and limit IE-associated risks to help increase patients' quality of life.

Tiago Rafael Veloso, PhD[a]
Bartosz Ditkowski, PhD[a]
Petra Mela, PhD[b]
Marc F. Hoylaerts, PhD[c]
Ruth Heying, MD, PhD[a]
[a]*Cardiovascular Developmental Biology*
Department of Cardiovascular Sciences
KU Leuven
Leuven, Belgium
[b]*Department of Tissue Engineering & Textile Implants*
AME-Helmholtz Institute for Biomedical Engineering
Aachen, Germany
[c]*Center for Molecular and Vascular Biology*
Department of Cardiovascular Sciences
KU Leuven
Leuven, Belgium

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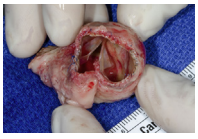

ELUCIDATING THE MECHANISMS OF INFECTIVE ENDOCARDITIS IN BOVINE JUGULAR VEIN CONDUITS: ARE WE ANY CLOSER?

Reply to the Editor:

Multiple reports have raised concerns regarding the high rates of late endocarditis in bovine jugular vein (BJV) grafts used for right ventricular outflow tract reconstruction as conduits[1,2] (Figure 1) or as percutaneously placed stent-mounted valves.[3,4] The pathophysiologic mechanisms for these findings remain unclear.

In a recent study in the *Journal*, Veloso and colleagues[5] found that in vitro adherence of bacterial strains to patches of bovine pericardium, BJV, and cryopreserved homograft was similar between materials under both static and simulated flow conditions. These findings were different from those reported by Jalal and colleagues,[6] who found that static bacterial adherence was greater in BJV tissue (including stent-mounted valves) than in porcine pericardium, and that adherence increased when the leaflets of the valves were traumatized. In a Letter to the Editor in this issue of the *Journal*, Jalal and colleagues[7] suggest that the differences between both studies are likely explained by the use of native strains in the study by Veloso and colleagues[5] compared with pathogenic strains isolated from patients in the study from Jalal and colleagues.[6]

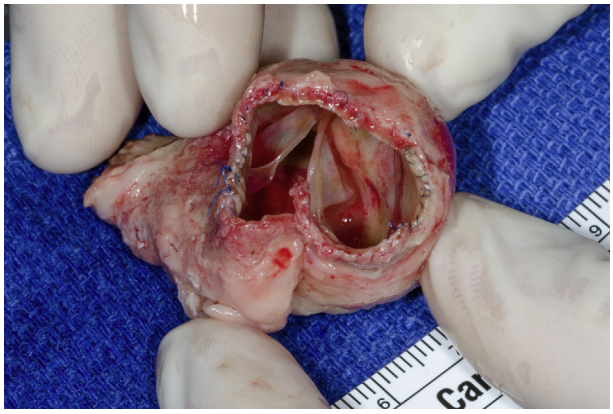

FIGURE 1. Necrotic bovine jugular conduit explanted 1 year after implantation.

Both studies are important steps toward the goal of elucidating the mechanisms that cause an increased clinical risk of endocarditis in patients receiving BJV grafts. However, they also illustrate the difficulty of simulating in the laboratory what happens to patients in the clinical setting, especially in the long term. The incidence of endocarditis for patients with BJV seems to be a late-occurring event, with the risk apparently increasing after 7 years from implantation.[1] Endocarditis is likely a consequence of a complex interplay of multiple factors that include, among other things, material characteristics, bacterial strains, circulating coagulation factors and proteins, patient susceptibility, shear stress, turbulent flow, thrombosis, tissue injury, and time. Simulating this complex interplay in vivo is obviously quite challenging. Bacterial adherence is just one factor. In fact, some studies have shown that in vitro adherence may not correlate as well with the ability of a bacterial strain to cause experimental endocarditis in an in vivo model.[8]

It is clear that more sophisticated in vitro constructs may provide a better insight into the role that different bacterial strains and materials play in the development of endocarditis in real patients. The use of fluorescent-labeled bacteria and flow chambers to simulate shear stress like the ones used by Veloso and colleagues[5] is a step on the right

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direction. The use of complex microfluidic devices (laboratory on a chip) that contain different cell lines and tissues to better simulate the interaction between blood and tissue[9] may be a possible avenue for future experiments. Some authors have developed novel techniques using in vivo intravascular video microscopy to directly visualize bacterial adherence to live tissue.[10] The closer we get to simulating real in vivo conditions, the closer we will get to elucidating the conundrum of bacterial endocarditis in patients with BJV grafts.

Carlos M. Mery, MD, MPH
Division of Congenital Heart Surgery
Department of Surgery
Texas Children's Hospital/Baylor College of Medicine
Houston, Tex

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