FIGURE 1. Operative mortality after the Norwood procedure. Exponentially weighted moving average (EWMA) with 95% confidence intervals.

operative mortality adhering to the proposed definition and report that new information here:

Operative mortality of the Norwood procedure for hypoplastic left heart syndrome (death within 30 days after surgery in or out of the hospital and after 30 days during the same hospitalization subsequent to the operation) decreased from 21.1% during the first 3 years to 4.9% during the last 3 years of the reported 12-year period. Accordingly, the exponentially weighted moving average of operative mortality after the 157 Norwood procedures fell to 3.58% (Figure 1).

Interstage mortality, accordantly defined as all deaths that occurred after the 30-day period or after discharge from hospital after the Norwood operation but before the subsequent hemi-Fontan operation, could be reduced with introduction of our home surveillance program from 13.2% to 0%.

As recalculations changed our data only minimally, we hope that the readers appreciate that we did not try to mislead anyone or to create unrealistic expectations among referring physicians, caregivers, and families but rather honestly presented our institutional experience with the Norwood operation for children with hypoplastic left heart syndrome.

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COMPARABLE PATENCIES OF THE RADIAL ARTERY AND RIGHT INTERNAL THORACIC ARTERY OR SAPHENOUS VEIN BEYOND 5 YEARS: RESULTS FROM THE RADIAL ARTERY PATENCY AND CLINICAL OUTCOMES TRIAL

To the Editor:

A recent article by Hayward and colleagues¹ presents important data regarding the long-term patency and clinical outcome of the radial artery (RA), right internal thoracic artery (ITA), and saphenous vein (SV) when used as conduits in patients undergoing

coronary artery bypass grafting. The main purpose of the authors' trial was to identify the place of the RA in the hierarchy of options available to supplement the ITA to the left anterior descending coronary artery. Patients were monitored at defined time points (mean, 5.5 years), with the results leading the authors to suggest that the RA or free ITA are equally satisfactory in younger patients and that RA and SV grafts produce similar angiographic outcomes in older patients.

Two points are of particular interest. First, the authors found a striking increase in vein graft patency compared with that seen in previously published studies. Second, the authors recognize the importance of atraumatic harvesting of both the RA and SV in achieving improved graft performance. These results were presented at the 2008 American Association for Thoracic Surgery Meeting, where some relevant points were raised. In particular, the authors were asked whether any of the veins in the study were harvested endoscopically. The response was that they were not because endothelial integrity might have been affected by this method, adding "These veins were all taken in a shamelessly open no-touch manner."

It is not clear which no-touch method was used, but if it was the same or similar to that used routinely in our unit in Örebro, the SV would have been removed without distension and with its surrounding cushion of tissue intact.² This method provides a graft with a patency rate comparable with that of the ITA³ and preserves normal vessel structure that is very different in appearance from that of SV grafts prepared conventionally (Figure 1). We believe that the vasa vasorum plays an important role in the improved patency of SVs harvested with surrounding tissue because medial blood flow is restored through this network of nutrient microvessels after completion of graft insertion and removal of vascular clamps. This does not occur in conventionally harvested veins in which the

FIGURE 1. Representative transverse sections of radial artery, no-touch, and conventionally harvested saphenous veins. Examples of complete sections are shown at the top left of each panel. The main panels have been used for the identification of endothelial cells with CD31 immunohistochemistry (dark brown staining). The lining endothelium of the lumen can be seen in all sections. In the radial artery (A) endothelial cells of the vasa vasorum are relatively sparse and restricted to the adventitia/media border. In the no-touch saphenous vein (B) there is a higher density of vasa vasorum that penetrate more deeply into the media. In conventionally prepared vein grafts (C) the number of vasa vasorum are reduced because of removal of and damage to the surrounding tissue at harvesting. Scale bar = 0.5 mm.

vasa vasorum are reduced in number or damaged (Figure 1).⁴ Endothelial integrity is also compromised with endoscopic harvesting, and although this method has gained popularity in recent years, it is difficult to imagine how vein removal can be achieved without considerable damage to the vein's endothelium, including that of the vasa vasorum. The vasa vasorum of veins is more pronounced than in arteries because oxygen and nutrients are supplied mainly from the lumen, and this difference is visually striking where the density in the SV is considerably higher than the RA (Figure 1 and Dreifaldt, unpublished data).

Although there are conflicting data regarding the SV or RA being the second graft of choice, we believe that preservation of normal vein structure with the Örebro no-touch technique² is essential for improved vein graft performance. The clinical and angiographic outcomes of a randomized clinical trial due to end this year comparing no-touch harvested SV with RA grafts are eagerly awaited.

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Reply to the Editor:

We thank Dreifaldt and colleagues for their interest and their comments. We are aware of their previous pub-

lished experience with atraumatic harvesting of the saphenous vein and its potential effect on graft patency.

We agree that minimization of endothelial disruption by means of high-pressure distension is important to early (and possibly later) graft function. Although their technique describes removal of the saphenous vein without inflation, harvesting in the Radial Artery Patency and Clinical Outcomes trial permitted injection of the saphenous vein with a blood/Ringers/papaverine/milrinone solution mixture while avoiding distension against a closed outflow. Furthermore, although manipulation or palpation of the vein was minimized and the vessel wall never held, the vein was removed with its adventitia intact but devoid of any surrounding fatty or fibrous tissue, unlike the broader pedicled technique referenced.

We hope that careful handling of the conduit preserves endothelial integrity of the lumen and the vasa vasorum, and this might contribute to the superiority of the patency we have reported compared with historical controls. However, other factors, such as selection of the largest non-left anterior descending coronary artery target and careful attention to secondary prevention during rigorous clinical