of symptoms was 3.0± 1.67 years (Table -2).

Table (2):- Showing the preoperative clinical presentations.

Prep.	Group A	Group B
NYHA Class II	10 (33%)	6 (20%)
NYHA Class III	20 (67%)	24 (80%)
AF	15 (50%)	14 (47%)
Duration of Symptoms	3.5 ± 1.23 years	3.0± 1.67 years

Preoperative Echocardiography:

Preoperative echocardiographic evaluation; bidimensional, M-mode, colour flow Doppler was performed prior to surgery in all patients.

Group A:

Mitral valve pathology was: 8 patients (27%) had isolated mitral regurgitation (MR), 10 patients (33%) had isolated mitral stenosis (MS), and 12 patients (40%) had double mitral lesion (DM). Functional tricuspid regurgitation was mild or didn't exist in 27 patients (90%) and moderate in 3 patients (10%). The subvalvular apparatus was mildly thickened and fused in 5 patients (17%), while in 25 patients (83%) it was markedly thickened, fused, and calcified.

The mean Wilkin's score was 10.4 ± 0.6.

The mean End Diastolic dimension was 6.08 ± 1.3 cm.

The mean End Systolic dimension was 4.19 ± 0.6 cm.

The mean EF was 61.8 ± 7.9 %.

The mean PASP was 40.13 ± 9.11 mmHg.

Group B:

Mitral valve pathology was: 15 patients (50%) had isolated mitral regurgitation (MR), 8 patients (27%) had isolated mitral stenosis (MS), and 7 patients (23%) had double mitral lesion (DM). Functional tricuspid regurgitation was mild or didn't exist in 28 patients (93%) and moderate in 2 patients (7%). The subvalvular apparatus was mildly thickened and fused in 21 patients (70%), while in 9 patients (30%) it was markedly thickened, fused, and calcified.

The mean Wilkin's score was 9.1 ± 0.7.

The mean End Diastolic dimension was 5.97 ± 1.5 cm.

The mean End Systolic dimension was 4.34 ± 0.5 cm.

The mean EF was 60.4±5.9%.

The mean PASP was 38.94±11.69 mmHg. (Table -3)

Table (3):- Showing the preoperative echocardiography details.

	Group A	Group B
EDD	6.08 ± 1.3	5.97 ± 1.5
ESD	4.19 ± 0.6	4.34 ± 0.5

EF	61.8 ± 7.9	60.4±5.9%
PASP	40.13 ± 9.11	38.94±11.69
Wilkin's score	10.4 ± 0.6	9.1 ± 0.7

Operative Assessment:

Group A:

Mitral Valve replacement was performed without preservation of any of the chordae tendineae of the anterior mitral leaflet.

Group B:

The techniques of preservation:

MVR with preservation of chordae tendineae was done for all the 30 patients. The techniques of preservation were: A technique in which a semi-elliptical-shaped piece of tissue was excised from the annulus of the anterior leaflet +PML preservation in 6 patients (20%); the anterior leaflet was divided into 2 to 5 chordal segments + PML preservation in 24 patients (80%).

The type and size of the prosthetic valve:

Group A:

All the valves used were of the mechanical type, 15 patients (50%) had a St. Jude mitral prosthesis, 9 patients (30%) had Sorin, and 6 patients (20%) had ATS. The sizes of the valves were 33mm in 2 patients (6%), 31mm in 6 patients (20%), 29 mm in 6 patients (20%), 27mm in 15 patients (50%), and 25mm in 1 patient (3%).

Group B:

All the valves used were of the mechanical type, 17 patients (57%) had a St. Jude mitral prosthesis, 8 patients (27%) had Sorin, and 5 patients (17%) had ATS. The sizes of the valves were 31mm in 3 patients (10%), 29 mm in 7 patients (23%), 27mm in 20 patients (67%), and 25 mm wasn't used in this group (Table -4, Figure-1).

Sizes of prosthetic valve in mm	Group A	Group B
25	1	0
27	15	20
29	6	7
31	6	3
33	2	0

Table (4):- Sizes of mechanical prosthesis used.

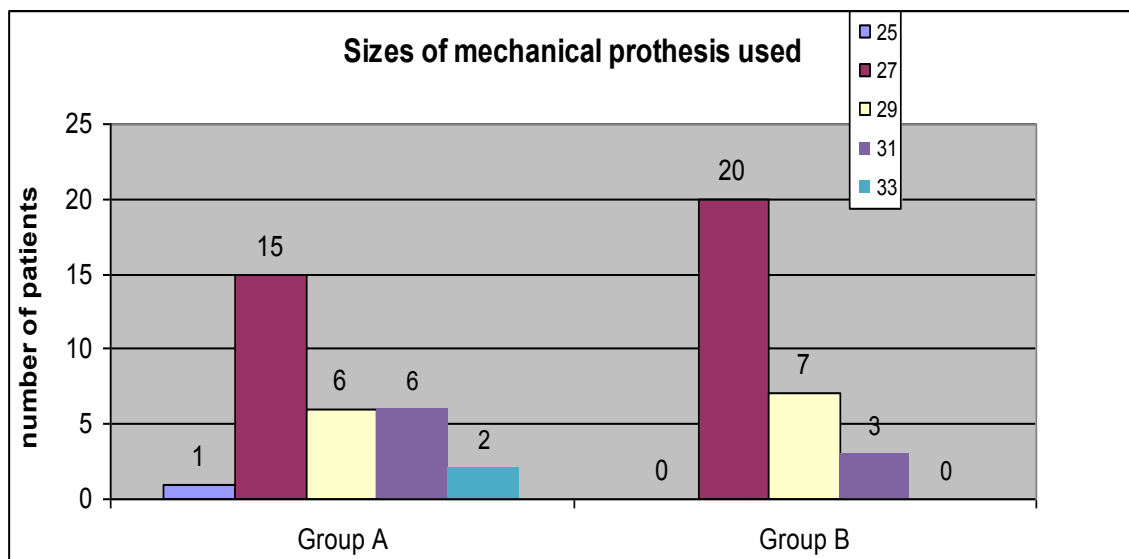


Figure (6-1):- Sizes of mechanical prosthesis used.

Aortic cross clamp and total bypass time:

Group A:

The mean aortic cross clamp time was 54.20±7.43 minutes. The mean total cardiopulmonary bypass time was 69.40 ±7.56 minutes.

Group B:

The mean aortic cross clamp time was 65.20±9.71 minutes. The mean total cardiopulmonary bypass time was 82.13±6.23 minutes, (Fig. 6-2 & Table 5)

Table (5):- Showing Aortic Cross Clamp Time and Total Bypass Time.

	Group A		Group B		P value	Significance
	Mean	S.D	Mean	S.D		
AXC	54.20	±7.43	65.20	±9.71	0.000	Significant
By pass time	69.40	±7.56	82.13	±6.23	0.000	Significant

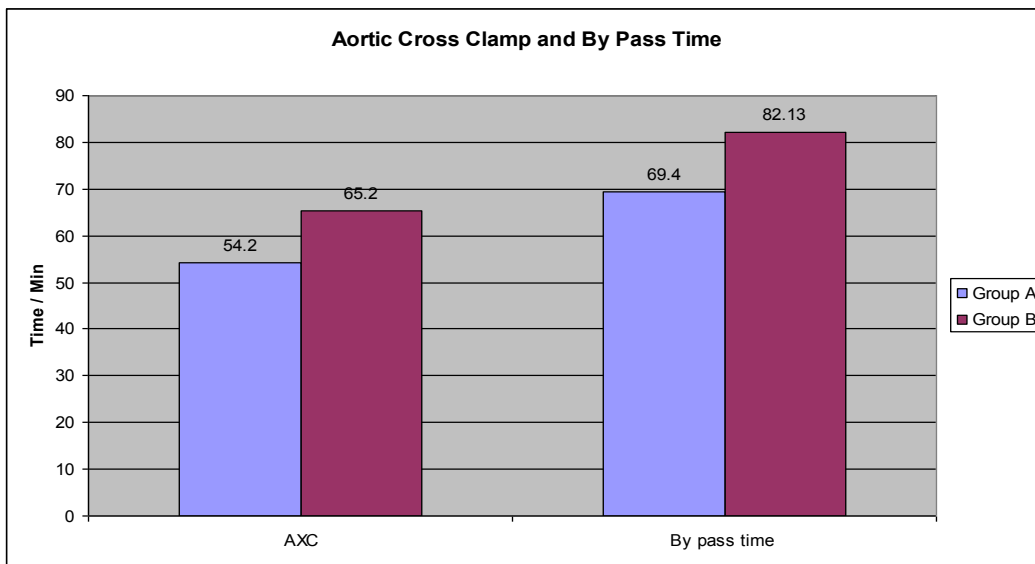


Fig (6-2):- Aortic Cross Clamp Time and Total Bypass Time.

Inotropic support:

Group A:

Weaning of bypass was smooth and without inotropic support in 12 patients (40%), while in 18 patients (60%) a small dose of adrenaline (0.05 mic/kg/min) was used.

Group B:

Weaning of bypass was smooth and without inotropic support in 2 patients (6.7%), while in 26 patients (86.7%) a small dose of adrenaline (0.05 mic/kg/min) was used, while in 2 patients(6.7%) larger dose of adrenaline (0.1 mic/kg/min)was used, (Fig. 6-3 & Table 6)

Table (6):- Showing the need for Inotropic Support.

		GroupA	Group B	P value	Significance
		(n=30)	(n=30)		
Inotropes	No	12(40%)	2(6.7%)	0.002	Significant
	Yes	18(60%)	28(93.3%)		

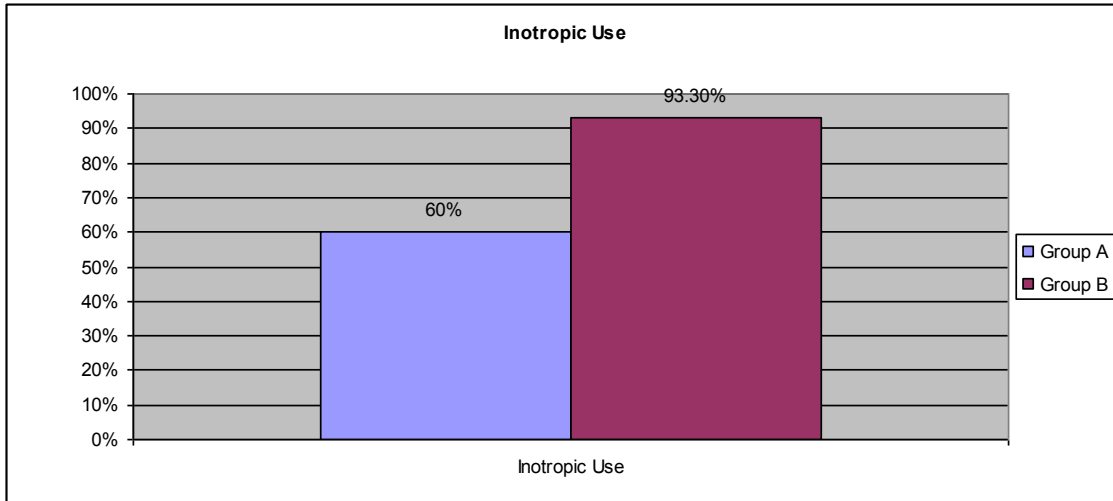


Fig (6-3):- Showing the Need for Inotropic Support.

Postoperative Data:

All patients were transferred to the cardiothoracic ICU and mechanically ventilated.

Group A:

The mean mechanical ventilation time was 5.63 ±1.87 hours while the mean total stay in the ICU was 38.4 ± 10.63 hours.

Group B:

The mean mechanical ventilation time was 7.40±3.96 hours, (Fig. 6-4), while the mean total stay in the ICU was 44.62 ± 9.79 hours, (Table 7)

Table (7):- Showing the Ventilation Time and Total ICU stay.

	Group A		Group B		P value	Significance
	Mean	S.D	Mean	S.D		
Ventilatory Support/hour	5.63	±1.87	7.40	±3.96	0.031	Significant
Total ICU stay/hour	38.4	± 10.63	44.62	± 9.79	0.028	Significant

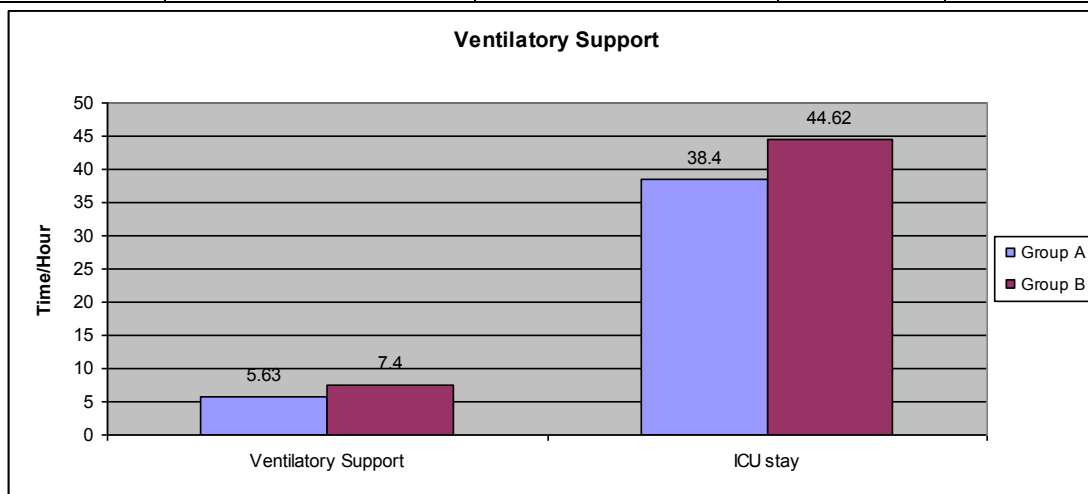


Fig (6-4):- Showing the Ventilation Time and Total ICU stay.

Postoperative complications:

Bleeding:

Re-exploration for bleeding in the early postoperative hours was needed in 2 patients (6.7%) in each group.

Other Complications:

In group A 4 patients (13.3%) had postoperative complications while in group B, 3 patients (10%) had postoperative complications

These complications include:

Rhythm disturbance:

In group A, one patient had a nodal rhythm on the first 7 hours post operatively, then rapid AF which was then controlled by medical treatment in the ICU.

In group B, two patients suffered from rhythm disturbances, the first patient had a complete heart block and he was paced by a temporary pacemaker for 6 hours then he returned back into normal sinus rhythm, the other patient was in nodal rhythm for 3 hours then returned back to AF.

Superficial wound infection:

This occurred in two patients in group A, and one patient in group B and they all responded to medical treatment.

Bleeding due to excessive anticoagulation:

This occurred to one patient in group A in the form of excessive bleeding from the nose, the INR was 5.5. The anticoagulation was stopped for 3 days, also 2 units of fresh frozen plasma was transfused for the patient. Then the INR was adjusted and accordingly the anticoagulation was resumed.

Table (8):- Complications.

Complications	Group A	Group B
Bleeding	2	2
Rhythm Disturbances	1	2
Superficial wound infection	2	1
Bleeding due to excessive anticoagulation	0	1
Total	5(17%)	6(20%)

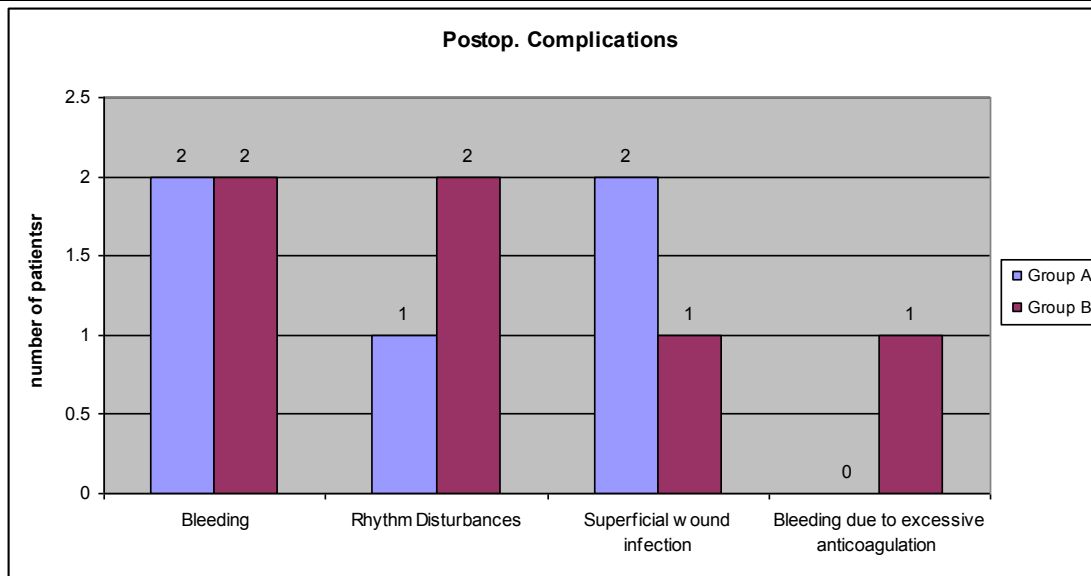


Fig (6-5):- Complications.

P value is 0.442, so there's no statistical significance for the postoperative complications in both groups.

Postoperative echocardiography:

In order to determine the role of the prosthesis, echocardiography was performed prior to discharge around the 7th postoperative day and 6 months postoperatively; it was normal in all cases. In group A, the mean gradient over the mitral prosthesis was 3.734 ± 0.3075 mm Hg and in group B, 3.931 ± 0.291 . Dimensions, EF and PASP have been calculated and the preoperative values have been compared.

In group B, there was a higher EF in both early and 6 months postoperative echo than in group A, and this is statistically important (P value = 0.001 and 0.00013).

Mean LVEDD decreased in group A from 6.08 ± 1.3 preoperatively to 6.04 ± 1.08 postoperatively on the 7th day, but the difference was not statistically important, $P = 0.42$. Mean LVEDD continued to decrease significantly to 5.89 ± 1.12 , 6 months post-operatively, with a statistically non-significant P value of 0.064. Mean LVESD decreased marginally from 4.19 ± 1.1 preoperatively to 4.02 ± 0.96 preoperatively in the early postoperative period. The decline was also mild at 6 months postoperatively, with a non-significant decrease in mean LVESD to 3.87 ± 0.63 (P=0.31).

Mean LVEDD decreased in group B from 5.97 ± 1.24 preoperatively to 5.79 ± 1.13 postoperatively on the 7th day, but the difference was not statistically important, $P = 0.08$. The mean LVEDD continued to decrease significantly to 5.48 ± 1.9 , 6 months after surgery, with a statistically significant P value of 0.042. Mean LVESD decreased marginally from 4.34 ± 0.83 preoperatively to 4.11 ± 0.91 preoperatively in the early postoperative period. The decline was noticeable after 6 months postoperatively, with a substantial decrease in mean LVESD to 3.68 ± 0.96 (P=0.05).

Table (9):- Preop and Postop LVEDD.

	Preoperative	7 days postoperative	6 months postoperative
	Mean S.D	Mean S.D	Mean S.D
Group A	6.08 ± 1.03	6.04 ± 1.08	5.89 ± 1.12
Group B	5.97 ± 1.24	5.79 ± 1.13	5.48 ± 1.9
P value	0.22	0.064	0.042
Significance	Nonsignificant	NonSignificant	Significant

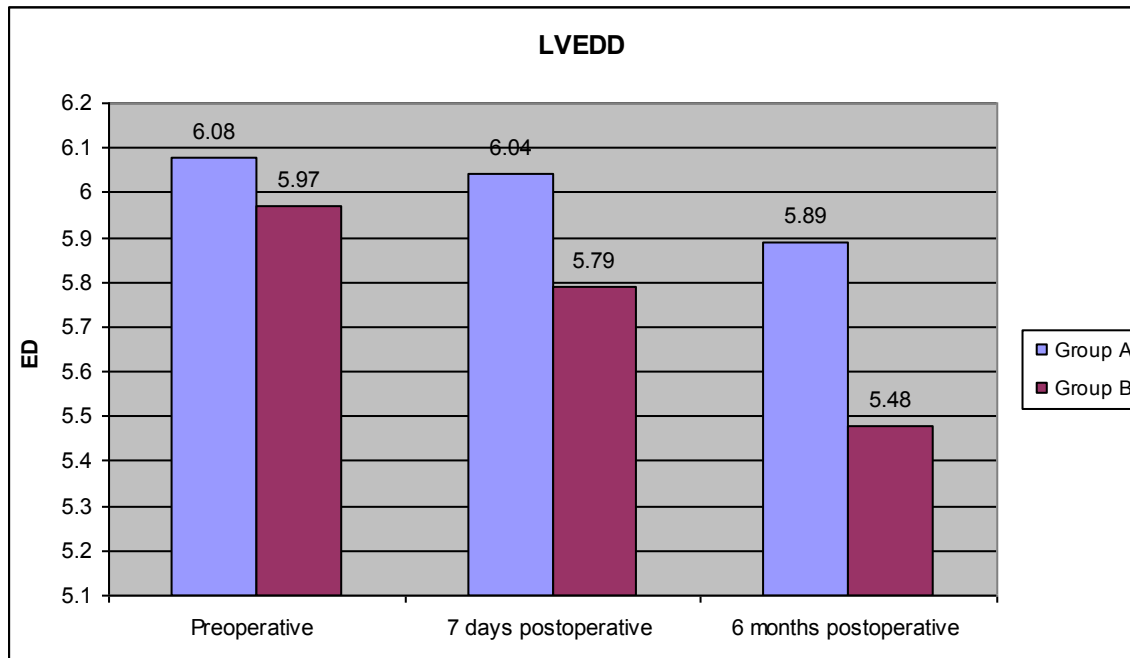


Fig (6-6):-Preop and Postop LVEDD

Table (10):- Preop and Postop LVESD.

	Preoperative	7 days postoperative	6 months postoperative
	Mean S.D	Mean S.D	Mean S.D
Group A	4.19 ± 1.1	4.02±0.96	3.89±0.63
Group B	4.34±0.83	4.11±0.91	3.68±0.96
P value		0.31	0.05
Significance	Nonsignificant	NonSignificant	Significant

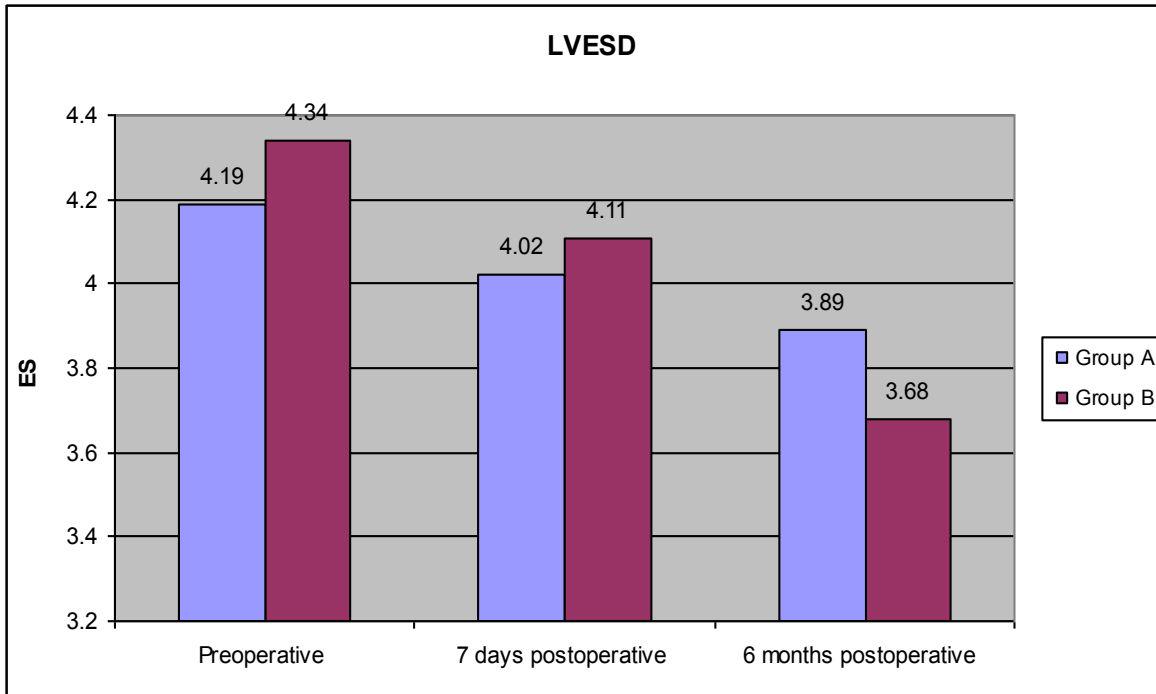


Fig (6-7):-Preop and Postop LVESD

Table (11):-Pre- and post-operative ejection fraction in the echocardiography.

	Preoperative	7 days postoperative	6 months postoperative
	Mean S.D	Mean S.D	Mean S.D
Group A	61.8±7.9	43.6±5.9	58.4 ±6.1
Group B	60.4 ±5.9	48.1 ±4.2	64.53±5.2
P value	0.442	0.001	0.0167
Significance	Nonsignificant	Significant	Significant

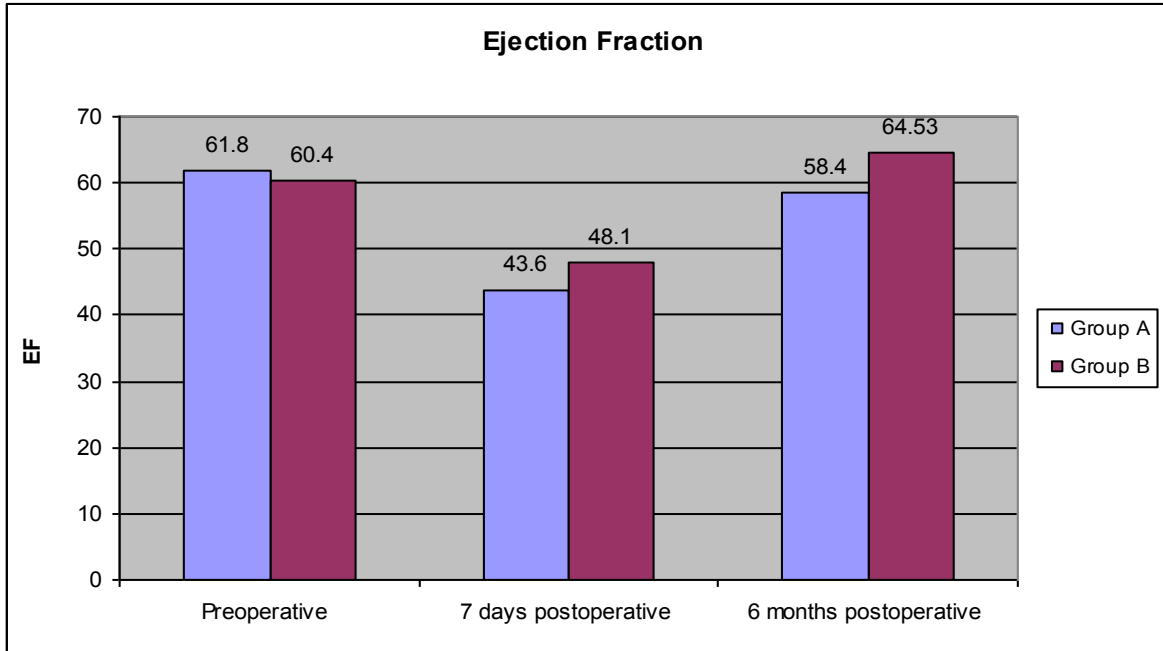


Fig (6-8):-Pre- and post-operative ejection fraction in the echocardiography

Table (12):-Pre- and post-operative Pulmonary artery pressure.

	Group A		Group B		P value	Significance
	Mean	S.D	Mean	S.D		
PASP-pre	40.13	±9.11	38.94	±11.69	0.661	Nonsignificant
PASP (7 days post-op)	35.53	±6.19	36.93	±8.15	0.457	Nonsignificant
PASP (6 months post-op)	31.53	±4.150	32.13	±5.41	0.632	Nonsignificant

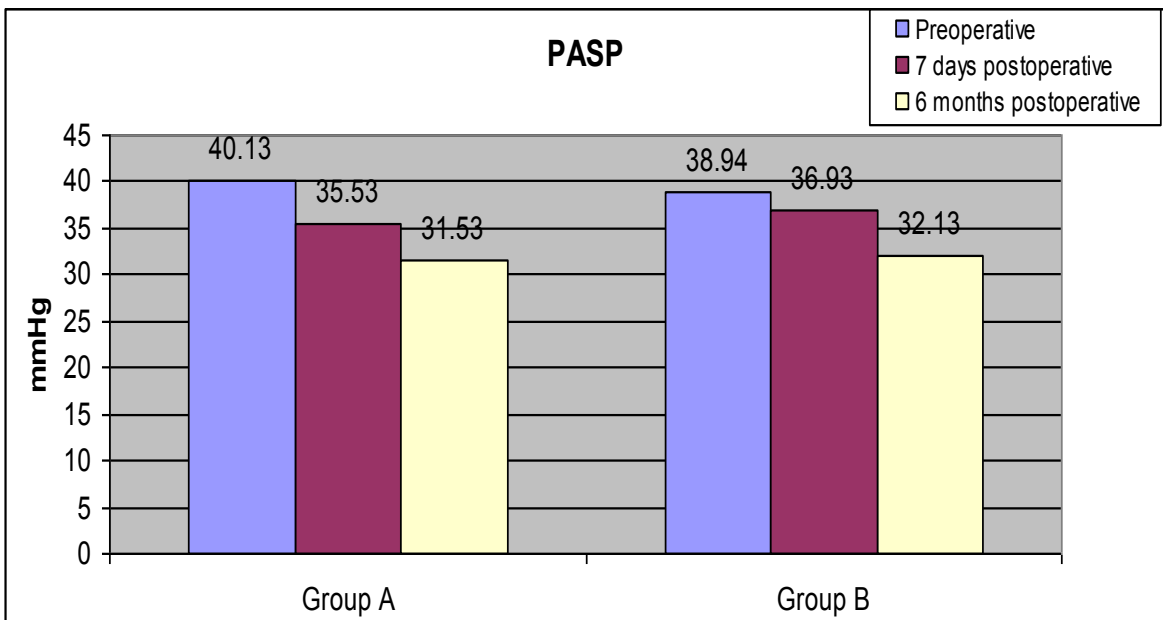


Fig (6-9):-Pre- and post-operative Pulmonary artery pressure.

Hospital stay (calculated from the day of the operation):

The mean hospital stay in days was 10.87 ± 2.94 in group A, while it was 10.0 ± 3.73 in group B.

Discussion:-

Rushmer and his peers (25) showed in 1956 that the papillary muscles play an important role in the contraction of the left ventricle. Lillehei and his colleagues found that preservation of the chordae of the posterior mitral leaflet resulted in a decrease in mortality from 37 to 14 percent in MVR patients, referring to Rushmer's findings in 1964. In patients with mitral valve replacement after MVR without protection of chordae tendineae, a substantial reduction in LVEF was noted by most investigators. After traditional MVR, the decrease in LVEF was caused by several variables, such as decreased preload, increased afterload, Contractile control or disabled. Preload is reduced by elimination of the regurgitant volume after MVR for mitral regurgitation, whereas afterload is increased by the disappearance of the low impedance ejection root into the left atrium. Interruption of ventricular valve interaction with the shift in loading status (32) is thought to be the key factor responsible for decreased ejection efficiency.

David and co-workers reintroduced Lillehei's methodology in 1981 and Hetzer and his colleagues (14) in 1983(5). In a larger series of patients, they documented the beneficial effects of chordal preservation on the clinical status of the patients with respect to the need for catecholamines and other clinical parameters.

In 1988 Miki and his colleagues⁽¹⁹⁾ published a new technique that allowed not only preservation of the posterior, but also of the anterior mitral leaflet.

Many surgeons continue to retain only the posterior leaflet with chordae tendineae because of concerns over greater technical complexity, longer operating time, potential interference with mechanical leaflet motion, need to undersize the mitral prosthesis, and the possibility of creating left ventricular outflow tract obstruction (LVOTO)⁽¹⁷⁾.

To overcome the limitation of bileaflet preservation, a variety of techniques have been introduced. These differ primarily in the location where the anterior leaflet chordae are inserted in the mitral annulus. The tension of the preserved main anterior leaflet chordae may act on the posterior annulus (Feike's technique), the trigonal area (Miki's technique), on the anterior annulus (Khonsari's I and II technique), or on a point half-way between these locations (Hetzer's technique)⁽⁴⁾.

This research was conducted to evaluate the immediate and short-term improvements (6 months) in LV output following MVR with chordae tendineae preservation. Thirty patients who underwent MVR with complete or partial preservation of chordae tendineae were studied to obtain this objective, compared to other group of thirty patients with nearly same preoperative risks and severity of disease, without any type of subvalvular apparatus preservation of the AML. We excluded from the study patients with associated coronary heart disease requiring coronary artery bypass surgery, associated other valvular disease necessitating other valves replacement, Patients with infective endocarditis, and Redo heart surgery. Patients with mild functional tricuspid regurgitation were included in the study.

The mean age in our sample was 31.53 ± 6.68 and 31.47 ± 5.60 years respectively. In our study the mean age is lower than in other studies since rheumatic affection is evident in Egypt in this age group. In 1996(21), Natsuaki and associates recorded a mean age of 55 ± 10 in their study. In 1994, Okita and his colleagues(22) recorded a mean age of 52.6 years, despite the fact that the valve disease was only of rheumatic origin in their study. A mean age of 35.6 ± 19.0 was reported by Chowdhury and his colleagues in 2005(4); their research was performed in India and the valve pathology was rheumatic mitral disease.

In our research, females contributed to 58 percent of patients, which indicates that there is more female love. In the 1994 study of Okita and his peers,(22) women contributed 76 percent.

In Egypt, we have several patients with mitral stenosis with highly calcified leaflets and extreme pulmonary hypertension (PASP above 90 mmHg) in very late stages. These patients were removed from our study. In 2010, Zakai SB(35) and colleagues found that an important finding between the groups was that of PA pressures and LA scale. In the conservation classes, there was a substantial improvement relative to the resection group, whereas there was no statistically significant difference in the improvement of pulmonary artery pressure in our sample.

Straub and his colleagues in 1996⁽²⁸⁾ reported that preservation of the mitral subvalvular structures resulted in a significant reduction of arrhythmias in the postoperative course. In our study (in group B) AF existed preoperatively in 13 patients (43%); three of them were converted to SR before discharge. New onset AF occurred in one of patients, in whom re-conversion to sinus rhythm was successful

Chowdhury and his colleagues in 2005⁽⁴⁾ had a higher preoperative incidence of AF; 62.8% in the non-chordal group, 62 % in the posterior chordal-preservation group and 72 % in the total preservation group. Postoperatively the incidence of AF was 40%, 46 %, 42.4 % with no statistically significant difference ($p = 0.61$). They concluded that that chordopapillary preservation techniques did not affect the outcome of postoperative atrial fibrillation.

Mitral valve pathology in our study (group B) was 15 patients (50%) had isolated mitral regurgitation (MR), 8 patients (27%) had isolated mitral stenosis (MS), and 7 patients (23%) had double mitral lesion (DM) lesion.

In our research, a technique used to maintain annulopapillary continuity was determined by the state of the subvalvular apparatus. We used the technique of cutting a semi-elliptical piece of tissue from the anterior leaflet when the annulus was not extremely thickened, which was the case in 6 patients (20 per cent). In 24 patients (80 percent), when the anterior leaflet was severely thickened and calcified, Based on the size of the valve leaflet, it was divided into 2 to 5 chordal parts. Each section is then trimmed into chordal buttons and anatomically connected to the annulus. All the native chordal structures of the anterior mitral leaflet were resected in group A patients because the subvalvular apparatus was markedly sick, so only posterior mitral leaflet preservation was performed.

Compared to other studies **Hennein and colleagues in 1990**⁽¹²⁾ reported a cross clamp time of 45 ± 10 min in the conventional group and 47 ± 11 in the preservation group, while in our study the mean crossclamp time in group A was 54.20 ± 7.43 minutes, and it was 65.20 ± 9.71 in group B. **Gaiotto and his colleagues in 2007**⁽⁸⁾ reported cross clamp time of 46 ± 12 min, they used intermittent antegrade cardioplegia with coronary reperfusion to reduce the cross clamp time. The other reason for the shorter cross clamp time in the two previous studies is that they were conducted on patients with isolated mitral regurgitation of degenerative pathology. **Ghosh and his colleagues in 1992**⁽¹⁰⁾ reported a median cross clamp time of 68 min range (39-110) in the conventional group and 57 min (35-163) in the preservation group, While in our study, in the preservation group, the mean crossclamp time was more ($p < 0.05$).

One argument against preservation of the chordae of the anterior leaflet was that only undersized valve prosthesis could be implanted. However, in group B, we have implanted 31mm in 3 patients (10%), 29 mm in 7 patients (23%), 27mm in 20 patients (67%), and 25 mm wasn't used in this group (while in the non preservation group it was used once). In our study the mean BSA was 1.5 ± 0.14 m², thus implantation of 27 mm prosthesis was acceptable according to the investigations of Rowlatt and his colleagues in 1963 and King and his colleagues in 1985. Furthermore several homodynamic evaluations of the St. Jude cardiac valve prosthesis have shown that there is no significant difference of pressure gradients between the 27 mm and 29 mm prosthesis at rest and on exercise^(9, 13). This means that chordal preservation of the anterior mitral leaflet in MVR is not necessarily associated with implantation of undersized mitral valve prosthesis.

Comparing with other studies, Chowdhury and his colleagues implanted 29 to 33 mm prosthesis in 85.6 % of patients with total chordal preservation, confirming that preservation of the anterior leaflet doesn't preclude implantation of large prosthesis.

In our study weaning of bypass was smooth and without inotropic support in 2 patients (6.7%), while in 26 patients (86.7%) a small dose of adrenaline (0.05 mic/kg/min) was used, while in 2 patients (6.7%) larger dose of adrenaline (0.1 mic/kg/min) was used in the preservation group, and, weaning of bypass was smooth and without inotropic support in 12 patients (40%), while in 18 patients (60%) a small dose of adrenaline (0.05 mic/kg/min) was used in the non preservation group. Chowdhury and his colleagues in 2005 reported that 75.8% of patients in the conventional group required postoperative inotropic support while 22.5% of patients in the preservation group needed inotropic support. This could be due to less bypass time in the preservation group, while in our study there was significant increase in bypass time in the preservation group more than the conventional group.

In our study there was no mortality. **Okita and his colleagues in 1994**⁽²²⁾ **Tarelli and his colleagues in 1994**⁽³¹⁾ and **Kayagioglu and his colleagues in 2003**⁽¹⁵⁾ had also no mortalities in their study. **Hennein and his colleagues in**

1990⁽¹²⁾ had four perioperative deaths for the entire study population (6%), all the result of low-output cardiac failure and all occurring in patients in whom the chordae had been excised at operation. All late deaths occurred in the group of patients undergoing conventional replacement, occurring at an average of 37 ± 29 months postoperatively. **Muthialu and his colleagues in 2005**⁽²⁰⁾ reported that there was a survival benefit for patients undergoing leaflet preservation, either partial or total. Survival in the combined leaflet group was 92% versus 80% for total excision at 5 years, $p = 0.001$.

Left ventricular ejection fraction (LVEF) usually falls after conventional MVR for chronic MR. the falls has been explained by the increased afterload produced by a competent mitral valve^(3, 23). Several reports indicate that EF does not change significantly when chronic MR is corrected by mitral repair techniques. These observation suggest that left ventricular function may be enhanced when the mitral valve is not excised during correction of MR^(6, 7).

In our study the EF has declined in both groups at 7th day postoperative, in group A, EF declined from 61.8 ± 7.9 to 43.6 ± 5.9 , and, in group B, EF declined from 60.4 ± 5.9 to 48.1 ± 4.2 . Then EF improved with time to be 58.4 ± 6.1 in group A, and significantly improved in group B to be 64.53 ± 5.2 , at 6 months postoperatively.

Straub and his colleagues in 1996⁽²⁸⁾ reported that in the chordal preservation group the EF remained almost unchanged 7 days after operation (from 44.4 ± 14.0 % to 42.7 ± 8.7 %) and increased to 54.2 ± 11.2 % 3 months postoperatively ($P \leq 0.05$). In contrast, the EF in the conventional group decreased from 40.2 ± 12.7 % preoperative to 32.7 ± 8.4 % 7 days postoperatively ($P \leq 0.05$) and recovered after 3 months postoperatively to 48.1 ± 12.4 %.

Gaiotto and his colleagues in 2007⁽⁸⁾ performed MVR with preservation of the chordae tendineae in patients with end stage dilated cardiomyopathy. They reported an improvement in LVEF ($P = 0.008$) at the 3rd postoperative month.

Chowdhury and his colleagues in 2005⁽⁴⁾ reported that the EF continued to decline in the nonchordal group and returned to preoperative levels after initial decline in the chordal preservation group. At the end of 4 years, the fractional change of the EF was statistically significant only in the chordal preservation group.

Alsaddique in 2007⁽¹⁾ reported that the EF, in his patients who underwent MVR with preservation of the chordae tendineae, was maintained without deterioration in the immediate postoperative period.

In the perioperative stage LVEDD has been shown to be the most reliable index of LV function. A reduction in LVEDD has been found uniformly to correlate well with the level of clinical improvement after valve surgery^(24, 29).

The mean LVEDD decreased in our sample in group A from 6.08 ± 1.3 preoperatively to 6.04 ± 1.08 postoperatively at day 7, but the difference was not statistically important, $P = 0.42$. Mean LVEDD continued to decrease significantly to 5.89 ± 1.12 , 6 months post-operatively, with a statistically non-significant P value of 0.064. Mean LVESD decreased marginally from 4.19 ± 1.1 preoperatively to 4.02 ± 0.96 preoperatively in the early postoperative period. As the mean LVESD was not substantially reduced to 3.87 ± 0.63 ($P = 0.31$), the reduction was also mild at 6 months postoperatively. Mean LVEDD decreased in group B from 5.97 ± 1.24 preoperatively to 5.79 ± 1.13 postoperatively on the 7th day, but the difference was not statistically important, $P = 0.08$. The mean LVEDD continued to decrease significantly to 5.48 ± 1.9 , 6 months after surgery, with a statistically significant P value of 0.042. Mean LVESD decreased marginally from 4.34 ± 0.83 preoperatively to 4.11 ± 0.91 preoperatively in the early postoperative period. The decline was noticeable after 6 months postoperatively, with a substantial decrease in mean LVESD to 3.68 ± 0.96 ($P = 0.05$).

Kayagioglu and his colleagues in 2003⁽¹⁵⁾ reported that the LVEDD and LVESD decrease in the preservation group and increased in the conventional group postoperatively but the changes were statistically insignificant. EF decrease slightly postoperative in patients with preserved chordae, however it decreased significantly in patients with conventional MVR.

Gaiotto and his colleagues in 2007⁽⁸⁾ reported a reduction in the LVEDD ($p = 0.038$) and LVESD ($p = 0.008$) in patients with end stage cardiomyopathy who underwent MVR with preservation of the chordae tendineae.

Chowdhury and his colleagues in 2005⁽⁴⁾ reported that the left ventricular end-systolic volume (LVESV) decreased slightly from the preoperative level in the total excision group in the immediate postoperative period. Although there

was gradual improvement at 1 to 4 years of follow up, the improvement was not statistically significant. The remaining groups (the posterior preservation and the total preservation) demonstrated statistically significant reduction in LVESV in the immediate as well as the late postoperative period. The total chordal group demonstrated greater fractional change as compared to the posterior chordal and the non chordal group. The left ventricular end-diastolic volume (LVEDV) decreased by comparable degrees in all three groups in the immediate postoperative period and on follow up. Only the total chordal group had statistically significant percentage reduction of LVEDV at 4 years of follow up.

Fractional shortening was not universally used by most authors. **Muthialu and his colleagues in 2005⁽²⁰⁾** reported that the FS was 34% preoperatively vs. 26% postoperatively in the conventional group, and 31 % vs. 29 % in the preservation group, p=0.06.

Conclusion:-

We concluded that total chordal preservation is possible in the majority of patients undergoing MVR for rheumatic heart disease, as this study showed significant improvement in the LV function in the patients in which the AML was preserved.

References:-

1. Alsaddique AA: Mitral valve replacement with the preservation of the entire valve apparatus. Rev Bras Circ Cardiovasc Vol. 22 São Jose Preto Apr./june 2007.
2. Athanasiou T, Chow A, Rao C, Aziz O, Siannis F, Ali A, Darzi A, Wells F: Preservation of the mitral valve apparatus: evidence synthesis and critical reappraisal of surgical techniques. Eur J Cardiothorac Surg 2008, 391-401.
3. Boucher CA, Bingham JB, and Osbakken MD. Early changes in left ventricular size and function after correction of left ventricular volume and overload. Am j Cardiol, 1981; 47: 991.
4. Chowdhury K, Kumar AS, Airan B, Mittal D, Subramaniam KG, Prakash R, Seth S, Singh R, Venugopal P: Mitral Valve Replacement With and Without Chordal Preservation in a Rheumatic Population: Serial Echocardiographic Assessment of Left Ventricular Size and Function Ann Thorac Surg 2005; 79: 1926-1933.
5. David TE, Strauss HD, Mesher E, Anderson MJ, Macdonald IL, Buda AJ. Is it important to preserve the chordae tendinae and papillary muscles during mitral valve replacement? Can J Surg. 1981 May; 24(3): 236-9.
6. David TE. Papillary muscle-annular continuity: is it important? J Card Surg 1994; 9(Suppl): 252-4.
7. Duran CG, Pomar JL, Revuella JM, Gallo I, Poveda J, Ochoteco A, and Ubago JL. Conservative operation for mitral insufficiency critical analysis supported by postoperative hemodynamic studies in 72 patients. J Thorac Cardiovasc Surg, 1980, 79: 326.
9. Gaiotto FA, Puig LB, Mady Ch, Fernandes F, Tossuniam CE, Pardi MM, Dollan L, de Oliveira SA, Ramires JF, Pomerantzeff PMA. Mitral valve replacement with chordae tendinae preservation, traction and fixation in end-stage dilated cardiomyopathy. Rev Bras Cir Cardiovasc vol.22 no. 1 São Jose do Rio Preto Jan./Mar. 2007.
10. Gabbay AC, Colvin SB, Baumann FG, Harty S, Spencer FC: Current concepts of mitral valve reconstruction for mitral insufficiency. Circulation 1988; 78: 1087.
11. Ghosh PK, Shah S, Das A, Chandra M, Agarwal SK, Mittal PK. Early evidence of beneficial effects of chordal preservation in mitral valve replacement on left ventricular dimensions. Eur J Cardiothorac Surg 1992; 6: 655-659.
12. Grossi EA, Galloway AC, Miller JS, Ribakove GH, Culliford AT, Esposito R, Delianides J, Buttenheim PM, Baumann FG, Spencer FC, Colvin SB: Valve repair versus replacement for mitral insufficiency: when is a mechanical valve still indicated? J Thorac Cardiovasc Surg 1998, 115:389-394 discussion 394-386.
13. Hennein HA, Swain JA, McIntosh CL, Bonwo RO, Stone CD, Clark RE, Bethesda M. Comparative assessment of chordal preservation versus resection during mitral valve replacement. J Thorac Cardiovasc Surg 1990; 99: 828-37.
14. Horstkotte D, Schulte HD, Bircks W, Strauer BE: Lower intensity anticoagulation therapy results in lower complication rates with the St. Jude Medical prosthesis. J Thorac Cardiovasc Surg 1994; 107: 1136.
15. Hetzer R, Drews T, Siniawski H, Komoda T, Hofmeister J, Weng Y. Preservation of papillary muscles and chordae during mitral replacement possibilities and limitations. J Heart Valve Dis 1995; 4(suppl 2): S115-S123.
16. Kayagioglu I, Ates M, Sensoz Y, Gorgulu S, Idiz M, Kanca A. comparative assessment of chordal preservation versus chordal resection in mitral valve replacement for mitral stenosis (long-term follow-up: 8 years). Tohoku J. Exp. Med 2003; 200: 119-128.

17. Lillehei CW: Value of Preserving Chordal Integrity. Both experimental and clinical data (Discussion). *J Thorac Cardiovasc Surg* 1963, 46:494-495.
18. Lillehei CW: New ideas and their acceptance as it has related to preservation of chordae tendineae and certain other discoveries. *J Heart Valve disease* 1995; 4(suppl 2): S 106-14.
19. Miller DW Jr, Johnson DD, Ivey TD: Does preservation of the posterior chordae tendineae enhance survival during mitral valve replacement? *Ann Thorac Surg* 1979, 28:22-27.
20. Miki S, Kusuhara K, Ueda Y, M Komeda, Y Ohkita, and T Tahata. Mitralvalvereplacement with preservation of chordae tendinae and papillary muscles *Ann Thorac Surg* 1988; 45: 28-34.
21. Muthialu N, Varma SK, Ramanathan S, Padmanabhan Ch, Rao KM, Srinivasan M. Effect of chordal preservation on left ventricular function. *Asian Cardiovasc Thorac Ann* 2005; 13: 233-7.
22. Natasuaki M, Itoh T, Tomita S, Furukawa K, Yoshikai M, Suda H, Ohteki H. Importance of Preservation of the mitral Subvalvular Apparatus in Mitral valve Replacemnt. *Ann Thorac Surg* 1996; 61: 585-90.
23. Okita Y, Miki S, Ueda Y, Tahata T, Sakai T, Matsuyama K. Mitral valve replacement with maintenance of mitral annulopapillary continuity in patients with mitral stenosis. *J thorac Cardiovasc Surg* 1994; 108: 42-51.
24. Philips HR, Levine FH, and Crater JE. Mitral valve replacement for isolated mitral regurgitation: Analysis of clinical course and late postoperative left ventricular ejection fraction. *Am J Cardiol*, 1981; 48: 467.
25. Peter CA, Ausin EH, Jones RH. Effect of valve replacement for chronic mitral regurgitation on left ventricular function during rest and exercise. *J Thorac Cardiovasc Surg.* 1981, 82: 127-135.
26. Rushmer RF, Finlayson BL, Nash AM. Movement of the mitral valve. *Circ Res*,1956; 4: 337-342.
27. Shuhaiber J, Anderson RJ: Meta-analysis of clinical outcomes following surgical mitral valve repair or replacement. *Eur J Cardiothorac Surg* 2007, 31:267-275.
28. Sasaki H, Ihashi K. Chordal-sparing mitral valve replacement: pitfalls and techniques to prevent complications. *Eur J Cardiothorac Surg* 2003; 24: 650-652.
29. Straub U, Feindt P, Huwer H, Petzold T, Kalweit G, Vollmer I, Gams E. Postoperative assessment of chordal preservation and changes in cardiac geometra following mitral valve replacement. *Eur J Cardio-thorac Surg* 1996; 10: 734-740.
30. Schuler G, Peterson KL, Johnson A, Francis G, Denmish G, Utley J, Daily PO, Ashburn W, Ross J Jr. 1979; 59: 1218-1237.
31. Talwar S, Jayanthkumar HV, Kumar AS: Chordal Preservation during mitral valve replacement: basis, techniques and results. *IJTCVS* 2005, 21:45-52.
32. Tarelli G, Musazzi A, Semeraro F, Ceriani L, Respighi E. Effect of the preservation of annulopapillary continuity on the left ventricular ejection fraction after mitral valve replacement. *Eur J Cardio-thorac Surg* 1994; 8: 478-481.
33. Tarelli G, Musazzi A, Semeraro F, Ceriani L, Respighi E. Effect of the preservation of annulopapillary continuity on the left ventricular ejection fraction after mitral valve replacement. *Eur J Cardio-thorac Surg* 1994; 8: 478-481.
34. Yau TM, El-Ghoneimi YA, Armstrong S, Ivanov J, David TE: Mitral valve repair and replacement for rheumatic disease. *J Thorac Cardiovasc Surg* 2000, 119:53-60.
35. Yun KL, Rayhill SC, Niczyporuk MA, Fann JI, Zipkin RE, Derby GC, Handen CE, Daughters GT, Ingels NB Jr, Bolger AF, et al.: Mitral valve replacement in dilated canine hearts with chronic mitral regurgitation. Importance of the mitral sub-valvular apparatus. *Circulation* 1991, 84:III112-124.
36. Zakai SB, Khan SU, Rabbi F, Tasneem H. Effects of mitral valve replacement with and without chordal preservation on cardiac function: early and mid-term results, *J Ayub Med Coll Abbottabad.* 2010 Jan-Mar;22(1):91-6.