Remodeling the mitral valve: An outside-in strategy

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In this issue of the *Journal*, Kataoka and colleagues¹ present an interesting study that evaluates the efficacy of an externally placed device on experimentally induced ischemic mitral valve regurgitation (IMR). Using a sheep model, they study a surgically positioned, polymer-filled mesh placed externally at the area of posterolateral myocardial infarction. This biocompatible device stabilizes the left ventricle wall, reduces atrial and ventricular remodeling, and reduces chordal tethering without cardiopulmonary bypass. Transthoracic echocardiography and direct pressure measurements demonstrate improved hemodynamic parameters and reduced chordal length, which restores mitral valve function. This innovative device is an alternative solution to mitral valve ring annuloplasty for IMR.

Ventricular restoration for ischemic cardiomyopathy remains an attractive target of therapy. For heart failure, surgical techniques, such as partial left ventriculectomy, and external compression devices, such as CorCap (Acorn Cardiovascular Inc, St Paul, Minn) and HeartNet (Paracor Medical Inc, Sunnyvale, Calif), have been applied to prevent left ventricular (LV) dilatation that occurs in cardiomyopathies. Unfortunately, these approaches fail to normalize LV function or improve survival despite hemodynamic and quality-of-life improvements.²⁻⁴ Similarly, for IMR, several surgical techniques and devices have been proposed that involve direct repositioning of the papillary muscles, compression of the LV, imbrication of the papillary muscle, or chordal cutting.^{5,6} The complexity of IMR remains challenging, with limited long-term benefits from these options.

Kataoka and colleagues highlight a new technology that targets the specific area of ischemic LV injury and resultant valve dysfunction. IMR affects millions of patients and is associated with a doubling in mortality among patients with mild or greater degrees of regurgitation.⁷ LV remodeling associated with IMR is dynamic, as location and degree of myocardial injury rather than valve pathology are critical. LV remodeling after ischemic events results in continuous ventricular and atrial chamber enlargement with contractile dysfunction. Repair of IMR with ring annuloplasty is often selected over replacement based on

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Central Message

An experimental external polymesh cardiac device may provide a novel mechanism of left ventricular wall stabilization to improve clinical outcomes for ischemic mitral regurgitation.

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perceptions of improved outcomes with repair and elimination of long-term anticoagulation.⁸ However, a randomized, multicenter trial challenged this practice by comparing mitral repair with restrictive annuloplasty with valve replacement for IMR. The repair group had significant increase in recurrence rate of moderate or greater IMR at 2 years (59% vs 4%).⁹ The most common mechanism underlying recurrence of IMR was persistence of leaflet tethering, which is not addressed with ring annuloplasty. LV remodeling after chronic ischemic events is an important factor in IMR.

The authors target this clinical need with an experimental device that reduces IMR and progression to heart failure. They created a unique device tailored to patient-specific LV and MV remodeling requirements. It is adjustable to achieve appropriate reverse remodeling in an infarcted and distorted LV. Although this 8-week recovery animal model does not replicate the chronic IMR remodeling of the LV seen clinically, the concept and application are intriguing, as surgical repair for correction of IMR has significant limitations. The development of external LV support device directed to the location of myocardial injury is a unique and innovative addition to the surgical armamentarium.

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