Committee to Revise the 1998 Guidelines for the Management of Patients With Valvular Heart Disease) endorsed by the Society of Cardiovascular Anesthesiologists, Society for Cardiovascular Angiography and Interventions, and Society of Thoracic Surgeons. *J Am Coll Cardiol*. 2008;52:e1-142.

4. Evangelista A, Flachskampf FA, Erbel R, Antonini-Canterin F, Vlachopoulos C, Rocchi G, et al. Echocardiography in aortic diseases: EAE recommendations for clinical practice. *Eur J Echocardiogr*. 2010;11:645-58.

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Reply to the Editor:

We thank Grewal and colleagues for their interest in our article, "Cardiac magnetic resonance imaging is more diagnostic than 2-dimensional echocardiography in determining the presence of bicuspid aortic valve."¹ In our study, we found that transthoracic echocardiography (TTE) correctly discriminated 62% of patients with bicuspid aortic valve, compared with 93% with cardiac magnetic resonance imaging (CMRI).¹ Excluding nondiagnostic test results, the sensitivities for bicuspid aortic valve were 86% for TTE and 96% for CMRI.¹ Our study population included patients with aortic stenosis, regurgitation, and normally functioning valves.

We congratulate Grewal and colleagues for analyzing their own experience with preoperative imaging for bicuspid aortic valves. Their experience showed very similar results to ours, with identification rates of 78% with TTE and 94% with CMRI. Sensitivities were also similar to our results, with 60% for TTE and 80% for CMRI. Grewal and colleagues' results do differ slightly from ours because their patient population focused on aortic stenosis only, which we found to reduce the accuracy of both preoperative tests.¹

Clearly, the implications for correct preoperative identification of bicuspid aortic valve are significant. From a practical standpoint, we perform

CMRI in all patients that are found by TTE to have a bicuspid aortic valve to evaluate the ascending aorta completely into the transverse aortic arch for the presence of aneurysm related to associated ascending aortopathy. We also perform CMRI in all patients who have TTE results nondiagnostic for aortic valve morphology. In this group of patients, CMRI can reliably identify valve morphology. We perform CMRI selectively in patients who are found on TTE to have a normal trileaflet valve. Recognizing that the TTE incorrectly identifies a trileaflet valve in 10% of patients who indeed have a bicuspid aortic valve, we perform CMRI in younger patients with aortic valve dysfunction (valve dysfunction typically occurs in younger patients with bicuspid aortic valve) and in patients with borderline ascending aortic aneurysm (aneurysms related to bicuspid aortic valve carry increased risks of dissection and rupture).

We agree with Grewal and colleagues that CMRI improves diagnostic certainty, improves risk stratification, and assists in surgical decision making in patients with bicuspid aortic valve.

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Reference

1. Malaisrie SC, Carr J, Mikati I, Rigolin V, Yip BK, Lapin B, et al. Cardiac magnetic resonance imaging is more diagnostic than 2-dimensional echocardiography in determining the presence of bicuspid aortic valve. *J Thorac Cardiovasc Surg*. 2012;144:370-6.

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VALUE OF THE TRICUSPID ANNULAR PLANE SYSTOLIC EXCURSION AS A FOLLOW-UP PARAMETER IN PATIENTS WITH HYPOPLASTIC LEFT HEART SYNDROME

To the Editor:

We read with great interest the recent article from Kasnar-Samprec and colleagues,¹ "Unloading of Right Ventricle by Bidirectional Superior Cavopulmonary Anastomosis in Hypoplastic Left Heart Syndrome Patients Promotes Remodeling of Systemic Right Ventricle But Does Not Improve Tricuspid Regurgitation." In our opinion, this is an interesting article describing effects of volume changes on remodeling of the systemic right ventricle (RV) in patients with hypoplastic left heart syndrome (HLHS). Kasnar-Samprec and colleagues¹ found reduced tricuspid annular plane systolic excursion (TAPSE) relative to age-related reference values in all their study groups. Kasnar-Samprec and colleagues¹ also stated that "most had normal RV function," although how else they assessed RV function was not clearly stated. We would interpret the depressed TAPSE as a sign of impaired RV systolic performance both before and after bidirectional superior cavopulmonary anastomosis. We may add that Klitsie and associates² recently published a study suggesting that longitudinal systolic RV function is expected to be decreased after congenital heart defect surgery. We completely agree with the findings of Kasnar-Samprec and colleagues¹ that bidirectional superior cavopulmonary anastomosis promotes the remodeling of the systemic right ventricle, and we would add that in pediatric patients with different physiology (tetralogy of Fallot that has been addressed surgically), the TAPSE values worsen continuously with time.^{3,4} Kasnar-Samprec and colleagues¹ state that in patients with nonsignificant tricuspid

regurgitation the TAPSE is significantly reduced after the BSPCA relative to preoperative values, as opposed to no significant change preoperatively and postoperatively in the patient groups with significant tricuspid regurgitation. Kasnar-Samprec and colleagues¹ also suggest that TAPSE is directly related to RV preload status. We want to mention that, in accordance with their data,¹ researches should be very careful in interpreting TAPSE values in the presence of significant tricuspid regurgitation (which provides afterload reduction as well as affecting preload), because there could be false-positive high TAPSE values in this condition. Significant tricuspid regurgitation might have a detrimental effect on the long-term outcome of the systemic RV in patients with HLHS, whereas in those patients (falsely) high TAPSE values are to be expected during the follow-up investigations. Longitudinal assessment of the TAPSE for individual patients should help show interval changes in RV systolic function with time in those patients with falsely high TAPSE values. Kasnar-Samprec and colleagues¹ support the notion that the RV is highly susceptible to postoperative function impairment in pediatric patients with a systemic RV.

We thank Kasnar-Samprec and colleagues¹ for addressing the need for careful and systematic evaluation of the RV in patients with HLHS before and after bidirectional superior cavopulmonary anastomosis. We hope that with more interesting studies like this one, quantification of systemic RV function will become an routine measurement in patients with HLHS.

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References

1. Kasnar-Samprec J, Kühn A, Hörer J, Vogt M, Cleuziou J, Lange R, et al. Unloading of right ventricle by bidirectional superior cavopulmonary anastomosis in hypoplastic left heart syndrome patients promotes remodeling of systemic right ventricle but does not improve tricuspid regurgitation. *J Thorac Cardiovasc Surg.* 2012;144:1102-9.
2. Klitsie LM, Hazekamp MG, Roest AA, Van der Hulst AE, Gesink-van der Veer BJ, Kuipers IM, et al. Tissue Doppler imaging detects impaired biventricular performance shortly after congenital heart defect surgery. *Pediatr Cardiol.* September 22, 2012 [Epub ahead of print].
3. Koestenberger M, Nagel B, Avian A, Ravekes W, Sorantin E, Cvirn G, et al. Systolic right ventricular function in children and young adults with pulmonary artery hypertension secondary to congenital heart disease and tetralogy of Fallot: tricuspid annular plane systolic excursion (TAPSE) and magnetic resonance imaging data. *Congenit Heart Dis.* 2012; 7:250-8.
4. Koestenberger M, Nagel B, Ravekes W, Avian A, Heinzl B, Fandl A, et al. Tricuspid annular peak systolic velocity (S') in children and young adults with pulmonary artery hypertension secondary to congenital heart diseases, and in those with repaired tetralogy of Fallot: echocardiography and MRI data. *J Am Soc Echocardiogr.* 2012;25:1041-9.

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Reply to the Editor:

We thank Koestenberger and Ravekes for their kind comments on our article. They emphasized the importance of tricuspid annular plane systolic excursion as a marker of right ventricular (RV) function.

As we stated in our Methods section, subjective “eyeballing” by an experienced pediatric cardiologist and ultrasonographer was the method for quantification of RV function. Although this is certainly not the criterion standard in determining the RV function, it has its value in the hands of an experienced observer. Bellsham-Revell and associates¹ demonstrated a good correlation between eyeballing in echocardiography and RV functional analysis by magnetic resonance

imaging in patients with hypoplastic left heart syndrome (HLHS).

We would be very cautious in the interpretation of reduced tricuspid annular plane systolic excursion values in children with HLHS as a real indicator of an impaired RV function. Publications comparing quantitative echocardiographic parameters of RV function in patients with HLHS against the values in healthy subjects are scarce. The systemic RV in HLHS might be significantly different from the RV in a normal biventricular heart not only in ventricular geometry but in its function as well because of different interventricular interactions. It is not certain whether it is reasonable to compare a systemic RV in a univentricular heart with the RV in a biventricular circulation or whether it is better to compare it with the left ventricle.

Most data on ventricular function in HLHS compare the parameters before and after a given medical intervention. Petko and coworkers² found a reduction in RV global and regional longitudinal strain as well as a reduction of tricuspid annular plane systolic excursion after the Norwood operation, although they found no change in RV fractional area change. They were not able to discern any patient-specific or surgical factors to explain this finding. Ugaki and associates³ found reductions in RV end-diastolic area and RV fractional area change after tricuspid valve repair in patients with HLHS. It is clear that in this case the RV function could have been affected by the surgical procedure itself.

As Koestenberger and Ravekes confirmed, it is essential to interpret the parameters of the RV function in the patients with HLHS in the context of the loading condition under which the systemic RV is working. Further studies are necessary to evaluate RV function more thoroughly in this patient group by adding modern techniques, such as