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EDITORIAL COMMENTARY

Better seeing is more believing: Angioscopy in aortic valve repair

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See related article on pages 1666-8.

In this issue of the *Journal*, Tsagakakis and colleagues¹ very nicely present their first experience with intraoperative evaluation of valve geometry by angioscopy during aortic valve repair. Reviewing this article, at first I enjoyed their angioscopic pictures; later, however, I became a little skeptical because (1) the decision for rerepair was not based on the angioscopic findings but on conventional postoperative echocardiography, (2) the angioscopically observed geometric abnormalities were not validated by instantaneous echocardiography, (3) the pictures were 2-dimensional and did not allow assessment of leaflet

height, and (4) the level of the diastolic pressure was not clear.

Repair of the aortic valve is attractive, but it is still a developing and difficult technique, at least for me, even after more than 600 aortic valve repairs. Why? The anatomy and dynamics of the aortic root are extremely complex, resulting in a highly sophisticated, fine-tuned concert of all components, mainly the aortoventricular and sinotubular junction, the interleaflet triangles, and the leaflets,² within relatively small dimensional boundaries and tolerances. In diastole, the leaflets coapt perfectly in absolute parallel, without any folds or irregularities (Figure 1, A). This morphologic unit between the heart and the ascending aorta is the optimal solution for a long-lasting stenosis- and regurgitation-free valve mechanism, not producible by human technology. All dimensional abnormalities will lead to more or less valve dysfunction and in the worst case to insufficiency, whereby one or multiple anatomic levels or components can be affected, each needing consideration during repair. Furthermore, the quality, the pliability, the age-related increase in stiffness,³ the height, or other pathologies of the leaflets influence the results of repair. Consequently, the complexity of repair has different degrees, all aimed at creating a perfect coaptation line and area of 2 to 3 mm for complete sealing without stenosis. Even little folds in the free edge of a single leaflet can cause regurgitation, especially if the tissue is

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FIGURE 1. Endoscopic view of the normal aortic root at different diastolic pressures. A, At 80 mm Hg; B, at 40 mm Hg; C, at 0 mm Hg. Note the straight parallelism of the coaptation area of the leaflets in panel A, which becomes irregular when the diastolic pressure is reduced, making the assessment of the valve difficult.

somewhat stiffer than virgin young material (such as with a bioprosthesis or in older patients⁴).

Assessment of the results of repair by direct visualization is the commonly used technique not imitating diastolic pressure. Without diastolic pressure, the leaflets show unpredictable irregularities in their morphologic appearance, making the assessment difficult (Figure 1, B and C). The strength of the work of Tsagakis and colleagues¹ is their reintroduction of angioscopy of the aortic valve after repair.⁵ This technique nicely shows the morphology of the leaflets, but only from a top view in 2 dimensions. The coaptation line can clearly be seen, but less so the height of the leaflets and the coaptation depth. For assessment of the functional relevance of the abnormalities, adequate diastolic pressure and simultaneous quantification of regurgitation would be helpful. Probably the presented angioscopic visualization will be refined in an attempt to reach a precision that allows decision making. Aside from that, the questions are as follows: What is in general the value of angioscopy, and what is its difference from commonly used direct inspection of the repaired valve? Furthermore, can we improve this direct inspection with special holders imitating diastolic pressure? In the future, probably other techniques such as preoperative 3-dimensional printing of the individual root with the

possibility of in vitro preclinical repair attempts or even more sophisticated computational evaluation will provide detailed information on how to repair before we step into the operating room.

After all, long-term results of more than 20 years in these relatively young patients are needed to find the best indications, techniques, and limitations. Prospective, randomized trials would give the most reliable answers, but the complexity of pathologies and the diversity of surgical techniques are considerable obstacles. Meanwhile we must rely on quorum sensing, and every measure to improve the quality of repair is desirable. Angioscopy may become one of those tools.

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Aortic cannulation system for minimally invasive mitral valve surgery

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See related commentary on pages 1672-3.

Port-access technology with an endoaortic clamp (EC) or transthoracic clamp has been widely adopted and confirmed as having excellent clinical outcomes.¹ Nevertheless, concerns still remain about the risks of vascular

and neurologic events potentially associated with the use of retrograde aortic perfusion and balloon manipulation, particularly in patients with aortoiliac atheromatous disease.^{2,3}

Because of these concerns, a minimally invasive approach is denied to these high-risk patients relegating them to standard sternotomy. This situation prompted the development of a device for direct ascending aortic cannulation and clamping to extend minimally invasive mitral valve surgery (MIMVS) even to patients initially ineligible. The Endodirect (ED) cannula (Edwards Lifesciences, Irvine, Calif) allows antegrade arterial perfusion and insertion of an EC for aortic clamping, cardioplegia delivery, and aortic venting.⁴ Potentially, its use can avoid the risk of aortoiliac dissection and of retrograde embolism with neurologic injury related to retrograde aortic perfusion. It also provides a better stability for the EC and a lower risk of balloon migration.

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