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EDITORIAL COMMENT

Percutaneous Chordae Mitral Repair

Is it the Right Way to Fix Mitral Regurgitation?*

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Mitral regurgitation (MR) is the most common valve disease in developed countries (1). If surgical mitral valve repair or replacement remains the gold standard treatment for degenerative MR, one-half of the patients with severe symptomatic MR are not referred for surgery, either due to frailty, multiple comorbidities, or prohibitively high surgical risk (2). The mortality rate in this cohort of patients reaches 50% at 5 years of follow-up, and up to 90% of surviving patients require hospitalization for heart failure within 5 years after the diagnosis of severe MR (2). Several transcatheter mitral valve repair technologies have emerged for treating MR in patients at high or prohibitive surgical risk. Transcatheter chordal implantation using expanded polytetrafluoroethylene sutures is an appealing technique that is supported by its success in conventional open-heart surgery and conforms to the "respect rather than resect" principle in mitral valve repair (3). A proper force distribution on prolapsed tissue, chordal orientation, and optimal muscular attachment are the elements of optimal MR reduction with this approach; thus, quality of mitral repair depends mainly on ventricular dynamics.

In this issue of *JACC: Basic to Translational Science,* Ticar et al. (4) describe an alternative to current percutaneous chordal repair options that relies on the concept of an artificial papillary muscle by fixing a polymer mesh that contains the entire prolapsing segment and collects a multitude of chords in a swing arm. Based on its design, this innovative concept offers several advantages. First, the swing arm is stabilized via a transleaflet clasp with a counteracting atrial wing aligned to avoid ventricular muscular attachment, and therefore, the impact of ventricular dynamics on mitral repair results. Second, computational analysis showed a good biomechanical behavior of the device. Because the neochordae are not implanted directly into the leaflet but are included in a polymer mesh, there is an optimal distribution of tension forces that ensures prolapse fixation and valve sealing. Third, the swing arm showed no fatigue or erosion issues in the 90-day long-term animal model, which presumed the durability of the device. Furthermore, the device demonstrated satisfactory healing in the necropsy analysis with an endothelialization of the polymer matrix. Last, none of the 5 animals had more than trace MR at 60-day imaging evaluation.

Despite this promising concept, there are some limitations that need to be highlighted. 1) The investigators did not study the thrombogenic potential of the device nor did they report their anticoagulation approach. 2) All of the implants were performed through a transseptal approach. All animal implantations were performed under cardiopulmonary bypass (CPB). It is a little bit disappointing to use CPB for the deployment. The objective of these techniques is to avoid the CPB collateral damages even if the CPB duration was short and did not exceed 30 min. 3) It is obvious that the long-term animal model of MR is difficult to reproduce, but how easy will the implantation be with a flail leaflet? 4) In the same direction, elasticity of myxomatous tissues is different from

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normal ones, so how will the device behave in this setting? 5) Finally, as for all chordal repairs, this device could not address all mechanisms of the MR, especially the annulus dilation.

Only transcatheter mitral valve implantation (TMVI) can be suitable for a wide range of mitral valve anatomies and MR mechanisms. By avoiding the morbidity of open mitral replacement and effectively preventing recurrence of MR, TMVI provides the best option for treating mitral valve disease. In a recent meta-analysis (5), TMVI achieved high technical success with predictable and durable MR reduction up to 1 year. Nonetheless, in-hospital mortality remains high, with 11% of patients dying in the 30 days following the procedure. In addition to high-risk profile patients, this high rate could be partially explained by the learning curve and the myocardial injury secondary to a transapical approach. These results improved with the less invasive transseptal approach, which reduced mortality to <1% with last-generation devices. Therefore, is transcatheter chordal repair the right way to fix MR percutaneously?

AUTHOR RELATIONSHIP WITH INDUSTRY

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