10. Russell HM, Forsberg K, Backer CL, Wurlitzer KC, Kaushal S, Mavroudis C. Outcomes of radial incision of the tricuspid valve for ventricular septal defect closure. *Ann Thorac Surg.* 2011;92:685-90; discussion 690.
11. Zoghbi WA, Enriquez-Sarano M, Foster E, Grayburn PA, Kraft CD, Levine RA, et al. Recommendations for evaluation of the severity of native valvular regurgitation with two-dimensional and Doppler echocardiography. *J Am Soc Echocardiogr.* 2003;16:777-802.
12. Hoffman JI, Kaplan S, Liberthson RR. Prevalence of congenital heart disease. *Am Heart J.* 2004;147:425-39.
13. Hoffman JI, Kaplan S. The incidence of congenital heart disease. *J Am Coll Cardiol.* 2002;39:1890-900.
14. Kapoor L, Gan MD, Bandyopadhyay A, Das MB, Chatterjee S. Improved exposure of isolated perimembranous ventricular septal defects. *Ann Thorac Surg.* 2000;69:291-2.
15. Hudspeth AS, Cordell AR, Meredith JH, Johnston FR. An improved transatrial approach to the closure of ventricular septal defects. *J Thorac Cardiovasc Surg.* 1962;43:157-65.
16. Idriss FS, Muster AJ, Paul MH, Backer CL, Mavroudis C. Ventricular septal defect with tricuspid pouch with and without transposition: anatomic and surgical considerations. *J Thorac Cardiovasc Surg.* 1992;103:52-9.
17. Tatebe S, Miyamura H, Watanabe H, Sugawara M, Eguchi S. Closure of isolated ventricular septal defect with detachment of the tricuspid valve. *J Card Surg.* 1995;10:564-8.
18. Scully BB, Morales DL, Zafar F, McKenzie ED, Fraser CD Jr, Heinle JS. Current expectations for surgical repair of isolated ventricular septal defects. *Ann Thorac Surg.* 2010;89:544-9; discussion 550-1.
19. Anderson BR, Stevens KN, Nicolson SC, Gruber SB, Spray TL, Wernovsky G, et al. Contemporary outcomes of surgical ventricular septal defect closure. *J Thorac Cardiovasc Surg.* 2013;145:641-7.

Key Words: ventricular septal defect, tricuspid valve detachment, outcome, infant

EDITORIAL COMMENTARY

Taking 1 step backward to go 2 forward? Managing the tricuspid valve in the surgical closure of a ventricular septal defect

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The era of surgical intervention for ventricular septal defects (VSDs) began in 1952 when Muller and Dammann placed a pulmonary artery band to limit pulmonary blood flow.¹ Transatrial closure was described subsequently by Stirling et al in 1957.² The use of tricuspid valve (TV) detachment strategies to allow for improved exposure during transatrial closure of a VSD was introduced by Hudspeth in 1962 and has been historically well described.³ Surgical literature has focused on technical variations for valve detachment and in turn, provided data consistent with excellent outcomes, regardless of approach.⁴⁻⁶

Timing for VSD closure generally has been accepted to occur at 4-6 months of age, with the employment of pharmacologic afterload reduction and diuretic therapies allowing for growth and maturation before surgical intervention. The concept of earlier complete

reparative strategies, however, is a strongly encouraged thematic philosophy in the field of congenital heart surgery.

Allen Sherrill Hudspeth, MD

Central Message

Tricuspid valve detachment during transatrial closure of a ventricular septal defect has been well described. Bang et al suggest this approach in patients younger than 3 months of age.

See Article page 491.

In this issue of the *Journal*, Bang et al⁷ from Seoul, Korea, describe excellent outcomes in TV detachment for VSD closure in infants younger than 3 months of age. They describe both parallel and perpendicular incisional approaches. Their study cohorts consist of 296 infants who underwent isolated transatrial closure of a VSD, of which 49 (16.6%) had TV detachment and subsequent reconstruction. Their incidence of using this technique of TV detachment is consistent with that described by several groups.⁴⁻⁶

The lack of any previously described outcomes for VSD reparative approaches involving TV detachment in younger infants provides a level of relevance to the reader. Atrioventricular valvular tissue commonly is thought to be quite friable and fragile in the neonatal and infant patient. Strategies to best expose a VSD via retraction of valvular structures is often challenging, especially in the hands of an assistant surgeon. In addition, excessive stretching of tissue within this region often is cited as a source of temporary or complete heart block after surgical intervention.

The group describes a greater incidence of heart block, residual VSD, as well as need for further TV repair in the control rather than study group. These findings, although not statistically significant, further promote the concept of strategized TV detachment in select patients with TV chords traversing the VSD and attaching to the anterior or superior margin of the defect.

The study is limited as the result of its retrospective, nonrandomized nature and, as such, procedural and selection bias may influence results. Four surgeons

comprised the study team, with 1 surgeon almost exclusively using a perpendicular incisional approach.

Surgical approaches and techniques used by congenital heart surgeons remain remarkably heterogeneous, even in the subset of operations deemed to be straightforward. Anecdotal and personal biases regarding technical variations often produce stringent philosophies and educational mantras. Although the concept of TV detachment is well described, many still find it unappealing because of the iatrogenic creation of structural injury when adequate exposure is achievable by other methods. Bang et al⁷ remind us that TV detachment is indeed a safe approach in the setting of a challenging transatrial VSD closure, regardless of age or size.

References

1. Muller WH Jr, Dammann JF. The treatment of certain congenital malformations of the heart by creation of pulmonic stenosis to reduce pulmonary hypertension and excessive pulmonary blood flow. *Surg Gynecol Obstet.* 1952;95:213.
2. Stirling GR, Stanley PH, Lillehei CW. Effect of cardiac bypass and ventriculotomy upon right ventricular function. *Surg Forum.* 1957;8:433.
3. Hudspeth AS, Cordell AR, Meredith JH, Johnston FR. An improved transatrial approach to the closure of ventricular septal defects. *J Thorac Cardiovasc Surg.* 1962;43:157-65.
4. Russell HM, Forsberg K, Backer CL, Wurlitzer KC, Kaushal S, Mavroudis C. Outcomes of radial incision of the tricuspid valve for ventricular septal defect closure. *Ann Thorac Surg.* 2011;92:685-90.
5. Gaynor JW, O'Brien JE Jr, Rychik J, Sanchez GR, DeCampi WM, Spray TL. Outcomes following tricuspid valve detachment for ventricular septal defects closure. *Eur J Cardiothrac Surg.* 2003;24:511-5.
6. Scully BB, Morales DL, Zafar F, McKenzie ED, Fraser CD Jr, Heinle JS. Current expectations for surgical repair of isolated ventricular septal defect closure. *J Thorac Cardiovasc Surg.* 2013;145:641-7.
7. Bang JH, Park CS, Park J-J, Yun T-J, Baek JS, Yu JJ, et al. Detachment of the tricuspid valve for ventricular septal defect closure in infants younger than 3 months. *J Thorac Cardiovasc Surg.* 2016;151:491-6.