Commentary: Evolution of Chordal Techniques for Mitral Valve Repair

J. Scott Rankin MD

Department of Cardiovascular and Thoracic Surgery
West Virginia University, Morgantown WV

Disclosures: Dr. Rankin is a consultant for BioStable Science and Engineering, Inc., Austin TX, USA.

Corresponding author:
J. Scott Rankin MD
Department of Cardiovascular and Thoracic Surgery
West Virginia University
Morgantown, WV
1 Medical Center Drive, Morgantown, WV
jsrankinmd@cs.com

Text Word Count: 591
References: 20
Figures: 1
Videos: 3

Central Picture Legend: Diastolic (A) and systolic (B) appearance of a Barlow's valve after PTFE artificial chordal replacement.

Central Message

Developing techniques of chordal reconstruction was integral to mitral repair. The video by Rehman et al (1) illustrates current methods, and this commentary discusses the history of these techniques.
Commentary

In the 1960’s and 70’s, mitral valve replacement for mitral regurgitation (MR) was among the highest-risk procedures in cardiac surgery (2). Fifty years later, surgery for MR has become extremely safe and effective (3) – arguably one of the major success stories in Medicine. This transition was due largely to the development of contemporary mitral valve repair, and in this issue, Rehman and colleagues present their current technique for “robotic artificial chord implantation” in a highly lucid video (1). The purpose of this commentary is to discuss some of the developmental steps that culminated in current repair efficacy.

While many surgeons reported repairing mitral valves in the 1960’s (4), it was Carpentier who developed the concept of mitral ring annuloplasty that is the basis of current reconstruction. To quote Carpentier: “Prosthetic rings of a suitable shape and size are necessary to perform a measured annuloplasty which will [reproducibly] restore the normal [geometric] contour - and thereby both a normal orifice area and optimum function of the valve” (5). We forget now that mitral repair was not immediately accepted, and in fact, some of Carpentier’s initial approaches, such as chordal shortening (Figure 1A), were associated with an incidence of repair failure (Figure 1B) (6). After presenting such a case in morbidity conference in the 1980’s, the author was intensely criticized by fellow faculty members for embarking on a new and unproven program. One often thinks about calling these colleagues now to say - “you see, mitral repair did work out” – but alas, they have departed.

Toward the end of the 1980’s, Robert Frater and Herb Vetter addressed the chordal support problem by inserting Polytetrafluoroethylene (PTFE) sutures for artificial chordal replacement (ACR) (7). Interestingly, Frater had worked with Dr. Ellis on mitral repair while at Mayo Clinic (8), and in a 1962 Lancet article (9), he made the prophetic statement: “…the
patient with a mitral prothesis is a patient for life.” His advent of ACR contributed significantly to transitioning away from replacement, and as he later stated: “The initial growth [of ACR] was entirely without promotion, sponsorship, or marketing - driven by the desire of the individual surgeon to achieve the fundamental goals of restoring valve competence and the modern reality of mitral valve repair” (10).

Many surgeons made important contributions to ACR (11-16). In early clinical experience, it became evident that achieving precise chordal length was critical. By 1995, we began tying an initial temporary knot, and then completing the chordal length adjustment after ring insertion. Initial submission of this technique for publication was met with an interesting, if not amusing, review: “…the originality, the scientific accuracy, the relevance and the presentation are really very poor and I do not even know where to start with my remarks and suggestions to try to improve this stuff. Personally, I would recommend outright rejection of this manuscript”. However, with some effort, the technique of “adjustable ACR” was published (17), followed by two more articles (18,19). At the STS meetings 20 years ago, we presented videos of this approach (Video 1 and Video 2), and also posted on CTSNet. ACR proved especially useful for repair of anterior leaflet prolapse (20), and then 15-years ago, a transition was made to implanting chords robotically (Video 3) (21), a progression that ultimately culminated in current highly effective techniques for robotic mitral repair, as nicely illustrated in Dr. Rehman’s video (1). Even now, it is common to be contacted by patients who are 25-30 years after ACR - with no subsequent valve problems. Such is the goal of cardiac valve repair.

References


Figures

**Figure 1:** Panel A: Carpentier’s method for shortening elongated chordae that was associated in some patients with late chordal rupture (Panel B) (5,6).

Video Legends

**Video 1:** “Mitral Valve Repair for Barlow’s Syndrome using Adjustable Artificial Chordal Replacement”. Presented at the STS meeting 2004 and posted on CTSNet. [http://www.jsrmd.com/ftp/1_ACR_BarlowsC.mp4](http://www.jsrmd.com/ftp/1_ACR_BarlowsC.mp4)

**Video 2:** “Adjustable Artificial Chordal Replacement (ACR) for Repair of Mitral Regurgitation due to Isolated Posterior Leaflet Prolapse.” Presented at the STS meeting 2005 and posted on CTSNet. [http://www.jsrmd.com/ftp/2_PACRc.mp4](http://www.jsrmd.com/ftp/2_PACRc.mp4)

**Video 3:** “Robotic Artificial Chordal Replacement for Repair of Mitral Valve Prolapse”. Presented at the ISMICS meeting 2008. [http://www.jsrmd.com/ftp/3_RACRc.mp4](http://www.jsrmd.com/ftp/3_RACRc.mp4)