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Commentary: Overpromised, understudied: The slippery slope of pediatric cardiac device development

Charles D. Fraser, Jr, MD



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CENTRAL MESSAGE

Pediatric device development is critical for children with cardiac disease. Unfortunately, the pressure to introduce innovation may, at important levels, result in inadequate scientific evaluation.

A legendary scientist in the Department of Engineering at the University of Texas–Austin was renowned for the tough admonition, his “researcher’s creed,” that he gave students proposing research in his laboratory: “Believe nothing, doubt everything, demand proof.” These cynical yet prophetic words should be applicable to much of what we do in pediatric cardiac surgery, and particularly the choices we make in placing new devices in children.

During the course of my career as a pediatric cardiac surgeon, I have relearned this bitter lesson too many times: if something sounds too good to be true, it probably is. There are many examples of this reality. We thought the DeBakey Child ventricular assist device (VAD) was going to revolutionize durable mechanical circulatory support in children. We were wrong.^{1,2} We believed that the Contegra bovine jugular valved conduit would offer a lower long-term risk profile in terms of durability and freedom from infection. It does not.³ We were confident that the risk profile of the Berlin Heart pediatric VAD was adequately established. It had not been.⁴ We are not alone in these experiences. The Sorin tissue valve did not perform well in children and had to be recalled with a warning to patients/families.⁵ The Shelhigh valved conduit performance and integrity in both the right and left ventricular outflow tract positions were unacceptable.⁶ In this issue of the *Journal*, we learn more about the performance of small intestinal submucosa patches and valve constructs, and the information is disappointing.

From the University of Texas Dell Medical School, Dell Children’s Medical Center, Austin, Tex.

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Address for reprints: Charles D. Fraser, Jr, MD, Texas Center for Pediatric and Congenital Heart Disease, Dell Children’s Medical Center, 4900 Mueller Blvd, Suite 3S.003, Austin, TX 78723 (E-mail: Charles.fraser@austin.utexas.edu).

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Why does this keep happening? Why do we jump on the “bandwagon” of new devices and materials for use in complex cardiac conditions in children? Most importantly and appropriately, we all sincerely want better options for our patients who have bad problems—a durable VAD with a low-risk profile, a better valved conduit, patch material that promotes native tissue ingrowth. We know that in pediatric cardiac surgery, developing innovative devices may be much more difficult when compared with our counterparts in adult cardiac surgery—start-up capital is scarce, the regulatory pathways onerous, grant funding opportunities limited and challenging, and the potential market small—the proverbial “Valley of Death” for new devices. And... of course, we have the realities of somatic growth and differences of biology in childhood to contend with in our research efforts. So, when something comes along that looks good, we are hopeful. We are early adopters. Sometimes it works out, sometimes not.

It is undeniable that devices and materials that we use in pediatric cardiac surgery are not always adequately tested before being used in patients. For a given situation or clinical need, this may or may not be justifiable. Unfortunately, there is also another element that remains, at minimum, controversial; at worst, unethical. As the authors of the current paper allude to in their discussion section, there is the ongoing reality of conflict of interest

in research that is performed in device development.⁷ Is acknowledging equity ownership in the “small print” of a scientific article sufficient to eliminate reasonable concerns about data integrity and interpretation? Or should we demand that investigators who are involved in the critical analytic steps that lead to human device implantation be completely distanced from any real or perceived financial conflict of interest? Tough questions when one considers the desperate need for solutions, the paucity of options in critical settings, and limited resource opportunities. Unfortunately, it can be a slippery slope. The pressures to get devices into patients are real and compelling. When it comes to scientific evaluation of new technology for children, however, it may be best to “believe nothing, doubt everything, and demand proof.”

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Commentary: “CorMatrix: If it is too good to be true, ...”

Francesco Formica, MD,^a and Tain-Yen Hsia, MD^b

The search for a perfect substitution material in reconstructive cardiovascular surgery continues. Ideally, such material will possess these properties: freedom from calcification, traction, and retraction; fully biocompatibility; resistant to infections, inflammation, and fibrosis; easy to handle; and promotes tissue remodeling and regeneration while allowing for growth. Numerous substitute materials, either biological and synthetic, have been applied in cardiac valve repair, ventricle walls, and great vessels reconstruction. Although we have extensive experience with autologous pericardium, xenopericardium, homograft, polyethylene (Dacron) and polytetrafluoroethylene (Gore-Tex) materials, none proved to be completely satisfactory. Biological



Francesco Formica, MD (left), Tain-Yen Hsia, MD (right)

CENTRAL MESSAGE

In animal studies, pulmonary valve conduit made with CorMatrix showed a high incidence of early valve failure and infection, with corresponding histologic features of inflammation and poor remodeling.

material will inevitably degenerate and calcify, and there is no growth potential in any of the synthetic options.

Since its introduction more than 20 years ago, decellularized porcine small intestinal submucosa (CorMatrix Cardiovascular, Inc, Roswell, Ga), has been tested in a variety of reconstructive cardiovascular operations. Its

From the ^aCardiac Surgery Unit, San Gerardo Hospital, Department of Medicine and Surgery, University of Milano-Bicocca, Monza, Italy; and ^bPediatric Cardiac Surgery, Yale New Haven Children’s Hospital, New Haven, Conn.

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Address for reprints: Francesco Formica, MD, Clinica Cardiocirurgica Ospedale San Gerardo, ASST Monza Via G.B. Pergolesi 33, 20052, Monza (MB), Italy (E-mail: francesco_formica@fastwebnet.it).

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