See Article page 1349.

Commentary: Results of total coronary artery occlusion on graft patency following coronary artery bypass graft surgery: More information is needed!

Harold L. Lazar, MD

In their practice of coronary artery bypass graft (CABG) surgery, surgeons will encounter coronary arteries that are chronically occluded. Should these chronic total occluded (CTO) vessels be bypassed, and if so what conduits should be used? Previous studies suggest that bypassing CTO vessels results in reduced early graft patency, especially when saphenous vein grafts (SVGs) are used.¹ Lin and colleagues² sought to determine the effects of CTO vessels on long-term graft patency following CABG. The study population consisted of 301 patients from a single center previously enrolled in the Coronary Artery Bypass Grafting Surgery Off- or On-pump Revascularisation (CORONARY) study.³ Computed tomography angiograms were performed in 206 patients (68%) at a mean follow-up of 6.8 years. The Fitzgibbon grading system (A = excellent, unimpaired; B = a stenosis >50%; and O = complete occlusion) was used to assess graft patency. The overall rates of type B or O graft failure was higher in CTO grafts to non-left anterior descending territories (25.6% vs 16.2%; $P = .001$) and was significantly higher in SVGs (23.4% vs 12.5%; $P = .001$) in the right coronary artery territory. There was no significant difference in long-term death, myocardial infarction, or the need for repeat revascularization between a CABG performed in patients with and without CTO lesions. Do all CTO vessels have reduced graft patency, and if so

Harold L. Lazar, MD

CENTRAL MESSAGE

Long-term patency of saphenous vein grafts is reduced in totally occluded coronary arteries, but more information is needed to determine the mechanism.

what is the mechanism for this graft failure? Unfortunately, there are several issues with this study that limit the conclusions that can be made.

The study population was small and was derived from a post hoc analysis from a single center looking at outcomes following on-pump versus off-pump CABG in which off-pump CABG was associated with decreased graft patency.⁴ In the current study by Lin and colleagues,² more patients in the CTO vessel group underwent off-pump CABG (56% vs 48%), but because of the small sample size this did not reach statistical significance. A repeat Computed tomography angiogram was obtained in only 68% of patients. A significant limitation was the lack of adherence to guideline-directed medical therapy (GDMT) in these patients. At the time of discharge, only 20% of patients received a statin and 8% were taking an angiotensin-converting enzyme inhibitor. During follow-up, 68% of patients received a statin and 4% an angiotensin-converting enzyme inhibitor. No information is reported regarding low-density lipoprotein cholesterol levels of these patients. Lack of adherence to GDMT has been shown to influence long-term outcomes following CABG, especially vein graft patency.⁵ The decreased vein graft patency seen in these patients could also be explained by the poor adherence to GDMT, especially statins. We are not told what arterial grafts were used to bypass non-left anterior descending vessels—pedicle or free right internal thoracic artery grafts, radial arteries, or right gastroepiploic vessels—and whether the

From the Division of Cardiac Surgery, Boston University School of Medicine, Boston, Mass.

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Address for reprints: Harold L. Lazar, MD, Division of Cardiac Surgery, Boston University School of Medicine, 80 E Concord St, Boston, MA 02118 (E-mail: harold.l.lazar@gmail.com).

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anastomoses were performed in the right coronary artery or posterior descending artery.

To understand why graft patency is decreased in CTO vessels, 2 other factors must be taken into consideration: segmental wall motion and collateral flow. The lack of information on segmental wall motion in the area of myocardium supplied by the CTO vessel is another important limitation in the study by Lin and colleagues.² Akinetic, dyskinetic, and severely hypokinetic segments of myocardium have been associated with decreased graft patency regardless of the type of conduit that is used.¹ Another important factor is the degree of collateral flow in CTO vessels. Rentrop and colleagues⁶ developed a scale to quantify the extent of collateral filling in CTO vessels ranging from minimal filling of collateral channels, to partial filling, to complete filling of the vessel distal to the occlusion. Although early graft patency has not been associated with the Rentrop scale for collateral flow, the long-term effects of collateral flow on graft patency for arterial versus SVGs is unknown.¹ Although there is concern that competitive flow in CTO vessels will decrease graft patency—especially SVGs—it is conceivable that an SVG to a CTO vessel with well-developed collaterals might have a higher patency if these collaterals supply blood to other vascular beds that serve viable but ischemic myocardium. Bypassing a CTO vessel in which the distal target has poor collateral blood flow, is small in caliber, is diffusely diseased, and supplies nonviable

myocardium is unlikely to remain patent regardless of the type of conduit that is used.

Unfortunately, data from the study by Lin and colleagues² are insufficient to tell us what conduits should be used to bypass an occlusion in vessels with good collateral flow serving viable myocardium. Lin and colleagues² should be encouraged to review their database to determine the effect of collateral flow and segmental wall motion in areas of myocardium serving CTO vessels. Until then, to determine the influence of a CTO vessel on graft patency following CABG, more information is needed!

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