2. Hussein N, Honjo O, Haller C, Hickey E, Coles JG, Williams WG, et al. Hands-on surgical simulation in congenital heart surgery: literature review and future perspective. *Semin Thorac Cardiovasc Surg*. 2019 [Epub ahead of print].
3. Scanlan AB, Nguyen AV, Ilina A, Lasso A, Cripe L, Jegatheeswaran A, et al. Comparison of 3D echocardiogram-derived 3D printed valve models to molded models for simulated repair of pediatric atrioventricular valves. *Pediatr Cardiol*. 2018;39:538-47.
4. Yoo SJ, Spray T, Austin EH III, Yun TJ, van Arsdell GS. Hands-on surgical training of congenital heart surgery using 3-dimensional print models. *J Thorac Cardiovasc Surg*. 2017;153:1530-40.

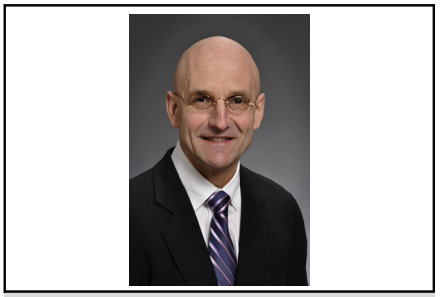
CONG

See Article page 1035.

Check for updates

Commentary: Operate on my printed model—absolutely; my newborn grandchild?

Ronald K. Woods, MD, PhD



Ronald K. Woods, MD, PhD

CENTRAL MESSAGE

Procedural training on 3D-printed models may enhance knowledge and technical performance of selected congenital cardiac surgical procedures.

Training of pediatric cardiac surgeons and mentoring junior surgeons—mission vital, yet not easy to do. The difficulty is inherent to the low- (or no) error margin in many of the procedures we do. Let's suppose you are an experienced surgeon with a newborn grandchild with transposition of the great arteries (TGA) and ventricular septal defect (VSD). You are to advise your son or daughter to choose between surgeon A, who trained at a reputable program, met all certification criteria (remarkably did 10 mentored TGA/VSD procedures during training), and is in year 1 in practice. As faculty, surgeon A has done 2 mentored repairs with excellent results. Surgeon A will now operate independently with a senior mentor readily available. Your other option is surgeon B, who has done 70 repairs with excellent results. Your advice? And that is the essence of our challenge. In part, this highlights the importance of the work by the group in Toronto, who has invested considerably in expertise and infrastructure to enable the incorporation of 3-dimensional (3D) training models into their curriculum. They now provide an assessment tool and demonstrate that practicing the arterial switch on a 3D TGA model can result in performance improvement.[1] Despite numerous challenges, I suspect most, if not all accredited training programs will incorporate this type of training as part of their curriculum at some point in the future, even if simply by sending trainees to specialized "boot camps." Although possibly limited to a handful of common anomalies, it couldn't hurt (except maybe some money), and it may well help.

But does the number of 3D model procedures or scores influence your choice of surgeon?

Suppose you are the surgical director of a 150 pump case/year program and do 2 to 4 TGA/VSD procedures per year. Your denominator is low—one little mishap could impact your percentage for the next several reporting cycles. At what point do you allow your junior partner to be the primary surgeon? At what point do you step away from mentoring every detail of the case? What feedback are you getting from your cardiologists? These are incredibly important questions, and the answers have incredibly important implications for Surgeon A maturing to Surgeon B. The solution may not be easy, but it isn't magic—it requires available, willing, competent mentors who will stand before, with, and behind their junior partners; and it requires check-writers to understand they are not simply paying for a

From the Division of Pediatric Cardiothoracic Surgery, Department of Surgery, Medical College of Wisconsin, and Herma Heart Institute, Children's Wisconsin, Milwaukee, Wis.

Disclosures: Author has nothing to disclose with regard to commercial support.
Received for publication Jan 23, 2020; accepted for publication Jan 24, 2020; available ahead of print Feb 8, 2020.

Address for reprints: Ronald K. Woods, MD, PhD, Division of Pediatric Cardiothoracic Surgery, Department of Surgery Medical College of Wisconsin, Children's Wisconsin, 9000 W Wisconsin Ave, MS B 730, Milwaukee, WI 53226 (E-mail: rwoods@chw.org).

J Thorac Cardiovasc Surg 2020;160:1044-5
0022-5223/$36.00

https://doi.org/10.1016/j.jtcvs.2020.01.069

specific service or a specific surgeon and their productivity—they are paying for competent service from the specialty for decades to come. Now a final question—in which context do you think the A to B process will occur (1) more efficiently with exposure to all levels of complexity; (2) the availability of more than one senior mentor; and (3) relatively less financial impact of "wasting" the senior surgeon's salary on first assist time—a small program or a large program? The structure of care delivery may be relevant to ensuring a stable supply of surgeon Bs.

Reference

1. Hussein N, Honjo O, Haller C, Coles JG, Hua Z, Van Arsdell G, et al. Quantitative assessment of technical performance during hands-on surgical training of the arterial switch operation using 3-dimensional printed heart models. *J Thorac Cardiovasc Surg*. 2020;160:1035-42.