The pursuit of optimal tissue valve durability: Novel treatments

Richard J. Shemin, MD

From the Division of Cardiac Surgery, Department of Surgery, and Cardiovascular Center at UCLA, David Geffen School of Medicine at UCLA, Los Angeles, Calif.

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

Received for publication April 12, 2018; accepted for publication April 12, 2018.

Address for reprints: Richard J. Shemin, MD, 100 UCLA Medical Plaza, Suite 730, Los Angeles, CA 90095

(E-mail: Rshemin@mednet.ucla.edu).

J Thorac Cardiovasc Surg 2018;156:196

0022-5223/\$36.00

Copyright © 2018 by The American Association for Thoracic Surgery

<https://doi.org/10.1016/j.jtcvs.2018.04.059>

Richard J. Shemin, MD

Central Message

Improved tissue preservation focused on inbound glutaraldehyde leads to reduced tissue calcification of bovine pericardium in both in vitro and in vivo animal models.

See Article page 197.

The popularity of tissue valves as a device to avoid anticoagulation continues to increase. The potential of transcatheter valve-in-valve treatment of bioprosthetic valves further promotes this trend. Younger patients are opting for a bioprosthetic valve for lifestyle reasons.

The medical device industry continues to study novel methods of tissue preservation to understand better the biology of tissue failure and to mitigate the pathophysiology changes that lead to limited durability due to structural deterioration. Glutaraldehyde prevention to crosslink collagen under low-pressure fixation is an industry standard. Surfactant treatment of the tissue has also become standard and practically effective. The current tissue treatments are focused on residual tissue glutaraldehyde deposits, phospholipids, and the reexposure of the tissue to glutaraldehyde in the storage solutions. Rinsing the valve before implantation only partially removes the glutaraldehyde with current rinsing protocols.

The article by Meuris and colleagues¹ in this issue of the *Journal* is a comprehensive study of a new treatment process of a bovine pericardial valve to reduce mineralization by LivaNova (LivaNova PLC, London, United Kingdom). The treatment strategies are preclinical.

The importance of this article to the practicing surgeon is due in part to the comprehensive study both in vitro and in vivo (rat subcutaneous pouch technique and the juvenile sheep mitral implant model). Every surgeon should be aware of these techniques to study glutaraldehyde tissue. The improvements will, it is to be hoped, provide patients with valves that have improved durability by reducing unbound inbound residual aldehyde groups. Neutralization

of these toxic aldehyde groups addresses the presence of phospholipids that react with calcium ion to form calcium phosphate apatite crystals within devitalized cells.

The “FREE” treatment described in the article shows promise to provide a clinically more durable bioprosthesis. The comprehensive study of the tissue tensile strength, residual phospholipids and unbound glutaraldehyde content, extractable aldehydes, and freedom from calcification in the subcutaneous rat model and juvenile sheep model is promising.

Other companies have advanced similar tissue presentation processes on the market (Inspiris Resilia; Edwards Lifesciences, Irvine, Calif) or have something in the pipeline. If tissue durability is indeed improved, the cardiac surgical and community and our patients will benefit from these advances in tissue preservation.

Reference

1. Meuris B, De Praetere H, Strasly M, Trabucco P, Lai JC, Verbrugge P, et al. A novel tissue treatment to reduce mineralization of bovine pericardial heart valves. *J Thorac Cardiovasc Surg*. 2018;156:197-206.