plete repair should be deferred until the child is 6 to 7 years old to confirm whether the pulmonary valve annulus has sufficiently developed. Various techniques^{3,4} for repair must be chosen individually for this subset of anomalies.

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Tricuspid valve in hypoplastic left heart syndrome

To the Editor:

With great interest, we read the article by Ohye and colleagues,¹ describing their institutional experience with surgery for tricuspid valve regurgitation (TR) in patients with hypoplastic left heart syndrome (HLHS). The detailed analysis and clear presentation are praiseworthy. The authors focus on right ventricular (RV) volume overload and annular dilation of the tricuspid valve as the most common mechanism leading to significant TR, whereas structural abnormalities of the tricuspid valve in HLHS are mentioned only briefly as leaflet prolapse and leaflet tethering. We believe, however, that some morphologic features unique to the tricuspid valve in HLHS deserve closer attention.

Some years ago, we specifically studied the tricuspid valve morphology in a series of 82 anatomic specimens of HLHS.² One finding was that structural abnormalities of

the tricuspid valve were markedly more frequent in hearts with a patent mitral valve. Overall, we found some dysplasia of tricuspid valve leaflets in 35% of the HLHS specimens and in up to 50% of those with mitral stenosis. It would be interesting to know whether the authors' clinical experience also reflects this notion; that is, whether the majority of the patients with HLHS requiring tricuspid valve repair had mitral stenosis rather than atresia. If this were the case, one might infer that patients with HLHS and mitral stenosis are indeed predisposed to clinically relevant TR and might necessitate closer follow-up examinations and perhaps earlier intervention.

Regarding repair of a regurgitant tricuspid valve, the authors favor a partial annuloplasty that effectively eliminates the posterior leaflet and results in a functionally bifoliate valve. Because the coronary artery in the atrioventricular groove can be put at risk with annuloplasty procedures, it is worth noting that a previous study³ described a significant prevalence of left coronary dominance (56%) in hearts with aortic and mitral atresia compared with regular right coronary dominance in hearts with aortic atresia and mitral stenosis.

The final point we would like to raise is the use of a partial ring for reinforcement of an annuloplasty. In HLHS the septal leaflet of the tricuspid valve differs markedly from that in a normal heart. We found that in hearts with mitral atresia, when the RV aspect of the interventricular septum is concave (ie, bulging toward the left ventricle), the usual direct chordal attachments of the septal leaflet are replaced by additional papillary muscles.² The interventricular septum in HLHS becomes essentially part of the RV free wall, and the architecture of the septal leaflet resembles that of the anterosuperior leaflet. Therefore it would be interesting to know how the authors orientate the partial ring, with the opening facing the anterosuperior leaflet or the septal leaflet. With the right atrioventricular valve in HLHS being supported to a greater extent by RV free wall musculature, one wonders whether a closed ring might not be more effective in preventing redilation.

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Reply to the Editor:

I appreciate the comments of Ho and Stamm in their letter to the editor. I am well aware of their excellent article describing the findings of tricuspid valve (TV) abnormalities in 35% to 50% of 82 pathologic specimens of hypoplastic left heart syndrome (HLHS).¹ Because our article was a retrospective, observational review, it did not have the scientific rigor of their study, nor did we have many pathologic specimens available for review. Therefore we concentrated on clinical, rather than morphologic, issues. The only method for evaluation of the anatomy of the TV available to us was echocardiography, which did not always correlate with the intraoperative findings. Because neither of these methods of assessment is particularly robust for describing the exact morphology of the TV, they were not stressed in the article. We also did not attempt to correlate the anatomic subtype of HLHS to the development of tricuspid regurgitation.

We continue to prefer the partial annuloplasty for the repair of the TV in the setting of HLHS, as well as in other lesions. We have not experienced any coronary events or deaths that we thought might be coronary related in patients with HLHS or other anomalies. The few rings we have placed were positioned in the traditional orientation for concerns of the conduction system. Although these patients all universally had excellent results, we have only used them in rare cases in which we thought the relatively fixed annulus would be of sufficient size to carry the child into adulthood.

Thank you again to Drs Ho and Stamm for taking the interest to submit a letter to the editor regarding our article. Such interaction and airing of other viewpoints

strengthens the original submission, and I am grateful for their efforts.

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The return of the coronary stapler: Will a new technique overcome an old obstacle?

To the Editor:

I read with greatest interest the recent article by Dr Suyker and colleagues.¹ The authors used a circular coronary stapler to perform an end-to-side left internal thoracic artery (LITA)-to-left anterior descending artery (LAD) anastomosis in 10 pigs. The procedure was performed on the beating heart through a partial median sternotomy. Patency of the anastomoses was confirmed by means of postmortem angiography, and histomorphologic evaluation performed at 5 weeks after the operation showed a normal healing response.

A few comments seem to be appropriate and of interest to the readership of the Journal. The clinical use of circular coronary stapling has a short yet fascinating history.² Vladimir P. Demikhov (1916-1998) used the coronary stapling device in the early 1950s to make LITA-to-LAD end-to-end anastomoses in dogs and cadavers.³ On the basis of Demikhov's experiments, Vasilii I. Kolesov (1904-1992) first clinically applied the coronary vascular stapler (VCA-4) on March 22, 1967, when he constructed an end-to-end anastomosis between the LITA and LAD in a 52-year-old man with class IV angina.⁴ Three years later, the patient remained free of angina. Kolesov subsequently used modified staplers with prolonged bushing (Figure 1, A) and vacuum suction to hold the LITA wall while the stapling was performed (US patent 4,350,160 of September 21, 1982).² The coronary angiography performed almost 4 years after the operation with this vacuum-facilitated stapler demonstrated patent end-to-end anastomosis (Figure 1, B). Thus it has already been demonstrated that coronary stapling can be successfully applied clinically. There were 3 main ob-

Figure 1. A, Vascular circular stapler with prolonged bushing (VCA-PB) applied by V. I. Kolesov and E. V. Kolesov in coronary surgery: 1, coronary artery; 2, internal thoracic artery; 3, incision in the coronary artery; 4, bushing; and 5, prolonged bushing. From Kolesov VI. *The Surgery of Coronary Arteries of the Heart*. Leningrad: Meditsina Publishing; 1977. p. 163. B, Angiogram done in the late 1960s demonstrating patent end-to-end anastomosis (arrow) applied by vacuum-facilitated stapler 3 years and 7 months after the operation. Courtesy of Dr Evgenii V. Kolesov.

stacles that precluded the use of coronary staplers in the early era of coronary surgery.

First, it was easier and faster to perform the anastomosis by hand either with or without cardiopulmonary bypass. The modern demands of achieving minimally invasive coronary surgery through ever-shrinking incisions reversed this. Both Kolesov's and Suyker's staplers could be adjusted to video-assisted robotic coronary surgery.

Second, it was not possible to make an end-to-side anastomosis with those early staplers. The ingenious stapler described by Dr Suyker and colleagues resolved this problem.

The third and most significant obstacle was the inability of the early staplers to bite through the heavily atherosclerotic vascular wall. They chewed on it. The Kolesov stapler overcame this obstacle in the late 1960s. It produced a perfect anastomosis in heavily atherosclerotic coronary arteries. Will the new stapler described by Dr Suyker and colleagues overcome this obstacle too?

It never ceases to amaze me how often old ideas, which seemed utterly impractical

for many years, return to life. It seems that what has been accomplished in surgery never dies but rather remains dormant for a number of years, waiting to be rediscovered. The time of robotic and minimally invasive coronary surgery has come, and the coronary staplers are evolving under the pressure of modern technology to find their new applications. Are these stapling devices here to stay this time?

Last but not least, I would like to congratulate Dr Suyker and colleagues on their fine experimental study. I am anxiously awaiting the results of their clinical experience and hope that their stapler will be more successful than its predecessors. If it can successfully bite through the atherosclerotic vascular wall, it will have an enormous effect on minimally invasive coronary surgery.

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