Mitral valve re-repair after failed repair with artificial chordae

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Funded by the Judith Dion Pyle Chair in Heart Valve Research.
Received for publication Aug 28, 2023; revisions received Sept 29, 2023; accepted for publication Oct 10, 2023; available ahead of print Oct 21, 2023.
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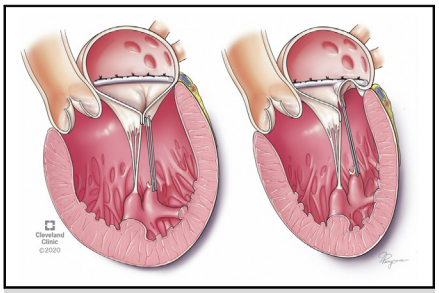
JTCVS Techniques 2023;22:114-7
2666-2507

https://doi.org/10.1016/j.xjtc.2023.10.017



Ventricular remodeling may cause chordal pseudoelongation and recurrent leaflet prolapse.

Leaflet resection and creation of artificial chordae are equally effective for mitral valve repair caused by degenerative posterior leaflet prolapse. However, failure modes differ between the 2 approaches.[1,2] Ventricular remodeling—changes in left ventricular geometry—may cause recurrent prolapse after initial successful mitral valve repair with artificial chordae. This study aims to determine the likelihood of mitral valve re-repair in patients with severe mitral regurgitation due to recurrent prolapse caused by ventricular remodeling after posterior leaflet repair with artificial chordae.

CENTRAL MESSAGE

Mitral re-repair is feasible with excellent mid-term results in the rare instance of early recurrent posterior leaflet prolapse due to neochordal pseudoelongation caused by ventricular remodeling.

METHODS

From January 1, 2008, to January 31, 2023, 406 patients underwent reoperation for mitral valve repair failure at Cleveland Clinic. Among them, 11 patients presented with moderately severe or severe mitral regurgitation caused by recurrent prolapse after initial successful posterior leaflet repair with artificial chordae and annuloplasty. Clinical data were retrieved from the prospective Cardiovascular Information Registry, with additional information extracted from medical records and follow-up surveys. The institutional review board (IRB) of the Cleveland Clinic approved the study protocol and publication of data (IRB# 23-844, approved on August 18, 2023). The IRB waived patient consent because the study was retrospective and deemed to pose a minimal risk.

RESULTS

Six patients were male, and the mean age was 58 ± 8.6 years. Median time between the first and

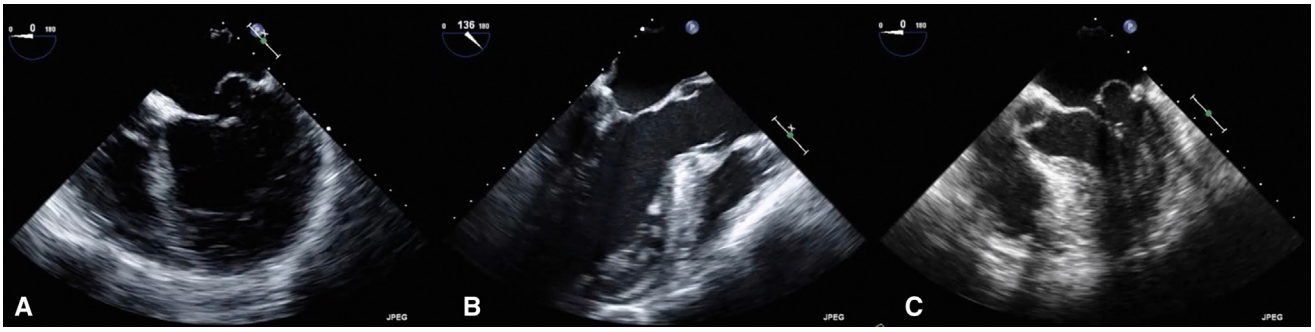


FIGURE 1. A 59-year-old patient with severe degenerative mitral regurgitation. A, Four-chamber view showing preoperative P2 prolapse and left ventricular dilatation. B, Long-axis view of successful initial mitral valve repair (artificial chordae fixed to P2 + 35-mm annuloplasty band) without evidence of prolapse. C, Four-chamber view 5 months after initial repair showing recurrent P2 prolapse in a shrank left ventricle after reverse remodeling.

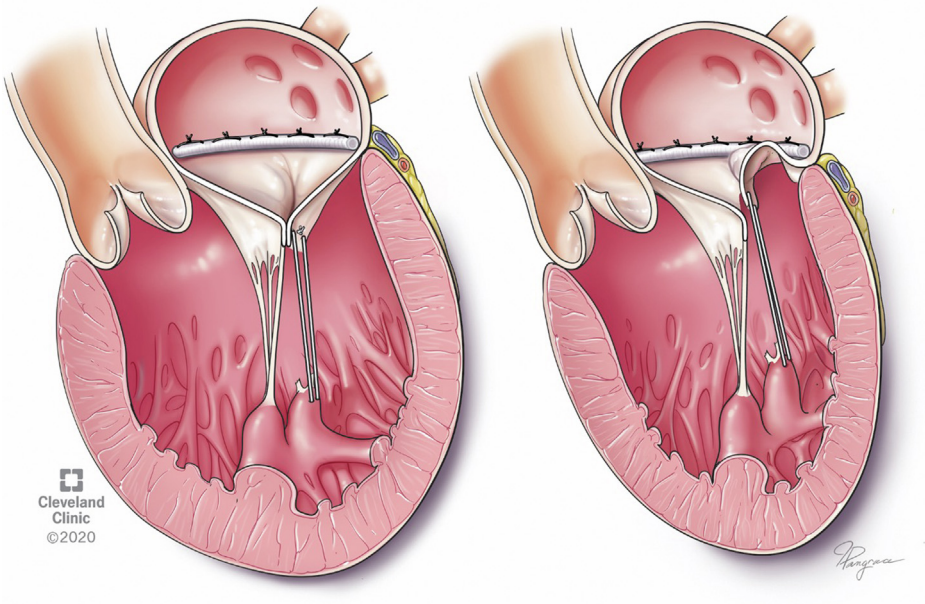


FIGURE 2. Recurrent mitral regurgitation due to chordal pseudoelongation. A seemingly perfect mitral valve repair using artificial chordae in a markedly enlarged left ventricle (*left*). As the ventricle shrinks (*right*), the artificial chordae appear too long (chordal pseudoelongation) for the remodeled left ventricle, leading to recurrent posterior leaflet prolapse.

reoperation was 14 months, and a decrease in left ventricular diameters was observed (Table E1). Ten of 11 patients had mitral valve re-repair (Figure 1). Re-repair techniques included creation of new, shorter artificial chordae (n = 5), posterior leaflet resection (n = 5), and placement of a new annuloplasty (n = 8). One patient had mitral valve replacement, as that patient had both recurrent prolapse of P2 and extensive fibrosis and restriction of P1. All patients undergoing re-repair left the operating room with no or trace mitral regurgitation, confirmed on predischarge echocardiogram. There was no operative mortality or major complications. At last echo follow-up (median 20 months), all patients had mild MR or less.

DISCUSSION

Chronic mitral regurgitation causes progressive enlargement of the left ventricle, ultimately leading to left ventricular dysfunction. Mitral valve repair induces positive reverse ventricular remodeling toward normalizing the left ventricular morphology and function.[3] Left ventricular chamber remodeling occurs in stages, characterized by an initial drop of the left ventricular end-diastolic diameter, followed by an improvement of left ventricular end-systolic diameter approximately 1 year after surgery. This is accompanied by a decrease in ejection fraction postoperatively, followed by a gradual recovery over time.[3,4] The technique used to repair the valve in the instance of posterior leaflet prolapse—either resection or creation of artificial chordae—doesn't influence the degree of reverse remodeling.[4] Ventricular remodeling has been recognized as a rare, but not negligible, cause of early mitral valve repair failure.[1,5] In an enlarged ventricle, the choice of artificial chordae for a posterior leaflet repair carries an inherent risk of early recurrent mitral regurgitation due to chordal pseudo-elongation as the ventricle reduces its dimension (Figure 2). Therefore, when degenerative posterior leaflet prolapse is associated with a dilated left ventricle, carefully evaluating the mechanism of mitral regurgitation to choose the best repair technique is crucial to achieving a successful and durable repair. Given the experience reported in this study, we favor resection of the posterior leaflet in this specific scenario. If a "respect" technique is selected, we recommend creating shorter chordae to avoid recurrent prolapse in the anticipated event of pseudoelongation due to remodeling.

In our series, leaflet resection and placement of shorter artificial chordae are equally effective in re-repair durability, with excellent midterm outcomes. Further larger studies are needed to characterize better the underlying mechanisms and exact ventricular segments involved in reverse remodeling.

CONCLUSIONS

Recurrent prolapse may cause mitral regurgitation in patients with a posterior chordal repair followed by left ventricular remodeling. Although uncommon, this scenario

presents an excellent opportunity for a relatively straightforward re-repair of the mitral valve.

Conflict of Interest Statement

Dr Gillinov serves as a consultant to Edwards Lifesciences, Medtronic, Abbott, ClearFlow, Artivion, AtriCure, and Johnson & Johnson. All other authors reported no conflicts of interest.

The *Journal* policy requires editors and reviewers to disclose conflicts of interest and to decline handling or reviewing manuscripts for which they may have a conflict of interest. The editors and reviewers of this article have no conflicts of interest.

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TABLE E1. Reverse remodeling effect on left ventricle geometry

		Preoperative primary mitral repair				Preoperative reoperation			
Patient number	Sex	LVEDD, cm	LVESD, cm	EF, %	Months to reoperation	LVEDD, cm	LVESD, cm	EF, %	Reoperation
1	M	5.8	3.8	60	18	5.2	3.3	62	Replacement
2	M	5.1	3.6	67	8	5.2	3.2	57	Resection
3	M	6.2	4.2	65	5	5	3	50	Resection
4	M	5.7	4	65	87	5	3.1	67	Neochordae
5	F	5.5	3.6	65	40	5	3.2	66	Neochordae
6	F	4.7	2.8	65	56	4.4	3	65	Resection
7	M	6.1	4	64	15	5	3.4	62	Neochordae
8	F	5.2	3.6	64	5	5.4	3.6	55	Resection
9	F	4.8	2.9	65	13	3.8	2.4	72	Neochordae
10	F	5.2	3.2	76	14	4.3	2.6	56	Neochordae
11	M	5.8	3.7	71	14	5.1	3.5	66	Resection
Median		5.5	3.6	65	14	5	3.2	62	

LVEDD, Left ventricular end-diastolic diameter; *LVESD*, left ventricular end-systolic diameter; *EF*, ejection fraction; *M*, male; *F*, female.