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Editorial Comment

Percutaneous Mitral Annuloplasty: Not Always a Cinch

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The basic surgical paradigm for mitral annuloplasty involves placing an undersized ring that encircles the entire mitral valve and uses the force of ring to compress the mitral annulus and leaflets along the septal to lateral axis (Fig. 1B). This septal-lateral compression is sometimes called septal lateral annular cinching (SLAC) [1,2]. Percutaneous adaptations of this procedure have used the coronary sinus as a route to encircle at least part of the mitral annulus to achieve SLAC. This report describes a novel approach in which cinching of the mitral annulus is not the mechanism. Rather, a rigid rod is placed in the coronary sinus behind the posterior leaflet, exerting direct pressure on the middle scallop of the posterior leaflet and compressing the septal to lateral dimension directly, compressing the regurgitant mitral orifice (Fig. 1C).

Olivier and coworkers report the results of temporary implantation of a percutaneous mitral annuloplasty (PTMA) device in humans [3]. Four implant attempts were made, and some reduction in mitral regurgitation (MR) was achieved in three of the four. Angulation of the coronary sinus precluded implant in one patient and in one delivery system was displaced in part when the device was manipulated and advanced.

The mechanism of this coronary sinus annuloplasty device differs fundamentally from others in the field. While coronary sinus annuloplasty is analogous to surgical annuloplasty and most easy to conceive of as a cinching transmitted through the coronary sinus to the mitral annulus, this PTMA device places a delivery catheter in the coronary sinus and then uses stiffening rods to apply pressure over the mid-segment of the posterior leaflet (Fig. 1C), with resultant compression of the regurgitant orifice in the septal to lateral dimension. This approach has some interesting consequences. Because pressure is being placed in the midportion of the posterior leaflet by stiff rods, just proximal and distal to the point of pressure the rods exert an outward tension away from the mitral annulus. This is in contrast to direct annuloplasty or other coronary sinus annuloplasty approaches where circumferential cinching of the entire annulus is the goal. Because the pressure is placed locally at the mid posterior leaflet area, compression of a circumflex trunk or branch vessel adjacent to the coronary sinus is likely less. The forces of mitral orifice compression are focal, and in the event that some of the regurgitant orifice is eccentric, this might be a potential limitation of this approach.

The population of patients in this report had ischemic MR. A large portion of the functional MR population has heart failure without ischemia as the etiology. It is unclear whether the differing mechanical approaches to these different patient populations will have different clinical results.

Patients with ischemia and consequent MR have a poor prognosis and relatively poor 1 year results from mitral repair using annuloplasty, and treating the MR alone may not be an adequate therapy. This appears not to be a consequence of the annuloplasty procedure, but of the underlying disease. The potential benefit of reduced MR remains to be seen in ischemic MR and the whole spectrum of new percutaneous devices will help elucidate the utility of reduction of MR in this setting.

The American Society of Echocardiography criteria for MR grading were used in this study [4]. In the past, reports of surgical therapy for MR have relied on estimation of MR primarily from color Doppler evaluations. It is clear the rigorous methods employed by these authors are necessary to adequately evaluate the results of both surgical mitral repair approaches and certainly of these new percutaneous technologies. For the color Doppler exam to be estimated as moderate to severe or severe, and then find a semi-quantitative estimation using the ASE criteria to yield a grade of moderate is not uncommon. These authors do not specify whether they used an independent core laboratory for echo analysis, but such core lab evaluations are critical

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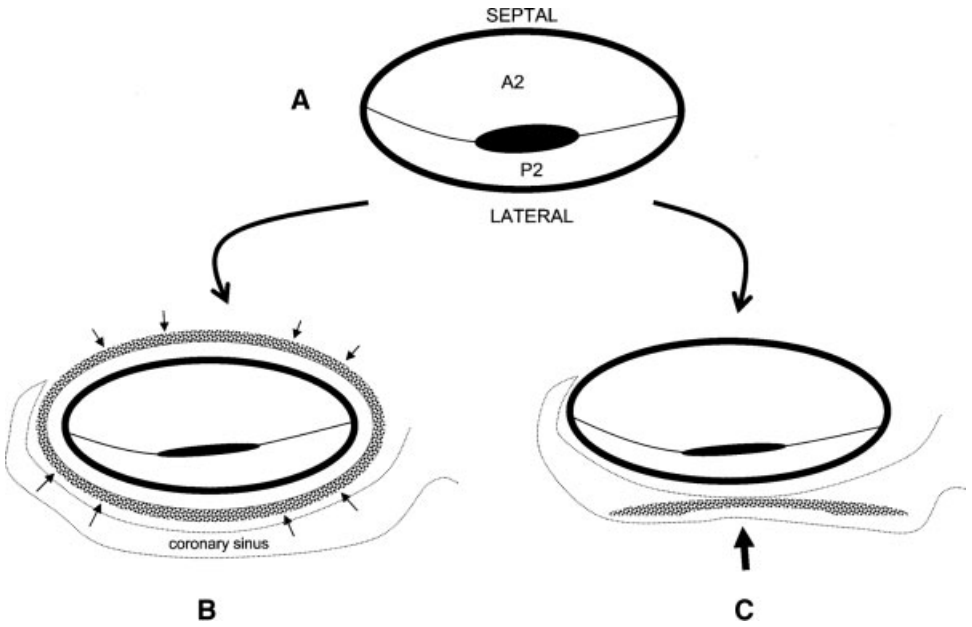

Fig. 1. (A) Schematic of the mitral valve. The mid-anterior (A2) and posterior (P2) leaflets are separated by the regurgitant orifice (black oval). (B) Surgical annuloplasty uses a circumferential ring (stippled) to constrict the mitral orifice and compress the septal-lateral dimension (small arrows). (C) PTMA uses rigid rods (stippled) to deliver force to the P2 segment via the coronary sinus, with resultant compression of the septal-lateral dimension (large arrow).

for the best assessments of trial results, in the same way that independent angiographic core labs have proven their value for trials of coronary therapy.

In this small experience the potential for a variety of coronary sinus-related complications, of course, cannot be elucidated. Other coronary sinus annuloplasty devices have had a small but notable episodes of coronary sinus perforation and cardiac tamponade related to coronary sinus cannulation or device delivery and there will be a learning curve for these devices. A unique feature of this device is the ability to tailor the degree of tension placed on the posterior annulus by using stiffening rods of varying stiffness. A mean of eight rods were tested to choose three that resulted in an optimal decrease in MR. This unique feature and the ability at some later time to remove and replace rods as needed is highly attractive, and the opportunity for staged treatment represents one of the fundamental differences between percutaneous and surgical therapies. The potential for serial treatments using a variety of the new percutaneous valve technology clearly separates them from surgery, and makes direct comparisons with surgical approaches difficult.

Ultimately, this report characterizes promising results using a temporary implant approach. Thus, no conclusions about the durability of the device can be made. Some of the coronary sinus annuloplasty devices, including this one, have fractured within a few months after initial permanent implantation in patients despite successful bench testing for many millions of cycles. Permanent implantation in the clinical environment remains the litmus test for the application of these devices, which is only the first step in defining their clinical utility. This experience with PTMA is part of the beginning of a very exciting journey into the development of percutaneous mitral repair devices. The accelerating pace of development reflects the degree of initial success with concepts such as this one.

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