

Partial preservation of subvalvular apparatus in Mitral valve replacement surgery: Impact on clinical outcome.

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ABSTRACT

Objectives: To evaluate the impact of partial preservation of subvalvular apparatus (SVA) in mitral valve replacement surgery on clinical outcome.

Study Design: Retrospective Study.

Methods: This study was conducted at department of cardiothoracic surgery, Liaquat National Hospital and Medical College, Karachi from the period of July 2012 to June 2014. During this period 50 patients were identified who underwent mitral valve replacement with matching demographics and were distributed in two groups according to type of operation performed. In Group A (n=25) subvalvular apparatus was partially preserved (Preservation of posterior leaflet and chordae.) while in Group B (n=25) subvalvular apparatus was not preserved at all. The reports of transthoracic echo performed preoperatively, at discharge, at 3 months and 3 years or longer were reviewed to observe the impact of both the techniques on various markers of left ventricular functions like ejection fraction (EF), left ventricular end diastolic diameter (LVEDD), left ventricular end systolic diameter (LVESD) and NYHA functional class.

Results: The various markers of left ventricular functions were remained preserve in Group A, while in Group B, constant downward trend was noticed.

Conclusion: We conclude that by adopting simpler technique of partial preservation we can easily achieve our objectives of implantation of an efficient, non obstructive valve without affecting the left ventricular functions, definitely a better clinical outcome.

Key words: subvalvular apparatus, mitral valve replacement, left ventricular end diastolic dimension and left ventricular end systolic dimensions.

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INTRODUCTION:

The objective of mitral valve surgery is to provide an efficient, non obstructive valve without affecting the left ventricular functions and these objectives can be achieved usually with valve conservation and repair techniques¹⁻². However in large number of patient with diseased mitral valve, repair is not possible at all and mitral valve replacement is the only option.

Traditionally mitral valve replacement is done with the orthodox technique without preservation of subvalvular apparatus³. In 1964 Lillehei CW and colleagues⁴ first time highlighted the significance of subvalvular apparatus (SVA) for the maintenance of left ventricular geometry and functions⁵⁻⁸ and recommended complete preservation. Nonetheless complete preservation technique was not that much adopted due to longer operation time due to technical complexities, concerns regarding implantation of smaller size valve, fear of entanglement of prosthetic valve and left ventricular outflow tract (LVOT) obstruction⁹.

In comparison to complete preservation, partial preservation technique is relatively simple and more adoptable with nearly same benefits as claimed by some authors¹⁰. The objective of this study is to evaluate the impact of partial preservation of SVA in mitral valve replacement surgery on left ventricular functions and on the clinical outcome of the local patient population.

METHODOLOGY:

We retrieved all the patients' data from our departmental databank and surgical notes, who underwent Mitral valve replacement during the period from July 2012 to June 2014. After exclusion of redo operations, ischemic mitrals, combined valve operations, patients with incomplete data and patients who were lost in follow up, final cohort of 50 patients were selected for this study with matching demographics.

All the patients were operated by same surgeon with same anesthetic protocol. Median sternotomy and left atriotomy through sondergaard groove was the standard approach. Moderate hypothermic (28 °C)

cardiopulmonary bypass with antigrade cold blood cardioplegia was instituted. Anterior mitral leaflet along with corresponding chordae was excised. The surgeon attempted to preserve posterior leaflet along with corresponding chordae in all the cases but was able to preserve in some cases -partial preservation Group A (n=25) while in other cases it was impossible to preserve due to scarring, fibrosis, shortening and or calcification – Non preservation Group B (n=25). Left auricle was tied off in all the case. Mitral valve replacement with mechanical or bio prosthetic was performed according to American College of Cardiology / American Heart association Guidelines [11]. The reports of transthoracic echo performed preoperatively, at discharge, at 3months and 3years or longer were reviewed to observe the impact of both the techniques on various markers of left ventricular functions like ejection fraction (EF), left ventricular end diastolic diameter (LVEDD), left ventricular end systolic diameter (LVESD) and NYHA functional class.

Descriptive statistics were calculated using SPSS version 21.0. Stratification was done and post stratification Chi square test was applied to observe the effect of modifiers on outcome. P value < 0.05 was considered as significant. Independent t-test was used as appropriate.

This project was sanctioned by hospital research committee. Every patient has given informed consent for the operation and permission for use of their medical record for research purposes at the time of surgery.

RESULTS:

There was no significant difference between two groups with regards to demographic and peri operative variables (Table 1). Both groups were comparable with respect to severity of symptoms – NYHA functional class with almost similar operative risk as reflected by their EuroSCORE.

Most patients had mixed mitral valve pathology followed by stenosis and regurgitation. The mechanical valve prosthesis was used in 78%, while bioprosthetic valve in 22%, almost equally distributed between two groups. The most common prosthetic size used was 29mm in 37 patients (18

Table 1
Demographic and Perioperative Characteristics

	Group A (n=25)	Group B (n=25)	P Value
Age	35.68 + 15	31.76 + 14.32	N.S
Gender M/F	12 13	11 14	N.S
A-Fib Pre Op	17 (68%)	18 (72%)	N. S.
A-Fib Post Op	14 (58%)	22 (88%)	< 0.05*
NYHA III and IV Pre Op	16 (64%)	14 (56%)	N. S.
NYHA III and IV Post Op	5 (20%)	11 (44%)	< 0.05*
Euro Score	6.5 + 2.5	6.4 + 1.7	N. S.
Mixed Mitral Valve Disease	11 (45%)	12 (48%)	N. S.
Mitral Stenosis	4 (16%)	11 (45%)	N. S.
Mitral Regurgitation	10 (39%)	2 (7%)	N. S.
Aortic X Clamp Time	61.19 + 14.42	65.83 + 23.71	N. S.
CPB Time	76.15 + 14.74	80.64 + 23.32	N. S.
Size of Valve	29.0 + 1.56	29.00 + 2.25	N. S.
ICU Stay (hours)	27.60 + 6.00 (24-42)	33.12 + 9.96 (24-48)	N. S.
Hospital Stay (days)	8 + 1.5	9 + 2	N. S.

A-Fib: Atrial Fibrillation

NYHA: New york Heart Association

CPB: Cardio pulmonary bypass

in group A and 19 in group B), 31mm in 9 patients (5 in group A and 4 in group B) and 27mm in 4 patients (3 in group A and 1 in group B).The cardiopulmonary bypass time, aortic cross clamp time and ICU stay was little bit longer in group B but of not any statistical significance.

Perioperative echocardiographic data (Table 2) showed that pre operative mean differences of EF, LVEDD and LVESD with respect to both groups were insignificant. Post operatively, there was statistically significant progressive downward trend noticed in EF in group B, while in group A, EF remain preserved. There was statistically significant improvement in LVEDD and LVESD in Group A, while in Group B, both parameters progressively deteriorated over the time. Initially the functional

class – NYHA III & IV was improved in both groups but with the time declining trend was noticed in Group B. The incidence of chronic atrial fibrillation was also high statistically in Group B as compared to Group A at longer follow up.

DISCUSSION:

Mitral valve repair is generally considered superior to replacement, however in large number of patient with diseased mitral valve, repair is not possible at all and mitral valve replacement is the only option. The first mitral valve replacement technique was reported by Starr-Edwards in 1961 and that was without preservation of subvalvular apparatus and involved complete resection of both leaflets with corresponding chordae. The increase in the incidence of low cardiac output syndrome

and progressive decrease in left ventricular ejection fraction following that technique¹²⁻¹⁴ lead to signify, the importance of subvalvular apparatus.

The notion of complete preservation of subvalvular apparatus to decrease the low cardiac output syndrome and associate mortality was initially reported by Lillehei in 1964. Following that various clinical and experimental studies have proven over the time that mechanism of action of normal mitral valve is totally dependent on synchronized interaction of all its anatomic components that is the annulus, leaflets, chordae tendinae, papillary muscle and left ventricular wall. Any disruption in this annulo – ventricular continuity will certainly disturb the left ventricular geometry and ultimately its functions¹⁵⁻¹⁷. Hansen¹⁸ in 1987 and then David and colleagues¹⁹ in 1994 re emphasized the concept through randomized trial and clearly showed progressive improvement in left ventricular systolic functions and LV performance both at rest and during exercise in the chordae preservation group. Since then though several modifications have been proposed²⁰⁻²² for complete preservation of SVA and are in practice as well, nonetheless many surgeons are still wary of longer operation time due to technical complexities, concerns regarding implantation of smaller size valve, fear of entanglement of prosthetic valve and left ventricular outflow tract (LVOT) obstruction²³⁻²⁴. These studies and recommendations of complete preservation are mostly western, where rheumatic valves are not that common. It is relatively easier to preserve SVA completely in more pliable valves of myxomatous or degenerative nature. Contrary to that the incidence of rheumatic mitral is high in local patient population and it is very challenging to preserve SVA completely in this cohort of patients with fibrotic and calcified valves. Besides due to financial constraints, our patients cannot afford to have redo operation for any complication of complete preservation.

In comparison to complete preservation, partial preservation technique is relatively safe, reliable and easily adoptable especially for our local patients with nearly same benefits of implanting an appropriate valve without affecting size and function of prosthetic valve.

CONCLUSION:

We know from literature search and through Meta analysis²⁵⁻²⁶ that complete preservation technique is superior but off course with lot of limitations. By adopting simpler technique of partial preservation we can easily achieve our objectives and definitely improve clinical outcome, as we have concluded in our study.

LIMITATIONS:

This is a retrospective study, totally dependent on echo data and was conducted in a single centre.

CONFLICT OF INTEREST:

None declare.

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