Commentary: "Daddy, is patient-prosthesis mismatch real?" "Yes, Billy, it lives under your bed with the other monsters"

Paul M. Kirshbom, MD

From the Division of Pediatric Cardiothoracic Surgery, Sanger Heart and Vascular Institute, Atrium Healthcare, Charlotte, NC.

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

Received for publication March 28, 2019; accepted for publication March 28, 2019; available ahead of print May 31, 2019.

Address for reprints: Paul M. Kirshbom, MD, Division of Pediatric Cardiothoracic Surgery, Sanger Heart and Vascular Institute, Atrium Healthcare, 1001 Blythe Blvd, Suite 200D, Charlotte, NC 28203 (E-mail: Paul.kirshbom@atriumhealth.org).

J Thorac Cardiovasc Surg 2019;158:e51-2
0022-5223/$36.00

https://doi.org/10.1016/j.jtcvs.2019.03.115

Paul M. Kirshbom, MD

Central Message

Patient-prosthesis mismatch can be predicted in certain cases and should be avoided if possible.

See Article page e49.

Aortic valve replacement with or without aortic root replacement, especially in the reoperative setting, has previously generated an endless series of questions involving what type of valve should be implanted (mechanical, bioprosthetic (stented or stentless), autograft, homograft, Osaki, transcatheter valve, etc, etc) and what size valve is appropriate. This discussion was somewhat simpler in the past, when bioprosthetic valves were primarily reserved for "old folks" because of concerns regarding multiple reoperations for bioprosthetic valve degeneration implanted in younger patients. Milewski and colleagues[1] have recently shed a bit more light on the topic of valve selection in younger patients, demonstrating very little difference in reoperation rates for bioprosthetic and mechanical valves implanted in patients younger than 30 years of age. Interestingly, they found that the only factor that was significantly associated with reoperation rate was the implantation of a valve 21 mm or smaller in size.

In this issue of the *Journal*, Nakamura and colleagues[2] from the University of Iowa present a case report involving a patient born with congenital aortic valve disease who underwent balloon valvuloplasty as a neonate, followed by homograft root replacement at the age of 10 years. Seven years later, the patient had the homograft root replaced with a 21-mm mechanical valved conduit. At the time, he was 17 years old and had a body surface area of 1.51 m^2, and at the end of the procedure, he had a mean gradient of 29 mm Hg across the valve.

Eight years later, the patient had grown to a body surface area of 1.64 m^2, the gradient across the valve had increased to a mean of 36 mm Hg, but he had no symptoms. Unfortunately, 8 months later he became fatigued and had shortness of breath, and an echocardiogram showed decreased left ventricular ejection fraction (down from 61% to 33%) and a decreased valve gradient in the setting of presumed low cardiac output. Catheterization also showed that he had an occluded left circumflex coronary artery of unknown duration.

Nakamura and colleagues[2] describe the subsequent operation during which they replaced and upsized the aortic valve to a 25-mm mechanical valve by means of a Konno aortoventriculoplasty without replacing the Bentall conduit. They describe this successful application of a combination of techniques, which worked out very well for this patient, despite a challenging sternal reentry. This report provides useful information for surgeons who might have to deal with redo root replacements. The real questions that are raised by this case report, however, are "How small an aortic valve is too small in a young adult who may become larger with time?" and "How high a gradient is acceptable at the end of an aortic valve or root replacement?"

Obviously, hindsight is twenty-twenty, but one could argue that this patient had patient-prosthesis mismatch in the operating room after the initial mechanical Bentall procedure. Even more worrisome is the fact that the patient was a 17-year-old male adolescent, with a significant likelihood of growing a few more inches in height and who knows how many pounds in weight, at which point a 21-mm valve would almost certainly be too small. By the time his symptoms developed, he had an indexed valve orifice area of 0.57 cm^2/m^2, at which point he had clear patient-prosthesis mismatch. Referring to patient-prosthesis mismatch in their review of this topic, Bilkhu and associates[3] stated, "The only effective intervention is redo surgery with implantation

of a larger valve and/or annular enlargement. Therefore, focus needs to be on prevention." Although the decision to redo such an operation at the initial procedure is daunting, it can be argued that it might have been the best choice, given the challenging operation this young man had to undergo to deal with the issue 8 years later.

Given the choices available in such a case, performing an annular enlargement and implanting a larger valve as the first mechanical implantation might have been the best choice. I believe that very few surgeons would argue against that. However once the 21-mm valve was in place and there was a mean gradient of nearly 30 mm Hg, how many of us would have bitten the bullet and put the crossclamp back on? After a long, difficult reoperation with a long clamp time, how many of us would hope that the gradient would go down with decreased inotropes and transfusion? How many of us would close our eyes and hope that the monster stayed under the bed?

This is a very nicely described and illustrated technical case report, but it is also a cautionary tale. Much of what we all do has become relatively routine, with the expectation of outstanding outcomes; but sooner or later, the monsters come out, and they still bite. Avoiding that is usually in our patients', and our own, best interests.

References

1. Milewski RK, Habertheuer A, Bavaria JE, Fuller S, Desai ND, Szeto WY, et al. Selection of prosthetic aortic valve and root replacement in patients younger than age 30 years. *J Thorac Cardiovasc Surg*. 2019;157:714-25.
2. Nakamura Y, Aldoss O, Ricci M. The Konno aortoventriculoplasty after the Bentall procedure. *J Thorac Cardiovasc Surg*. 2019;158:e49-50.
3. Bilkhu R, Jahangiri M, Otto CM. Patient-prosthesis mismatch following aortic valve replacement. *Heart*. 2019;105(Suppl 2):s28-33.