Commentary: Mitral valvuloplasty rings: Do they make the difference?

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The interest in valvuloplasty for mitral valve regurgitation (MR) has reached an all-time high, as was evidenced by the recent American Association for Thoracic Surgery Mitral Conclave, which I and some other 1500 physicians, the vast majority surgeons, just attended in New York. It is now abundantly clear and widely accepted that repair of the valve greatly benefits the patient, by comparison with replacement, in virtually any type of mitral valve pathology or etiology, perhaps with the exception of secondary, especially ischemic MR. Even in the latter, the results may be influenced by the surgical techniques used, and this is still under intense debate.^{1,2}

It is obvious that the evolution of the techniques, since the initial concepts described by Carpentier and others 5 decades ago,^{3,4} has played a major role in the excellent results we are witnessing today. In some types of MR, valvuloplasty is possible in nearly 100% of cases with freedom from recurrence above 90% at 20 years.⁵ Among the improvements introduced is the evolution of the annuloplasty rings, from the first use in 1968,³ which are now an integral part of the procedure in the majority of cases. Different types, shapes, and sizes were brought forward, some of which gained a position in the market and are widely used, although with little scientific evidence of superiority of 1 over the others.

Recurrence of MR is the most important mode of late failure in mitral valvuloplasty. This is most often due to progression of the valve disease, but ring dehiscence has been observed in a significant percentage of reoperations for failure of the repair.⁶ Dehiscence may be due to inappropriate suture technique or to the cardiac cycle-related forces occurring in the annular structure.

It is on this topic that Ncho and colleagues⁷ based their work. The authors created “heterogeneous” rings with rigid anterior and posterior, and flexible commissural segments, matching the geometry of the Profile 3D rigid ring (Medtronic, Minneapolis, Minn). They then measured cyclic suture forces (Fc) in 6 healthy ovine subjects in which they

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Central Message

Mitral valvuloplasty is widely performed. Rings of different types, shapes, and sizes are used in most cases, but there is little scientific evidence of superiority of 1 over the others.

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implanted undersized annuloplasty devices. Relative to the fully rigid ring, the heterogeneous ring had a 48% reduction in Fc at its commissural segments and a 32% reduction in the posterior annulus, but not in its anterior region. There were no significant differences in Fc relative to the fully flexible ring in any region. The conclusion derived from this work was that “the reduced Fc of the heterogeneous ring relative to the fully rigid ring suggest a promising approach to reduce suture dehiscence likelihood, while preserving the annular remodeling capability of fully rigid rings.”

Whether or not this animal experience in normal animal valves can predict favorable results in abnormal human mitral valves remains unknown, and the authors recognize this, stating that “future studies in diseased subjects are necessary to explore repair effectiveness of this ring.” They appear to indicate that this advantage would be of special value in patients with ischemic MR, because dehiscence of the ring is the main reason for recurrence of regurgitation in this pathology. However, it is now widely accepted that abnormalities of the subvalvular apparatus and of the ventricular wall, not correctable by the annuloplasty, are the main cause of valve insufficiency.⁸

Other authors have studied annular stress distribution with different types of rings,⁹ but the current study will certainly promote discussion among the mitral repair fraternity. However, there are some aspects that require deeper thought. As

pointed out by a reviewer during the evaluation process, the mitral annulus is saddle-shaped but loses this shape when it dilates in severe MR, as observed in advanced echocardiography, and the lateral displacement of both papillary muscles accelerates this flattening effect in ischemic MR. Hence, it is uncertain whether the 3-dimensional shape of the ring is necessary or even appropriate. It may even be worse in increasing the risk of dehiscence at the posterior part of the annulus and to decrease coaptation length at the central part of the mitral valve. Naturally, this experiment may not be applicable to other types of (flat) rings.

Another question is whether there may be material fatigue at the level of the interface between the flexible and rigid portions of the ring, and this is not answered by the study. On the other hand, in this work there is no clear evidence of a significant difference in Fc between the heterogeneous and the flexible rings in the commissural and the posterior annulus, hence the question regarding the real benefit of the new ring.

This is a very fine experimental study that gives us further insight into the cyclic forces that are associated with ring annuloplasty, but it seems to be applicable to only a particular type of ring in the market characterized by its 3-dimensional shape. It is not applicable to flat (ie, 2-dimensional) rigid rings or to flexible rings or bands,

each of which claims the advantages of its own physical and physiologic properties that are untouched by the conclusions derived from this work.

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