Authors have nothing to disclose with regard to commercial support.

their interest in our publication and would like to respond to their letter.

A reduction in TAPSE after cardiac surgery is a well-known phenomenon²; however, the normal value of TAPSE in this context is still unclear. This reduced measurement may reflect postoperative changes in right ventricular (RV) contractile patterns, with a relative loss of longitudinal shortening with respect to transverse shortening, as has been previously documented.³ The reasons for those observed changes have not been elucidated. Nevertheless, the type of cardiac surgery, beyond the complete pericardial incision or the use of cardiopulmonary bypass, could be an important factor related to those changes in the manner in which the RV contracts. Unlike in previous studies, which excluded patients who underwent valvular surgery,³ our study included several types of cardiac surgery. However, we must admit a selection bias in our study, because patients included were those who received a pulmonary artery catheter. This subgroup of patients usually have not only worse left ventricular function but also higher rates of RV dysfunction, such as our patients after heart transplantation when TAPSE and RV ejection fraction were particularly low compared with other surgeries; our results are similar to the findings of the previous study.³ With respect to differences between off-pump and on-pump surgery in our results, the present study included only 4 patients without cardiopulmonary bypass; thus, we are not able to respond to this question. In fact, only 8% of coronary artery bypass graft surgeries were performed without using cardiopulmonary bypass in our center during the study period. These unresolved questions might emphasize the importance of future studies in patients who have undergone cardiac surgery to define the reference values of TAPSE and its prognostic significance probably in both different clinical conditions and different cardiac surgical procedures.

The utility of TAPSE in the evaluation of RV function in patients with severe tricuspid regurgitation has already been demonstrated. In addition, the preoperative measurement of TAPSE also had a prognostic value in patients who underwent isolated tricuspid valve surgery.⁴ However, the utility of TAPSE that is obtained during the early postoperative period after tricuspid valve surgery should still be prospectively validated for the assessment of RV function. We have reviewed our data and confirmed that there were no cases of tricuspid valve repair in our series of patients.

Evaluation of RV function is essential in the management of critically ill cardiac patients. We want to encourage the use of echocardiography for routine assessment of RV systolic function in the postoperative period after cardiac surgery.

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THREE ARTERIES VERSUS THE SAPHENOUS VEIN FOR CORONARY ARTERY BYPASS GRAFT: WHY USE A DAMAGED GRAFT TO REPAIR A DAMAGED HEART?

To the Editor:

The recent study published in the *Journal* by Benedetto and colleagues¹ was on a large patient population aiming to establish whether the radial artery (RA), as a third arterial conduit in addition to the bilateral internal thoracic artery (BITA), is associated with better survival than the saphenous vein (SV). The authors conclude that long-term survival in these patients undergoing BITA grafting was not extended using the RA as the third arterial conduit in preference to SV in patients undergoing first-time coronary revascularization. The authors focus on the three main vessels used for revascularization, but the methods used when harvesting in coronary artery bypass graft (CABG) might also be considered. In their study, it seems that the internal thoracic artery (ITA) and RA were both used as pedicled grafts, whereas the pedicle of the SV was removed and the vein distended. The additional trauma inflicted on the SV, when compared with the arteries, may well affect its long-term patency.

SV graft performance is improved when harvested using an atraumatic, no-touch technique with a patency comparable with the ITA at up to 16 years follow-up.² SV prepared in this way maintain their normal architecture with a surrounding cushion of perivascular fat and adventitia preserved and the endothelium intact.³ There are striking,

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trauma-induced changes in SVs harvested by conventional methods compared with those prepared using the no-touch technique, where surrounding tissue remains intact and the vein is not distended (Figure 1). By comparing samples of conventional versus no-touch SV obtained at harvesting, a number of structural changes have been identified likely to affect graft patency early and in the long term.

If we consider the vascular damage to conventionally prepared SV, it is clear that the outer layers are affected (Figure 1). At the microscopic level, the adventitial and

medial vasa vasorum and medial vascular smooth muscle cells are damaged and, in addition, regions of endothelial denudation are evident.³ Substantial damage in these regions has also been reported at the ultrastructural level.⁴ This damage is not observed in no-touch SV grafts, therefore it seems reasonable to assume that the success of this technique is largely a result of preservation of normal vessel structure.

At the vessel's innermost surface, regions of endothelial denudation increased platelet aggregation, and thrombus formation will occur due to decreased endothelium-dependent nitric oxide (NO) production. Reduced, local, NO release may also contribute to vasospasm, which is often encountered at harvesting.³ Vascular smooth muscle cells in the media exhibit marked ultrastructural shape changes most likely caused by the combination of

FIGURE 1. Representative light microscopic toluidine blue-stained transverse sections comparing no-touch (A, B) and conventional (C) SV. A, No-touch SV displays lumen (*lu*), intimal folds (*arrows*), media (*M*), adventitia (*A*), and peri/paravascular connective tissue (*CT*). B, A fragment of no-touch SV showing islands of smooth muscle (*asterisks*) located in the adventitia; adventitial vasa vasorum (*Vv*), and adipose tissue (*ad*). C, A fragment of SV harvested conventionally showing the lack of characteristic intimal folds, which, together with the media, have been distended. Note that only remnants of adventitia and peri/paravascular connective tissue (*A-CT*) remain. *Asterisks* indicate islands of SM. *col*, Bundles of collagen intermingled with elastin. All at original magnification $\times 92$. (Modified from the original black and white figure published in Ahmed et al,⁴ which we acknowledge.)

high-pressure intraluminal distension and vascular trauma.⁴ In addition, damage to the vasa vasorum will reduce the transmural blood supply, a condition shown experimentally to cause neointimal hyperplasia.⁴ The cushion of fat surrounding the vein plays an important role in the improved performance of no-touch SV; it provides mechanical support, buffering against arterial hemodynamics once implanted into the coronary circulation.³ Also, perivascular adipose tissue (PVAT) is a source of adipocyte-derived factors beneficial to graft performance.⁵ For example, a recent study has shown that PVAT-derived prostanoids possess anticontractile activity against noradrenaline-induced contraction of human SV and ITA segments in vitro, suggesting that retaining this pedicle in both conduits may have potential clinical implications to improve coronary bypass graft patency.⁶

We recognize that, whereas the aforementioned observations relate to comparison of SV segments at the time of harvesting, the pathophysiologic changes following graft implantation are unclear. Such changes are outlined in a recent review describing those events that occur immediately after SV grafting, including altered hemodynamics, increased flow, and shear stress. Later processes of vein graft remodeling involve activation of vascular smooth muscle cells and fibroblasts, and development of neointimal thickening and atheroma formation, stages of graft occlusion most common where SV grafts are used to bypass small-diameter coronary arteries.⁷

Although the clinical relevance of the structural changes to the SV caused at harvesting has yet to be established, we recommend including a no-touch SV group in any study comparing conduits used in CABG. When stripping the SV of surrounding tissue and distending the vein we believe that a damaged graft is being used in an attempt to repair a damaged heart.

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SAPHENOUS VEIN GRAFT HARVESTING AND PATENCY: STILL AN UNANSWERED QUESTION

Reply to the Editor:

In their letter on our recent work,¹ Loesch and colleagues underline the importance of the saphenous vein (SV) harvesting technique, supporting the superiority of no-touch technique with surrounding soft tissue over the traditional approach, including dissection and manual distention.² The success of coronary artery bypass grafting is still limited by unsatisfactory SV graft patency because of the high incidence of thrombotic early graft occlusion, progressive intimal hyperplasia, and late graft atherosclerosis.³ A greater use of arterial grafts has been advocated in view of their observed better patency rate; however, additional arterial grafts remain largely underused as the result of their increased technical complexity and risk of sternal complication when using bilateral internal thoracic arteries.⁴

Basic science and clinical research has focused on several methods that have the potential to improve SV graft patency, including the no-touch harvesting technique.² SV usually is stripped of its adventitial layer and distended to overcome spasm, a procedure known to cause vein intima and medial wall damage.³ By using a no-touch technique, the SV is harvested with a pedicle of surrounding tissue and can be implanted without the need for previous distension. This has the potential to preserve vessel wall integrity, thus improving SV patency rate. Samano and colleagues² recently have reported a 16-year follow-up angiography study of 44 patients randomized to conventional SV harvesting (n = 27) versus the no-touch (n = 27) technique. Crude SV graft patency was 64% in the conventional group versus 83% in the no-touch group (P = .03). The main limitation of this study, however, was that the SV conventional group underwent aggressive manual distention with saline at 300 mm Hg for 1 minute whereas in the no-touch group, the SV was connected to the arterial cannula. Therefore, we are unable to establish whether the observed superior patency rate in the no-touch group was related to the presence of surrounding tissues or to the avoidance of overdistention. The effect of mechanical force damages