26. Shrestha M, Pichlmaier M, Baraki H, et al. Long term results after aortic valve-sparing operation. *Eur J Cardiothorac Surg.* 2012;42:56-62.
27. Leontyev S, Trommer C, Subramanian S, Lehman S, Dmitreva, Misfeld M, et al. The outcome after aortic valve-sparing (David) operation in 179 patients: a single-center experience. *Eur J Cardiothorac Surg.* 2012;42:261-7.
28. Cameron DE, Alejo DE, Patel ND, Nwakamma L, Weiss E, Vricella L, et al. Aortic root replacement in 372 Marfan patients: evolution of operative repair over 30 Years. *Ann Thorac Surg.* 2009;87:1344-50.
29. Kvitting JE, Kari FA, Fischbein MP, Liang D, Beraud A-M. David valve-sparing aortic root replacement: equivalent mid-term outcome for different valve types with or without connective tissue disorder. *J Thorac Cardiovasc Surg.* 2013;145:117-27.
30. Urbanski P, Zhan X, Hijazi H, Zacher M, Diegeler A. Valve-sparing aortic root repair without down-sizing of the annulus. *J Thorac Cardiovasc Surg.* 2012;143:294-302.
31. Marom G, Haj-Ali R, Raanani E. A fluid-structure interaction model of the aortic valve with coaptation and compliant aortic root. *Med Biol Eng Comput.* 2012;50:173-82.
32. Boodhwani M, de Kerchove L, Glineur D, Rubay J, Vanoverschelde J-L, Noirhomme P, El Khoury G. Repair of regurgitant bicuspid aortic valves: a systemic approach. *J Thorac Cardiovasc Surg.* 2010;140:276-84.
33. De Kerchove L, Boodhwani M, Glineur D, Vandyck M, Vanoverschelde J-L, El Khoury G, et al. Valve sparing root replacement with the reimplantation technique to increase the durability of bicuspid aortic valve repair. *J Thorac Cardiovasc Surg.* 2011;142:1430-8.

EDITORIAL COMMENTARY

Aortic valve repair: Easy and reproducible?

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See related article on pages 123-9.

Aortic valve repair has made marked progress in the past 20 years. Initially started as a technique for valve-preserving aortic replacement primarily for patients with aortic dilatation and an absence of relevant cusp pathology, it has evolved to encompass both isolated cusp repair and combined root and cusp repair. Early morbidity and mortality have been low,^{1,2} and the risk of valve-related complications is lower than that generally seen after replacement.² Aortic valve repair leads to excellent quality of life,³ and there is the beginning of evidence that it may also improve survival.⁴

Initially, few centers embarked on this new type of surgery; in Europe, it was mainly performed by the group from Brussels⁵ and my own group.⁶ With better understanding of the interaction of cusp and root geometry and refinement of techniques of cusp repair, the concept of aortic valve repair has been accepted and used successfully by other groups.⁷⁻¹⁰ The good early and midterm results of the series of Jasinski and colleagues¹¹ published in this issue of the *Journal of Thoracic and Cardiovascular Surgery* emphasize

that this surgical approach is reproducible. In addition, Jasinski and colleagues¹¹ found that repair failure was associated with bicuspid anatomy and complex cusp repair, whereas concomitant root replacement was associated with improved valve stability. Although the latter finding is in concord with other published data, Jasinski and colleagues¹¹ also saw an increased late mortality associated with root replacement, which offsets its potential stability advantage.

In the analysis of their experience, Jasinski and colleagues¹¹ also found 2 specific aspects that confirm previous publications and experience: (1) subannular plication sutures do not result in adequate repair stability, at least in the case of bicuspid aortic valves, and (2) repair of cusp prolapse by plication of redundant cusp tissue seems to yield more reproducible and stable results than does the application of a running polytetrafluoroethylene suture to the cusp margin. The observation on subannular sutures has been made previously by others^{12,13}; in fact, in my group's experience these sutures have been a potential predictor of valve failure.¹² The stability of cusp plication in prolapse repair is in concord with my own group's total experience in more than 1600 patients.

Is aortic valve repair therefore easy with most of the techniques described, and should all risk factors for failure be avoided? The results of Jasinski and colleagues¹¹ are difficult to interpret because of the inhomogeneity of the patient population studied and the variety of techniques used. The data thus may be difficult to reproduce by others if they attempt to base their clinical practice on the information of the publication. First, Jasinski and colleagues¹¹ used a classification that relates echocardiographic information to the mechanism of aortic regurgitation and suggests a principal type of surgery on this basis.¹⁴ This classification does not

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provide morphologic cutoffs, however, and thus should be taken only as a rough guide for intraoperative decisions. This classification may be misleading in instances when root dilatation masks cusp prolapse, and only after normalization of root dimensions through root replacement is the preexistent cusp prolapse unmasked. In restrictive cusp motion, this classification does not differentiate between root and cusp causes, a difference that leads to very different surgical strategies. As in mitral repair, the choice of the individual surgical technique depends even more heavily on morphology than it does on functional classification.

Second, the results of any valve repair surgery are related to the precision with which normal or nearly normal valve configuration can be achieved at the end of the procedure. Some surgeons—such as Jasinski and colleagues¹¹—seem to rely on visual inspection only for this purpose. There has been increasing evidence, however, that the application of objective measurement of cusp configuration^{15,16} will lead to a higher reproducibility of aortic valve repair.⁸ Although Jasinski and colleagues¹¹ state that they measured effective height, it is unclear exactly what value they considered to be normal and what their cutoffs for prolapse correction were. Finally, a rational approach to aortic valve repair should also include quantification of cusp tissue—for example by measuring geometric height—to rule out retraction, which so far provides a poor substrate for cusp repair.^{17,18} In my group, we have found it helpful to rely on morphologic criteria primarily, always analyzing and correcting root and cusp pathology separately. We have found that morphologic criteria are helpful to surgeons who are starting their practice.

Thus Jasinski and colleagues¹¹ should be congratulated for their good clinical results, but the reader should be careful in trying to reproduce them solely on the basis of the presented information. Aortic valve repair requires the disciplined application of principal strategies and their meticulous execution. With those prerequisites, it is a reproducible technique in a high proportion of patients with aortic regurgitation; however, it is not as easy as it may seem from a distance. The less experienced surgeon should rather be encouraged to look more closely at the growing evidence in this field and beyond the reference list of the article before initiating his or her own aortic valve repair program.

References

- Price J, de Kerchove L, Glineur D, Vanoverschelde JL, Noirhomme P, El Khoury G. Risk of valve-related events after aortic valve repair. *Ann Thorac Surg*. 2013;95:606-12; discussion 613.
- Aicher D, Fries R, Rodioncheva S, Schmidt K, Langer F, Schäfers HJ. Aortic valve repair leads to a low incidence of valve-related complications. *Eur J Cardiothorac Surg*. 2010;37:127-32.
- Aicher D, Holz A, Feldner S, Köllner V, Schäfers HJ. Quality of life after aortic valve surgery: replacement versus reconstruction. *J Thorac Cardiovasc Surg*. 2011;142:e19-24.
- de Meester C, Pasquet A, Gerber BL, Vancraeynest D, Noirhomme P, El Khoury G, et al. Valve repair improves the outcome of surgery for chronic severe aortic regurgitation: a propensity score analysis. *J Thorac Cardiovasc Surg*. 2014;148:1913-20.
- El Khoury GA, Underwood MJ, Glineur D, Derouck D, Dion RA. Reconstruction of the ascending aorta and aortic root: experience in 45 consecutive patients. *Ann Thorac Surg*. 2000;70:1246-50.
- Aicher D, Langer F, Kissinger A, Lausberg H, Fries R, Schäfers HJ. Valve-sparing aortic root replacement in bicuspid aortic valves: a reasonable option? *J Thorac Cardiovasc Surg*. 2004;128:662-8.
- Holubec T, Zacek P, Jamaliramin M, Emmert MY, Tuna M, Nedbal P, et al. Valve cuspidity: a risk factor for aortic valve repair? *J Card Surg*. 2014;29:585-92.
- Lansac E, Di Centa I, Sleilaty G, Crozat EA, Bouchot O, Hacin R, et al. An aortic ring: from physiologic reconstruction of the root to a standardized approach for aortic valve repair. *J Thorac Cardiovasc Surg*. 2010;140(6 Suppl):S28-35; discussion S45-51.
- Mangini A, Contino M, Romagnoni C, Lemma M, Gelpi G, Vanelli P, et al. Aortic valve repair: a ten-year single-centre experience. *Interact Cardiovasc Thorac Surg*. 2014;19:28-35.
- Miyahara S, Omura A, Sakamoto T, Nomura Y, Inoue T, Minami H, et al. Impact of postoperative cusp configuration on midterm durability after aortic root reimplantation. *J Heart Valve Dis*. 2013;22:509-16.
- Jasinski MJ, Gocol R, Mainowski M, Hudziak D, Duraj P, Deja MA. Predictors of early and medium-term outcome of 200 consecutive aortic valve and root repair. *J Thorac Cardiovasc Surg*. 2015;149:123-9.
- Aicher D, Kuniyara T, Abou Issa O, Brittner B, Gräber S, Schäfers HJ. Valve configuration determines long-term results after repair of the bicuspid aortic valve. *Circulation*. 2011;123:178-85.
- Navarra E, El Khoury G, Glineur D, Boodhwani M, Van Dyck M, Vanoverschelde JL, et al. Effect of annulus dimension and annuloplasty on bicuspid aortic valve repair. *Eur J Cardiothorac Surg*. 2013;44:316-22.
- Boodhwani M, de Kerchove L, Glineur D, Poncelet A, Rubay J, Astarci P, et al. Repair-oriented classification of aortic insufficiency: impact on surgical techniques and clinical outcomes. *J Thorac Cardiovasc Surg*. 2009;137:286-94.
- Schäfers HJ, Bierbach B, Aicher D. A new approach to the assessment of aortic cusp geometry. *J Thorac Cardiovasc Surg*. 2006;132:436-8.
- Bierbach BO, Aicher D, Issa OA, Bomberg H, Gräber S, Glombitza P, et al. Aortic root and cusp configuration determine aortic valve function. *Eur J Cardiothorac Surg*. 2010;38:400-6.
- Schäfers HJ, Schmied W, Marom G, Aicher D. Cusp height in aortic valves. *J Thorac Cardiovasc Surg*. 2013;146:269-74.
- le Polain de Waroux JB, Pouleur AC, Goffinet C, Vancraeynest D, Van Dyck M, Robert A, et al. Functional anatomy of aortic regurgitation: accuracy, prediction of surgical reparability, and outcome implications of transesophageal echocardiography. *Circulation*. 2007;116(11 Suppl):I264-9.