



See Article page 417.

Commentary: The Ross reversal: An innovative and useful extension of the armamentarium for the failing Ross

Martin O. Schmiady, MD,^{a,b,c} and
Michael Hübler, MD^d

During the last century, the aortic allograft and pulmonary autograft surgical procedures have revolutionized the field of cardiac surgery. Although survival of patients after the Ross procedure is excellent, concerns regarding autograft and allograft longevity have risen.¹ In a study from Klieverik and colleagues,² freedom from autograft reoperation 13 years after Ross operation was $69 \pm 7\%$. Progressive dilatation of the neo-aortic root was the main cause for reoperation in this population. To overcome this problem, an external reinforcement using vascular grafts was proposed by some centers, with unknown consequences for the vascular wall.³ In 2007, the group around Gösta B. Pettersson introduced a new reoperation option for patients with autograft failure.⁴ During the so-called “Ross reversal”, the failing autograft is excised, reconstructed, and reused in its native pulmonary position. In this issue of the *Journal*, Weiss and Petterson⁵ now focus on the technical details of this challenging operation and present their outstanding results with 36 Ross reversals done by the Cleveland team.

From the ^aClinic for Cardiac Surgery, University Heart Center, University Hospital Zurich, Zurich, Switzerland; ^bDepartment of Congenital Cardiovascular Surgery, University Children's Hospital Zurich, Zurich, Switzerland; ^cChildren's Research Centre, University of Zurich, Zurich, Switzerland; and ^dDepartment of Cardiac Surgery for Congenital Heart Disease, University Heart & Vascular Center Hamburg, Hamburg, Germany.

Disclosures: The authors reported no conflicts of interest.

The *Journal* policy requires editors and reviewers to disclose conflicts of interest and to decline handling or reviewing manuscripts for which they may have a conflict of interest. The editors and reviewers of this article have no conflicts of interest.

Received for publication Feb 22, 2021; revisions received Feb 22, 2021; accepted for publication Feb 25, 2021; available ahead of print March 2, 2021.

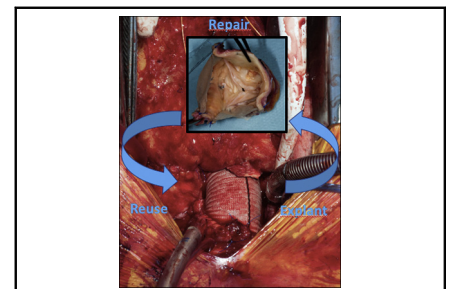
Address for reprints: Martin O. Schmiady, MD, Division of Cardiac Surgery, University Heart Center, University Hospital Zurich, Rämistrasse 100, CH-8091 Zurich, Switzerland (E-mail: martinoliver.schmiady@usz.ch).

JTCVS Techniques 2021;10:424-5

2666-2507

Copyright © 2021 The Authors. Published by Elsevier Inc. on behalf of The American Association for Thoracic Surgery. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

<https://doi.org/10.1016/j.jtc.2021.02.046>



The central steps of the Ross reversal.

CENTRAL MESSAGE

Ross reversal aims at maintaining the failing autograft and avoiding a double valve replacement. Against the background of the lack of an “ideal” valve substitute, it is a promising option, especially for younger patients.

In most cases, the autograft can be easily detached during redo surgery, as it is not completely ingrown from the epicardial side. To save time during cardiopulmonary bypass, the presence of a second experienced surgeon is recommended to refashion the autograft on a back table while the homograft is being explanted or the root replacement is performed. Owing to the limited data on long-term outcomes, it is difficult to define appropriate indications for this challenging operation. In 2017, Hussain and colleagues summarized their initial and midterm outcomes with the reverse Ross technique.⁶ The median follow-up was 4.1 years (range, 7 months to 11 years). Although all 30 patients had a solid indication for aortic root intervention, only 8 patients had an absolute indication for replacement of the pulmonary allograft.

At this time, it is uncertain whether the reconstructed autograft will have a better long-term performance than a functioning homograft. Against this background, the surgical indication should currently be strictly set and limited to patients with an absolute indication for both autograft and allograft replacement.⁷ In addition, first data about transcatheter aortic valve replacement in low-risk patients are now available; however, low risk and young age should not be confused. Regarding the mean age of 46 ± 13 years and significant dilatation of the aortic root, transcatheter aortic valve replacement cannot be recommended in this population.

Moving forward, strict monitoring of pulmonary autograft function and freedom from reoperation will play key roles in the long-term efficacy of the Ross reversal. Accumulating experience and evidence will hopefully draw more attention to this operation and lead more surgeons to consider this approach, especially for younger patients.

References

1. David TE, David C, Woo A, Manlhiot C. The Ross procedure: outcomes at 20 years. *J Thorac Cardiovasc Surg.* 2014;147:85-93.
2. Klieverik LMA, Takkenberg JJM, Bekkers JA, Roos-Hesselink JW, Witsenburg M, Bogers AJJC. The Ross operation: a Trojan horse? *Eur Heart J.* 2007;28:1993-2000.
3. Neri E, Massetti M, Tanganelli P, Capannini G, Carone E, Tripodi A, et al. Is it only a mechanical matter? Histologic modifications of the aorta underlying external banding. *J Thorac Cardiovasc Surg.* 1999;118:1116-8.
4. Flynn M, Little SG, Blackstone EH, Pettersson GB. Reversing the Ross operation: a new reoperation option for autograft failure. *J Thorac Cardiovasc Surg.* 2007;133:1645-7.
5. Weiss AJ, Petterson GB. The Ross reversal. *J Thorac Cardiovasc Surg Tech.* 2021;10:417-22.
6. Hussain ST, Majdalany DS, Dunn A, Stewart RD, Najm HK, Svensson LG, et al. Early and mid-term results of autograft rescue by Ross reversal: a one-valve disease need not become a two-valve disease. *J Thorac Cardiovasc Surg.* 2018;155:562-72.
7. Schmiady M, Bettex D, Hübler M, Schweiger M. Recycling of the pulmonary autograft during reverse Ross operation: from pulmonary valve to neo-aortic valve and back. *World J Pediatr Congenit Heart Surg.* 2019;10:242-4.