Immediate and Early Results of Mitral Valve Repair at King Chulalongkorn Memorial Hospital

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Objective : Comparison with prosthesis mitral valve replacement, mitral valve repair has lots of advantages, After valve repair, patients have better left ventricular function, a lower rate of thrombo-embolism and infective endocarditis. The authors studied early experience of mitral valve repair.

Material and Method : From January 2000 to May 2002, 43 consecutive patients with mitral regurgitation had mitral valve repair. Valve disease was degenerative in 51.2 per cent, ischemic in 18.7 per cent, rheumatic in 13.9 per cent, infectious in 11.6 per cent, and others in 4.6 per cent. Surgical techniques included P2 quadrangular resection (n = 13; 30.95%), chordal tranfer (n = 11; 26.19%), only annuloplasty (n = 10; 23.8%), artificial chordae (n = 3; 7.14%), commissural closure (n = 3; 7.14%), and others in 2 cases (4.76%)

Result : Immediate post-operative echocardiogram showed no or trivial regurgitation in 95 per cent and moderate regurgitation in 5 per cent. There was no operative mortality, but 1 case had hospital mortality with 1-24 months follow-up, 90 per cent of cases had FC. I and the other (10%) were in FC II.

Conclusion : This preliminary experience provided promising immediate and early result. The authors believe that mitral valve repair is safe and seems to have a much better result than mitral valve replacement. However, a randomized control study and long-term follow-up, in the future, are important.

Key word : Mitral Regurgitation, Mitral Valve Repair, Pathology of Mitral Valve, Technique of Mitral Valve Repair

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The etiology and pathology of mitral valve insufficiency in Asian populations is quite different from that in western countries[1,2]. Even though, there are still many cases of rheumatic heart disease, the other causes of mitral regurgitation such as myxomatous valve, ischemic heart disease as well as infective endocarditis are not uncommon. All of these etiologies need mitral valve repair instead of mitral valve replacement because patients who have valve repair usually result in preserving left ventricular function, fewer thromboembolism events, less infective endocarditis and avoid life-long anticoagulation[3-5]. The authors report experience of mitral valve repair in the aspects of cause of disease, valvular pathology, technique of repair and immediate to early result.

MATERIAL AND METHOD

Between January 2000 and May 2002, 43 consecutive patients had mitral valve repair at King Chulalongkorn Memorial Hospital. All of these patients were operated on by one surgeon. The patients were aged from 9 to 79 years (mean age, 49.23 ± 21.1 years). Pre-operative New York Heart Association functional class was 3 or 4 in 39 of these patients (90.70%). The pre-operative patient characteristics are shown in Table 1. The leading cause of mitral insufficiency was myxomatous degeneration (51.2%) Table 2 lists various causes of mitral regurgitation found among these patients.

In the rheumatic group, 2 patients were operated on during the active phase of acute rheumatic fever. All the patients in this group (n = 6) were younger than 16 years old.

In the ischemic mitral regurgitation patients (n = 8), cases were suffering from severe pulmonary edema due to acute myocardial infarction and complicated papillary muscle rupture. Mitral insufficiency was chronic in the other 6 patients and was caused by left ventricular geometric changing (LV Remodeling)

Operative technique

A membrane oxygenator with a standard roller pump was used for extracorporeal circulation. Mild systemic hypothermia (30 - 32°C) was employed. Myocardial protection was obtained with combined antegrade and retrograde cold blood cardioplegia (4 : 1) through the aortic root and the coronary sinus without topical hypothermia. Exposure of the mitral valve was *via* the classical interatrial groove incision in 81.4 per cent and *via* the superior transeptal approach in 18.6 per cent. The superior transeptal incision of the left atrium was selected in the patients who had a small left atrium. Table 3 summarizes the anatomic findings of the mitral valve pathology.

Most of the patients (65.12%) had annular dilatation, either isolated or combined with other pathology. In cases of mitral insufficiency caused by the prolapse of the valvular leaflet, the prolapsing segments were located more frequently at the mid-portion of either the anterior or posterior leaflet (A2 or P2) than the commisural segment. The authors found that the prolapse of the posterior leaflet was due to chordal elongation in 38.46 per cent and due to chordal rupture in 61.54 per cent. The anterior pro-

Table 1. Characteristics of the patients.

Patient's characteristics	N	%
Patients (n)	43	
Male/female	24/19	
Age (y)	9-79	
Mean age (mean ± SD)	49.23 ± 21.1	
NYHA class (mean ± SD)	3.34 ± 0.65	
History of CHF	24	55.8
History of angina pectoris	11	25.6
Previous stroke	3	6.9
Renal impairment (cr > 2)	4	9.3
Diabetic	8	18.6
Hypertension	9	20.9
Pre-operative IABP	2	4.6
Pre-operative assisted ventilation	2	4.6
Pre-operative acute MI with shock	1	2.3
Pre-operative unstable angina	5	11.6
Cardiac rhythm		
Sinus rhythm	24	55.8
Atrial fibrillation	19	44.2

SD = Standard deviation
CHF = Congestive heart failure
IABP = Intra-aortic balloon pump

Table 2. Causes of mitral regurgitation.

Causes	N	%
Myxomatous degeneration	22	51.2
Ischemic heart disease	8	18.7
Rheumatic heart disease	6	13.9
Infective endocarditis	5	11.6
Congenital mitral cleft	1	2.3
HOCM with SAM	1	2.3

HOCM = Hypertrophic obstructive cardiomyopathy
SAM = Systolic Anterior Motion of Mitral Valve

lapse was not much different from the posterior. It was from chordal rupture in 53.85 per cent, chordal elongation in 30.77 per cent and papillary muscle rupture in 15.38 per cent.

There were 18 patients who had a concomitant procedure performed with repair of the mitral valve. (Table 4)

The technique of mitral valve repair (Table 5) depended on the echocardiographic data and the operative finding. In 13 patients (30.23%) the prolapse of the mid portion of posterior leaflet was corrected with a quadrangular resection of the prolapse area. The resulting gap was then repaired using 2 different techniques. The method based on plication of the annulus described by Carpentier ed al and associated (6,7) was used in 9 patients. In another 4 patients, a sliding leaflet plasty was performed(8-10). The latter technique was selected when the height of the posterior mitral leaflet was more than 2 cm (usually found in myxomatous valve). In 11 patients, the anterior prolapse was corrected by chordal transfer (from primary chordae of P2 to the edge of A2 prolapsed portion). Recently, the authors used 4-0 polytetrafluoro ethylene (Gore-Tex; W.L. Gore & Associates, Flagstaff, AZ) for replacement of the A2 chordal in 3 cases. This technique was proposed by David and Frater et al.

It most of the patients (90.69%), the Cosgrove-Edwards Annuloplasty System was used to reduce the size of the annulus, reshape it, and reinforce the repair(11,12). The annuloplasty band sizes are reported in Table 6. Pericardial strip was used in 2 patients and no ring was used in 2 cases.

Anticoagulation

Anticoagulant treatment was not given to the patients who had sinus rhythm. Warfarin sodium was always used for patients with atrial fibrillation to maintain the international normalized ratio between 2.0 and 3.0

Follow-up

Information from outpatient data and telephone contacts with patients or their relatives was collected as part of the follow-up. The average duration of follow-up was 14 + 1.1 months. One patient was lost to follow-up.

RESULTS

One patient died in the hospital, giving an operative mortality rate of 2.3 per cent. This patient had had coronary artery bypass grafting and aortic valve replacement concomitant with mitral valve repair. He died on the 35th post-opertive day. The death was due to pneumonia and respiratory failure.

Table 3. Anatomic details of mitral valve pathology.

Pathology	N = 43
Annular dilatation	28
Prolapsed leaflet	31
Posterior	16
P1	0
P2	13
P3	3
Anterior	15
A1	1
A2	13
A3	1
Restriated leaflet	2
Ischemic MR (poor coaptation)	6

P1, P2, P3 } Based on Carpentier's classification(6)
A1, A2, A3

Table 4. Concomitant.

Procedure	Cases	%
CABG	10	23.26
TV Repair	4	9.3
CABG + AV Repair	1	2.33
CABG + AVR	1	2.33
TV Repair + Liation of coronary AV fistula	1	2.33
Septum myectomy	1	2.33

CABG = Coronary artery bypass graft
TV = Tricuspid valve
AV = Aortic valve
AVR = Aortic valve replacement
AV fistula = Arterio-venous fistula

Table 5. Techniques of valve repair.

Technique	N = 43
P2 quadrangular resection	13
Chordal transfer	11
Only annuloplasty	10
Artificial chordae	3
Closure of commisure	3
Closure of mitral cleft	1
P3 resection	1

P2, P3 = Based on Carpentier 's classification (*)

Table 7. Complications.

Complication	Cases	%
Temporary junctional rhythm	2	4.7
Temporary atrial flutter	1	2.3
Pericardial effusion	3	7.0
Pleural effusion	2	4.7
Infected leg wound	1	2.3
Intravascular hemolysis	1	2.3

Table 6. Size of annuloplasty band.

Size	N	%
28 mm	8	18.6
30 mm	2	4.7
32 mm	12	30.2
34 mm	14	32.6
36 mm	3	7

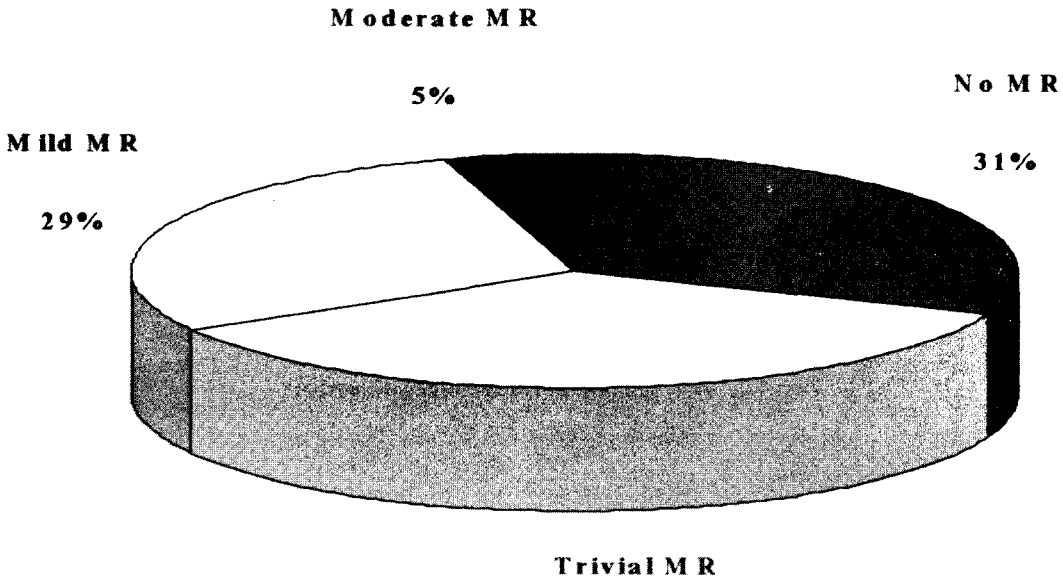

Fig. 1. Pre-discharge echocardiogram.

The post-operative complications are show in Table 7.

There were 2 patients who need reoperation for valve replacement. The first patient was a 9 year old boy who had been suffering from acute rheumatic fever and severe mitral regurgitation. Very poor and edematous tissue of the mitral leaflet was found during the first operation. The second case had to have valve replacement due to intravascular hemolysis after mitral valve repair.

An echocardiogram of the repaired mitral valve was performed in every patient before discharge and at one-year follow-up. The degree of mitral regurgitation before discharge is show in Fig. 1.

The diameters of the left atrium, left ventricular end systolic (LVES) and left ventricular and

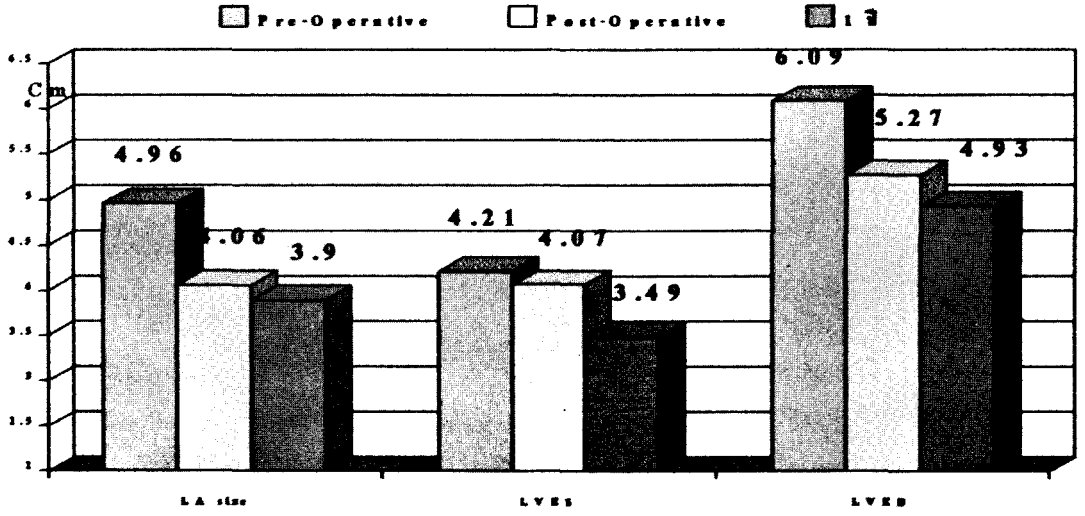

Fig. 2. Pre/post-operative echocardiogram.

diastolic (LVED) are showen in Fig. 2 and the comparison of the left ventricular ejection fraction is shown in Fig. 3.

Survival

There were 2 late deaths (4.6%). One was caused by digitalis toxicity and the cause of death is not known in the other one.

Ninety per cent of the surviving patients are in F.C. I and about 10 per cent are in F.C. II

Comment

The functional results of mitral valve repair have been excellent[13-17]. Mitral valve repair offers the advantages of avoiding life-long anticoagulation and preserving chordal as well as left ventricular function. The repair is technically more difficult, with a high failure rate, in the rheumatic group, and the reoperation rate is reported to be 4.8 to 27 per cent [18-23]. The causes of failure in rheumatic patients are as follows: 1) error in judgment, 2) the inherent complexity of the disease process and 3) recurrence or progression of rheumatic carditis[24,25].

The authors' experience with mitral valve repair in the rheumatic population has been encouraging with a subgroup of children and young adults who had severe mitral regurgitation in the early phase of healed rheumatic mitral valve in which only the annular dilatation had been found. The rheumatic valve was not repaired in the late stage because the authors believe that the surgeon could not correct all the leaflet retraction and subvalvular pathology. There was also failure to repair a case of acute carditis due to the very friable valve tissue.

Mitral valve billowing and prolapse (Barlow) still remains a somewhat mysterious disease, probably because of the imprecise terminology. However, Barlow recommended accepting the concept of Carpentier et al of "billowing and prolapse". The authors used different techniques to correct this kind of valvular defect depending on what anatomic patho-

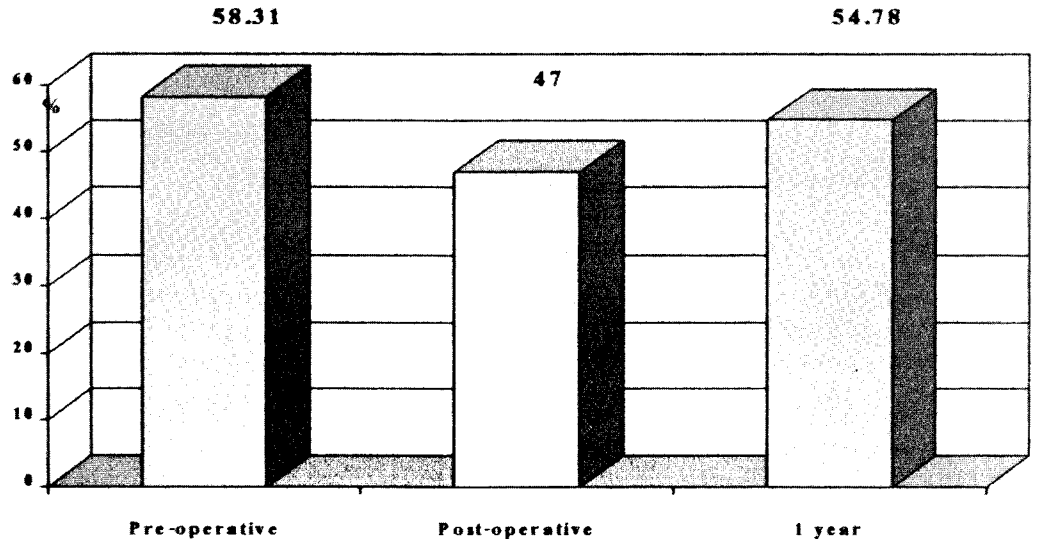

Fig. 3. Pre/post-operative left ventricular ejection fraction.

logy was found. Quadrangular resection was done for mid portion of posterior leaflet prolapse (p2) with a very good result. For anterior leaflet prolapse, two different methods were used to repair the valve. First, the primary chordae of the posterior leaflet was transferred to the prolapsed segment of the anterior leaflet.

Recently, the authors used 4 - 0 PTFE suture as an artificial chordae to replace the pathologic anterior chordae. It is a more simple and effective technique. Nearly all of the presented patients had the Cosgrove-Edwards Annuloplasty System which is very effective[26,27].

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ผลการผ่าตัดซ่อมลิ้นหัวใจไมตรัล ในโรงพยาบาลจุฬาลงกณ์

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ภูมิหลัง : การผ่าตัดแก้ไขโรคลิ้นหัวใจไมตรัลรั่ว ทำได้ 2 วิธี คือการเปลี่ยนลิ้นหัวใจ และการซ่อมลิ้นหัวใจ การซ่อมลิ้นใจไมตรัล เป็นการผ่าตัดซึ่งยุ่งยากกว่าการเปลี่ยนลิ้นหัวใจ แต่มีข้อดีกว่า ได้แก่ ผู้ป่วยจะมีการทำงานของหัวใจด้านล่างซ้ายที่ดีกว่า, ความเสี่ยงต่อการติดเชื้อของลิ้นหัวใจ และความเสี่ยงต่อการเกิดลิ่มเลือด จากลิ้นหัวใจน้อยกว่า และผู้ป่วยไม่จำเป็นต้องรับประทานยากันเลือดแข็ง

การศึกษา : ผู้ป่วยด้วยโรคลิ้นหัวใจไมตรัลรั่วได้รับการผ่าตัดซ่อมลิ้นหัวใจตั้งแต่ มกราคม 2543 ถึง พฤษภาคม 2545 เป็นจำนวน 43 ราย โดยศัลยแพทย์คนเดียวกัน สาเหตุของลิ้นหัวใจไมตรัลรั่ว ร้อยละ 51.2 เกิดจากการเสื่อมของลิ้นหัวใจหรือเอ็นยึดขอบลิ้นหัวใจ, ร้อยละ 18.7 เกิดจากโรคกล้ามเนื้อหัวใจขาดเลือด, ร้อยละ 13.9 เกิดจากโรคหัวใจรูมาติกส์, ร้อยละ 11.6 เกิดจากการติดเชื้อของลิ้นหัวใจ และสาเหตุอื่นอีกร้อยละ 4.6 วิธีการผ่าตัดซ่อมลิ้นหัวใจ จำนวน 13 ราย การผ่าตัดทำโดยวิธีตัดลิ้นหัวใจ แผ่นหลังส่วนที่ยืดออก, จำนวน 11 ราย ทำการผ่าตัดโดยการย้ายที่เกาะของเอ็นยึดลิ้นหัวใจ, ผู้ป่วย 10 ราย ได้รับการซ่อมลิ้นหัวใจโดยใช้แผ่นยึดเพื่อลดขนาดของวงขอบลิ้นหัวใจ, การผ่าตัดใช้เอ็นยึดลิ้นเทียมจำนวน 3 ราย และโดยวิธีการเย็บปิดมุมรอยต่อของลิ้นหัวใจในผู้ป่วย 3 ราย

ผลการศึกษา : การตรวจการทำงานของลิ้นหัวใจด้วยเครื่องตรวจคลื่นเสียง พบว่าภายหลังการผ่าตัดซ่อมลิ้นไมตรัล ผู้ป่วยร้อยละ 95 ไม่พบว่ามีการรั่วของลิ้นหัวใจ ร้อยละ 5 ยังพบว่ามีการรั่วระดับปานกลาง มีผู้ป่วยเสียชีวิตในโรงพยาบาล จำนวน 1 ราย การติดตามผลตั้งแต่ 1–24 เดือน พบว่าผู้ป่วยไม่มีอาการร้อยละ 90 และมีอาการเหนื่อยเล็กน้อยร้อยละ 10

บทสรุป : จากผลการศึกษา พบว่าการผ่าตัดซ่อมลิ้นหัวใจไมตรัล เป็นวิธีการผ่าตัดที่ปลอดภัยและได้ผลดี อย่างไรก็ตาม การติดตามผู้ป่วยในระยะยาวยังเป็นการศึกษาที่สำคัญ และมีความจำเป็น

คำสำคัญ : ลิ้นหัวใจไมตรัลรั่ว, การผ่าตัดซ่อมลิ้นหัวใจ, สาเหตุทางกายวิภาคของลิ้นไมตรัลรั่ว, วิธีการซ่อมลิ้นไมตรัล

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