way you have shown us a real improvement, and I congratulate you for that.

In the interest of time I have 2 fairly simple questions.

First, why do you think your device, compared with the Amplatzer device with which there is much more experience and much more heart block, produces so little conduction disturbance? That is my first question. So why no heart block?

Second, how low do you think the body weight that your technique and device could be used in would be? What is the smallest child who can have this procedure done?

Again, congratulations and thank you.

Dr Wu. Thank you. The second question; I will first answer that. The lowest body weight in our group was 4.5 kg at 3 months of age.

And the first question, complete atrioventricular block is the hottest issue with regard to device closure of VSDs. There was no complete atrioventricular block in our group. We think this is mainly because of the modified occluders we use. Compared with the Amplatzer VSD occluder, the modified occluder we use has 2 remarkable differences: first, the waist height of the occluder was enlarged from 3 mm to 7 mm in 1-mm increments.

The Amplatzer occluder has only 1 waist height (1.5 mm). From the viewpoint of a cardiac surgeon, properly increasing the waist height to correspond with the thickness of the intraventricular septum alleviates compression of the adjacent intraventricular septum and theoretically minimizes atrioventricular block.

Second, we designed a totally new concentric perimembranous VSD occluder. This kind of occluder may be more stable in the heart and is much easier to deploy. And in most perimembranous VSDs, the distance between the defect and the aortic valve annulus is more than 2 mm, so implanting the concentric occluder rarely interferes with the motion of the aortic valve and the concentric occluder does not have a protruding edge on the left disk which faces the apex after being deployed and then compresses the left side of the intraventricular septum where we know the conductive tissue is passing through.

Avoiding an oversized occluder is another very important point because progressive device flattening of originally oversized device has been hypothesized as a mechanism for the development of complete atrioventricular block.

EDITORIAL COMMENTARY

“The times they are a-changin’”

Winfield J. Wells, MD

See related article on pages 257-65.

The times they are a-changin’

—Robert Allen Zimmerman (aka Bob Dylan), 1963

Although there have been major improvements in perioperative care, cardiopulmonary bypass, myocardial protection, hemodynamic monitoring, and anesthetic management, the fundamentals of ventricular septal defect (VSD) closure have changed little since the pioneering work done nearly 60 years ago in Minnesota.¹ We are still using circulatory support with its obligate inflammatory response, opening the heart, and sewing a patch in place to close the defect while

accruing ischemic time to the myocardium. The use of blood products is also common in infants, a large portion of the patient population.

This report by Xing and colleagues² from Qingdao University on the northeast coast of China is a harbinger of what may be a paradigm shift in the way we manage some patients with a VSD. Based on earlier experiences, the concept of VSD closure with a catheter-delivered occluder is likely to trigger a negative response, primarily because of the incidence of heart block.³ However the development of the modified device as described by the Qingdao team merits reconsideration of this technique.

The strengths of the report are the large number of patients ($n = 458$) and the fact that 97% of them were followed up for an average of 4 years by 2 dedicated physicians using a standardized protocol. The outstanding results speak for themselves and the authors seem to have mitigated the complications associated with earlier occluders. Among those scheduled for the minimally invasive transthoracic device procedure, 96% had a successful closure of their VSD. There was no early or late mortality. There was not a single incident of complete heart block, only a 0.23% incidence of trace or mild aortic insufficiency, and less than 5% incidence of trace or mild

From the Children's Hospital of Los Angeles and Division of Thoracic Surgery, Keck School of Medicine, University of Southern California, Los Angeles, Calif.

Disclosures: Author has nothing to disclose with regard to commercial support.

Received for publication Sept 23, 2014; accepted for publication Sept 26, 2014; available ahead of print Oct 25, 2014.

Address for reprints: Winfield J. Wells, MD, Division of Thoracic Surgery, Keck School of Medicine, University of Southern California, Los Angeles, CA 90027 (E-mail: wwells@chla.usc.edu).

J Thorac Cardiovasc Surg 2015;149:265-6
0022-5223/\$36.00

Copyright © 2015 by The American Association for Thoracic Surgery

<http://dx.doi.org/10.1016/j.jtcvs.2014.09.109>

tricuspid insufficiency. When you add to this the avoidance of cardiopulmonary bypass, a 3.6% transfusion rate, exposure via a limited subxyphoid or third left interspace incision, and the fact that guidance was by transesophageal echocardiography and not fluoroscopy thus avoiding radiation exposure, the case for the authors' approach becomes even more compelling. Simply stated, we cannot match these results with our current techniques. Also it is notable that this is a surgical procedure using a transthoracic, transventricular-delivered device that avoids the potential for injury to peripheral vessels. Such injury is most likely to occur in the infant patient. The consequences of femoral or other major vessel compromise in infancy has not been completely defined.

The weakness of the report is that it comes from a single institutional experience using a unique device developed by the authors that is not commercially available. Although the explanation of how and why the Amplatzer occluder (AGA Medical Corp, Golden Valley, Minn) was modified to avoid earlier problems makes sense; however, it is still the case that until these exceptional results are duplicated in other respected institutions, we will not know the true potential of the technique. Until then, it will be difficult to avoid thinking that this is too good to be true. Although the

authors describe exclusion criteria, there is undoubtedly room for further refinement and specificity.

Meanwhile, Dr Xing and his associates should be recognized for their efforts in developing a modified occluder device and delivery system that has yielded outstanding clinical results. This is not a procedure that is appropriate for all patients with a VSD but their contributions have a chance of improving care for large numbers of children. It may also make VSD closure possible in situations where resources are limited.

Where might we be in 10 years with closure of VSDs? Have we been given a glimpse into the future? Once again to borrow from Mr Dylan: "the answer, my friend, is blowin' in the wind, the answer is blowin' in the wind."

References

1. Dushane JW, Kirklin JW, Patrick RT, Donald DE, Terry HR Jr, Burchell HB, et al. Ventricular septal defects with pulmonary hypertension; surgical treatment by means of a mechanical pump oxygenator. *JAMA*. 1956;160:950-3.
2. Xing Q, Wu Q, Shi L, Xing Y, Yu G. Minimally invasive transthoracic device closure of isolated ventricular septal defects without cardiopulmonary bypass: long-term follow-up results. *J Thorac Cardiovasc Surg*. 2015;149:257-65.
3. Predescu D, Chaturvedi RR, Friedberg MK, Benson LN, Ozawa A, Lee KJ. Complete heart block associated with device closure of perimembranous ventricular septal defects. *J Thorac Cardiovasc Surg*. 2008;136:1223-8.