



Original Article

Mitral valve repair for myxomatous mitral regurgitation; Respect or Resect

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Abstract

Background: The superiority of mitral repair using resection of the posterior leaflet versus neo-artificial chordae is still debatable. The objective of this study was to compare leaflet resection versus chordal replacement for mitral valve repair in patients with isolated myxomatous degeneration of the posterior mitral valve leaflet.

Methods: This study was conducted on 199 patients with severe symptomatic mitral regurgitation due to myxomatous mitral valve degeneration. Patients were grouped into two groups: Group (1): Respect technique which included 76 patients who had limited resection of the anterior leaflet, chordal transfer, and replacement of anterior leaflet chordae by polytetrafluoroethylene sutures, and placement of annuloplasty ring. Group (2): Resect technique included 123 patients where the operation was done by resecting the prolapsed mid scallop of the posterior leaflet and placement of flexible annuloplasty ring.

Results: There was no difference between both groups regarding gender. Patients in the Respect group were younger (37 (25th- 75th percentiles: 29- 44) vs. 54 (48- 60) years, $P < 0.001$). The minimally invasive approach was more commonly used in patients who had resection techniques (20 (26.32%) vs. 106 (86.18%); $P < 0.001$). Ischemic (99 (95- 106) vs. 79 (75- 82); $P < 0.001$) and cardiopulmonary bypass times (134.5 (130- 138.5) vs. 99 (97- 104) min; $P < 0.001$) were higher in the Respect group. Blood loss was more in the Resect group (370 (305- 390) vs. 550 (490- 600) ml; $P < 0.001$). There were no differences in the postoperative complications between groups. ICU stay was longer in patients in the Resect group (5 (5- 6) vs. 7 (6- 8) days; $P < 0.001$). Mitral valve gradient after 12 months was significantly higher in the Resect group (3 (3- 3.5) vs. 4 (3- 5) mmHg; $P < 0.001$). Mitral valve reoperation was required more in patients in the Respect group (5 (6.58%) vs. 1 (0.81%); $P = 0.03$).

Conclusions: Both Respect and resect techniques for mitral valve repair had comparable outcomes and durability. The repair technique should be tailored according to the mitral valve pathology.

KEYWORDS

Myxomatous mitral valve; Mitral valve repair; Respect technique; Resect technique

Article History

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Introduction

Mitral valve prolapse can occur in up to 2% of the general population, and it can progress to severe regurgitation (MR) in some patients

between the 5th and 7th decades [1-6]. The survival in patients with severe mitral regurgitation is lower compared to normal healthy adults [7]. Patients with severe asymptomatic MR



are at risk of developing cardiac complications within five years of the onset of severe MR [8]. In patients with severe MR, mitral valve repair is a good option to relieve the symptoms and improve survival [9]. Mitral valve repair is preferred to replacement because of the fewer valve-related complications and better survival [10, 11].

Isolated prolapse of the posterior leaflet is the most common abnormality associated with degenerative MR [12]. Several methods were described to repair this prolapsed posterior leaflet, including leaflet resection or preservation using artificial neochordae [9,12-14]. The superiority of one approach over the other is still debatable [9,15-18]. Both techniques showed good results, and there is no consensus regarding the ideal surgical technique of mitral valve repair in degenerative disease [19]. The objective of this study was to compare leaflet resection versus chordal replacement for mitral valve repair in patients with isolated myxomatous degeneration of the posterior mitral valve leaflet.

Patients and methods:

Design and patients:

This study was conducted on 199 patients with myxomatous mitral valve degeneration complicated with severe symptomatic MR eligible for mitral valve repair. Patients were grouped into two groups; Group 1 included patients who had repair using new artificial chordae (Respect group; n= 76), and Group 2 included patients who had resection of the posterior leaflets (Resect group; n= 123).

We included patients aged less than 70 years with severe symptomatic MR and New York Heart

Association (NYHA) Class III/IV. All patients had isolated myxomatous MR with no associated other valve lesion or coronary artery disease. Patients who had infection endocarditis, re-operative surgery, rheumatic or ischemic MR, and low ejection fraction (less than 40%) were excluded from the study.

Repair technique:

We used the Respect technique in Group 1, where the correction of the prolapsing leaflet was done by limited resection of the anterior leaflet, chordal transfer, and replacement of anterior leaflet chordae by polytetrafluoroethylene sutures and placement of annuloplasty ring. In Group 2, the resection technique was used where the operation was done by resecting the prolapsed mid scallop of the posterior leaflet and placement of flexible annuloplasty ring.

A 3D mitral ring was used in all cases, and the surgical approaches were through full sternotomy or right anterolateral thoracotomy.

Data:

Baseline characteristic data of patients were collected, including age, gender, and other comorbidities. The intraoperative data included cardiopulmonary bypass and ischemic times. Postoperative follow-up data were collected, emphasizing blood loss, ICU hospital stay, stroke, renal failure, or wound infection. In addition, we performed echocardiographic follow-up data at 6 and 12 months postoperatively. Echocardiographic data included the recurrence of mitral regurgitation, the mean pressure gradient across the mitral valve, or the need for reoperation.

Table 1: Preoperative and operative data

	Respect group (n= 76)	Resect group (n= 123)	P
Age (y)	37 (29- 44)	54 (48- 60)	<0.001
Female	46 (60.53%)	79 (64.23%)	0.60
Hypertension	20 (26.32%)	30 (24.39%)	0.76
Diabetes mellitus	30 (39.47%)	70 (56.91%)	0.02
Surgical approach			
Median sternotomy	56 (73.68%)	17 (13.82%)	<0.001
Mini-thoracotomy	20 (26.32%)	106 (86.18%)	
Ischemic time (min)	99 (95- 106)	79 (75- 82)	<0.001
Cardiopulmonary bypass time (min)	134.5 (130- 138.5)	99 (97- 104)	<0.001

Table 2: Postoperative outcomes

	Respect group (n= 76)	Resect group (n= 123)	P
Blood loss (ml)	370 (305- 390)	550 (490- 600)	<0.001
Re-exploration	4 (5.26%)	9 (7.32%)	0.40
Stroke	2 (2.63%)	0	0.15
Sternal wound infection	3 (3.95%)	8 (6.5%)	0.54
Renal failure	2 (2.63%)	3 (2.44%)	>0.99
Early reoperation for mitral regurgitation	6 (7.89%)	3 (2.44%)	0.09
Intensive care unit stay (days)	5 (5-6)	7 (6- 8)	<0.001

Statistical analysis

Continuous variables were tested for normality, and non-normal data were compared using the Mann-Whitney U test and normal data using the t-test. Binary data were compared using the Chi-square or Fisher exact test when appropriate. Quantile regression was used to evaluate factors affecting the length of ICU stay. A mixed-effect model with restricted maximum likelihood was used to test the change in the postoperative pressure gradient. Stata 16 (Stata Corp- College Station, TX- USA) was used to perform the analysis, and a P-value of less than 0.05 was considered statistically significant.

Results:

Preoperative and operative data

Patients in the Respect group were younger. The minimally invasive approach was more commonly used in patients who had resection techniques, and they had lower ischemic and cardiopulmonary bypass times. (Table 1)

Postoperative data:

Blood loss was more in the resect group, while no difference in re-exploration for bleeding. No difference was found in postoperative complications between groups. Patients in the Resect group had longer ICU stay. (Table 2)

Factors affecting ICU stay:

Longer ICU stay was associated with male gender, hypertension, diabetes, prolonged ischemic time, and the Resect group. (Table 3)

Long-term follow-up:

There was a significant difference between groups in the change of postoperative mitral valve pressure gradient ($P<0.046$); however, the change of pressure gradient was not significant within the

groups between 6 and 12 months ($P= 0.56$). There was no difference in follow-up mitral regurgitation, and reoperation was higher in patients who had neochordae. (Table 4)

Table 3: Multivariable regression for factors affecting ICU stay duration

ICU stay	Coefficient (95% CI)	p-value
Resect group	3.01 (2.54- 3.48)	<0.001
Age	0.01 (-0.003- 0.02)	0.14
Male	0.21 (0.006- 0.42)	0.04
Hypertension	0.43 (0.19- 0.66)	<0.001
Diabetes mellitus	0.31 (0.11- 0.51)	0.002
Median sternotomy	0.09 (-0.18- 0.35)	0.52
Ischemic time	0.05 (0.04- 0.07)	<0.001

Discussion

Posterior leaflets prolapse is the most common mitral valve lesion. Repair of the posterior leaflet prolapse can be performed through quadrangular resection, as proposed by Alain Carpentier. The resection technique proved safe and had good long-term results. However, it has several limitations, including reducing the coaptation surface, not respecting the anatomy of the mitral valve, and leading to the deformation of the ventricle base. Additionally, mitral valve prolapse is a spectrum of pathologies, and no one technique fits all mitral valve pathologies. Therefore, new repair techniques were proposed, emphasizing respecting rather than resecting the mitral valve leaflets. The use of artificial chordae to correct the leaflet prolapse restores the normal anatomy and physiology of the mitral valve, thus producing an optimal coaptation surface [20]. In this study, we compared the respect versus the resection techniques. Patients in the Respect

Table 4: Long-term outcomes

	Respect group (n= 76)	Resect group (n= 123)	P
MV gradient 6 months (mmHg)	3 (2- 4)	4 (3- 4)	0.01
Moderate or higher MR- 6 months	4 (5.26%)	3 (2.44%)	0.43
MV gradient 12 months (mmHg)	3 (3- 3.5)	4 (3-5)	<0.001
Moderate or higher MR- 12 months	4 (5.26%)	3 (2.44%)	0.43
Mitral valve reoperation – 12 months	5 (6.58%)	1 (0.81%)	0.03

Continuous data were presented as median (Q1-Q3) and binary data numbers and percentages. (MR: mitral regurgitation; MV: mitral valve)

group were younger, reflecting the surgeons' preference for this approach in young patients. Additionally, the ischemic and cardiopulmonary bypass times were longer in the Respect group. These results were concordant with the study of Dreyfus and colleagues, which showed longer ischemic and cardiopulmonary bypass time in the Respect group. Still, this long time did not reflect on morbidity or mortality, or ICU hospital stay. Longer times in the Respect group could be related to the learning curve in this group.

The Respect group had more median sternotomy and less mini-thoracotomy approach compared to the Resect group. This finding can be explained by the learning curve and surgeons' preferences. In contrast, the blood loss and ICU hospital stay were less in the Respect group compared to the Resect group, and these results were concordant with that from Lange and colleagues' study. This shorter ICU stay with comparable outcomes led to adopting the respect technique as a preferred modality of mitral valve repair of myxomatous degeneration of the mitral valve. The technique could be beneficial if there is no excessive tissue or limited excessive tissue in height only as in prolapse or flail leaflet.

In contrast, the resect technique is still preferred in certain situations like excessive tissue in width or annular calcification [21]. Makamura and colleagues found no difference in operative time and length of ICU and hospital stay between both groups. These findings are different from our results, but the small sample size of their study (n= 36) can explain this difference [22].

By comparing both groups regarding the mean gradient across mitral valve during follow up, the

Respect group had a lower mean gradient across mitral valve during follow up and this can be explained by larger mitral valve area in respect group compared to resect group due to preservation of mitral valve leaflet tissue to a great extent in the Respect group. This result was similar to Makamura and his colleagues' study but non-concordant with the Lange and colleagues' study results, which found a significant difference between both groups [21, 22].

Regarding recurrence of MR during follow-up, it was found that it was more in the Respect group, but it did not reach a significant level. This finding was similar to other studies [23 – 25]. Dreyfus and colleagues showed that there was a lower incidence of MR recurrence during follow-up and a lower need for reoperation in the Respect group. This can be explained by a higher percentage of candidates suitable for respect technique in this study with no excessive mitral valve tissue [26].

In our study, the need for reoperation was more in the Respect group, and this was similar to Oglou and colleagues' study, which showed that freedom from reoperation is less in the Respect group. Still, this result was discordant from Amine Mazine and colleagues' study, which showed that the need for reoperation was less in the Respect group [23, 25].

Finally, it was found that both techniques showed comparable outcomes and durability; however, the respect technique is relatively simple and more suitable if there is no excessive tissue or there is excessive tissue in height only as in leaflet prolapse or flail leaflet. In contrast, the resect technique is still preferred in certain areas like excess tissue or annular calcification [27].

Study limitations:

The study is limited by the retrospective design. Patients' selection is based on the surgeons' preferences and experience. The Distribution of the baseline data is different between groups, which may have affected the outcome. Baseline data are limited, and several preoperative and operative variables not included in this study may have affected the outcomes. The follow-up duration is limited, and a longer period of follow-up is required. Further randomized trials are recommended to overcome these drawbacks.

Conclusion

Both techniques of mitral valve repair showed comparable outcomes and durability. The repair technique should be tailored according to the mitral valve pathology.

Conflict of interest: Authors declare no conflict of interest.

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