The Ideal Conduit for Surgical Revascularization
The Quest for the Holy Grail Continues
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Coronary artery bypass grafting has been an important treatment option for patients with significant obstructive and flow-limiting coronary artery disease for decades. Although there was a decline in the number of procedures performed with the introduction of and subsequent improvements in percutaneous revascularization, surgical revascularization continues to be an appropriate and effective therapy for many patients. The issue of what conduit to use for surgical revascularization has been studied and debated for decades as well. There are many choices for the surgeon and cardiologist to consider and choose from, including saphenous vein, internal thoracic artery, radial artery, gastroepiploic artery, and in some cases, umbilical vein or cryopreserved vein. For patients having surgical revascularization, there is a clear advantage in clinical outcomes when the left internal thoracic artery is used to bypass the left anterior descending coronary artery.1,2 For additional grafts, or the choice of the best conduit to other coronary arteries, the evidence is less clear. Historically, the greater saphenous vein has been the most commonly used conduit for additional grafts, but many clinical and bench studies have examined the use of additional arterial conduits to improve long-term patency and outcomes. The radial artery as a choice for the second conduit was initially described in 1973 by Carpentier et al3; however, it quickly lost favor, because early angiographic studies revealed poor patency. Over time, with improvements in procurement techniques and medical therapy to prevent early vasospasm, there has been a renewal in interest in the radial artery as the second conduit of choice in patients who need multiple bypass grafts.

One such example is the present report by Webb and colleagues4 examining the long-term vascular reactivity and flow characteristics of the radial artery and greater saphenous vein in patients who had coronary artery bypass grafting. This was a well-designed prospective clinical study that allowed angiographic and pharmacological testing of the bypass grafts at 5 years. Importantly, the conduit to the branch of the circumflex coronary artery was randomized between the radial artery and the greater saphenous vein. At 5 years, Webb and colleagues were able to show that patent radial arteries but not saphenous veins dilated when exposed to adenosine and isosorbide dinitrate; however, there were no differences in diameter response to acetylcholine from either conduit. On the basis of this improvement in vasodilatory response, the authors speculated that this might be the reason for the more favorable patency of the radial artery conduit over the greater saphenous vein seen in their study.

The conclusion or speculation by Webb and colleagues4 implies that the radial artery is a better choice than the greater saphenous vein when multiple bypass grafts are performed. This is an important question as we continue our struggle to improve long-term patency and outcomes for patients with significant coronary artery disease. Is this new finding in 15 patients of late (5 years) vasodilation in radial artery conduits placed only to the circumflex artery distribution enough evidence to alter clinical practice? Unfortunately, there are multiple factors that will affect long-term patency and clinical outcomes. As noted by the authors, some of these clinical factors include the target vessel itself (size, location, and viable myocardial muscle mass it is supplying), surgical technique, postoperative antiplatelet therapy, and risk factor management. A recent meta-analysis of randomized controlled trials that examined radial artery versus saphenous vein graft patency did not show any advantage for the radial artery.5 In that analysis, the lack of superiority of the radial artery was attributed to the high incidence of severely impaired flow, probably related to vasoreactivity. Hayward and colleagues6 have just published the results of their prospective randomized trial that included radial artery versus saphenous vein grafts. Angiography was performed at 5 years, and for patients ≥70 years of age, there was no significant difference in patency between arterial and venous conduits. Although separated into groups based on age and conduits, the patency of the saphenous vein was similar to that of the radial artery and right internal thoracic artery at 5 years in the younger group. More concerning is the recent report by Fukui and colleagues,7 who reported a 1-year patency rate of the radial artery of only 69.5%. In their study, the 1-year patency of the radial artery was significantly worse than that of the right internal thoracic artery graft and saphenous vein graft. Fukui and colleagues7 concluded from their study, as have others,8 that the use of internal thoracic arteries for the left coronary artery system is the most reliable if multiple arterial conduits are being used. Desai and colleagues9 have studied patient and target-vessel characteristics to try to help make the clinical decision of when and where to use the radial artery versus a saphenous vein conduit. In a large group of patients, they documented that diabetes mellitus and small target-vessel diameter were asso-
ciated with an increased risk of graft occlusion for both radial arteries and saphenous vein grafts. Additionally, they noted that a history of peripheral vascular disease was associated with an increased risk of radial artery occlusion that was not seen with saphenous vein grafts, and radial artery graft patency was similar for men and women.

Coronary artery bypass grafting for obstructive coronary artery disease has improved significantly over the years. The patients being referred for surgical revascularization are more complex and higher risk than in previous decades. Despite this increasingly complex patient population, the risk-adjusted operative mortality rate has continued to decline. The difference in overall outcomes between percutaneous versus surgical revascularization appears to be narrowing. The choice of conduit for surgical revascularization will continue to play a large role in long-term outcomes. Currently, use of the internal thoracic artery to bypass the left anterior descending artery has well-defined advantages and benefits for patient outcomes. The choice of the second conduit for additional grafts remains less clear. The new data by Webb and colleagues presented in this issue of Circulation will certainly add to our knowledge of biological conduits. However, the preserved late vasoreactivity noted in radial artery grafts compared with saphenous vein grafts does not account for or completely explain the variable outcomes and potentially less favorable results of clinical outcomes seen in other studies. The most reasonable approach for choosing a conduit for additional bypass grafts at this time includes consideration of multiple clinical factors. The choice of radial artery versus saphenous vein should be individualized for each patient. Despite our increased knowledge of conduits and improvements in surgical technique and technology, the greater saphenous vein remains a commonly used conduit for surgical revascularization. For surgeons, cardiologists, cardiovascular researchers, and patients, the search for the best conduit for surgical revascularization continues.

Disclosures
None.

References

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