

# Early Failure after Non-resectional Mitral Valve repair with Artificial Chordae

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## Abstract

Severe recurrent mitral regurgitation (MR) within 1 year of mitral valve repair is usually attributed to a technical issue with the original repair procedure. However, when artificial chordae are employed to correct mitral valve prolapse, ventricular remodeling (i.e. decreased ventricular size) can lead to recurrent prolapse and valve dysfunction. To highlight this phenomena, we present 2 patients who experienced early failure after undergoing mitral valve repair with artificial chordae.

## 1 | INTRODUCTION

Degenerative mitral valve disease is the most common indication for mitral valve surgery in North America<sup>1</sup>. In such patients, mitral valve repair is preferred over mitral valve replacement<sup>2-4</sup>. Historically, resectional techniques described by Carpentier<sup>5</sup> were the predominant approach to mitral valve repair.

David and Frater<sup>6-8</sup> originally described the use of artificial ePTFE chords to reconstruct the mitral valve apparatus when ruptured or elongated native chordae are the cause of prolapse. Mitral valve repair with artificial chordae has excellent mid- and long-term outcomes<sup>9-10</sup>. It has been shown to produce equivalent clinical outcomes when compared with resectional techniques. Potential advantages when compared to resectional techniques include preservation of the mitral valve apparatus, greater surface of leaflet coaptation and decreased risk of SAM<sup>11-12</sup>. However, a small percentage of patients experience early mitral valve repair failure after repair with artificial chordae.

We report 2 cases of recurrent mitral regurgitation early after mitral valve repair with artificial chordae; these were attributable to recurrent prolapse resulting from left ventricular remodeling.

## 2 | CASE SERIES

### | Approach to Artificial Chordae Implantation

An ePTFE suture (CV-4) is passed through the fibrous region of a papillary muscle on the same side of the valve (ie, medial or lateral) as the region of prolapse. Each end of the suture is brought up to the leaflet edge and passed twice through the leaflet tissue in the region of prolapse; the needles pass from the ventricular to the atrial aspect and finish adjacent to each other on the atrial aspect. The chordal length is adjusted to a level to prevent prolapse, using the region of A1-P1 as a reference point and ensuring a generous zone of coaptation (Figure 1). The suture is tied on the atrial side of the MV leaflet. All repairs include a posterior annuloplasty band.

### | Case 1

A 42 year old male presented with 4+ MR, annular dilatation, mild left ventricular dilatation and mild left ventricular dysfunction. At index operation he had extensive posterior leaflet prolapse with ruptured

chordae to P2/P3. Two sets of artificial chords were fixed to the posterior leaflet and a 35-mm annuloplasty band placed. No SAM or MR was noted after the case, and leaflet coaptation was excellent. Three months postoperative, he presented with 3-4+ MR and mild symptoms. At reoperation, previously placed chords remained intact but he had P2 prolapse with a noticeably remodeled ventricle that was now normal in size. His valve was repaired with sliding valvuloplasty.

## | Case 2

A 51 year old male presented with 4+ MR, LV dilatation and mild biventricular dysfunction. At index operation he had multiple ruptured chords to his posterior leaflet. Artificial chords were fixed to the posterior leaflet and a 35-mm annuloplasty band was placed. He presented 6 months later with 4+ MR and NYHA Class II symptoms; his ventricular function had improved and ventricular size was now normal. At reoperation, artificial chords remained intact but were now too long, causing posterior leaflet prolapse. His valve was repaired with sliding valvuloplasty.

## | DISCUSSION

When compared to mitral valve replacement, mitral valve repair in patients with degenerative disease is associated with superior outcomes and, in addition, excellent durability<sup>13</sup>. However, there is an inherent failure rate after mitral valve repair<sup>14-15</sup>. Failure within 1 year of repair is traditionally attributed to technical error rather than to disease progression or new pathology<sup>16</sup>. Non-resectional techniques including the use of artificial chordae have potential advantages over leaflet resection stemming primarily from preservation of mitral valve physiology<sup>17</sup>. Here we describe our experience with 2 patients who required early reoperation for recurrent mitral regurgitation after mitral valve repair using artificial chordae.

In patients with left ventricular dysfunction and enlargement, mitral valve repair can be associated with reverse remodeling that includes a reduction in left ventricular dimension. We suggest here that reverse remodeling after mitral valve repair may occasionally result in ventricular morphology that causes recurrent prolapse in patients whose initial mitral valve repair was achieved with the application of artificial chordae. Further study of a larger number of patients will be necessary to understand the precise changes in ventricular dimension that can cause recurrent prolapse when artificial chordae are employed.

Determination of proper chordal length during surgery remains crucial in successfully performing artificial chord repair. Numerous techniques have been described to expand the number of tools at the surgeon's disposal<sup>18</sup>. We routinely utilize artificial chords using either the free-hand or pre-measured loop techniques with great success<sup>19</sup>. We suggest the mechanism of early failure described here represents an inherent risk of correcting mitral regurgitation in patients who have left ventricular dilatation and dysfunction rather than a technical failure. Reverse ventricular remodeling may result in recurrent prolapse in such patients. One option is to create chords that are somewhat shorter in patients with ventricular dilatation, anticipating the possibility of remodeling. A second option is to employ resectional techniques in such patients.

## 4. | REFERENCES

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