Fractional flow reserve–guided coronary artery bypass grafting: Less is more?

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Fractional flow reserve (FFR) testing is a procedure used during coronary angiography that determines the functional significance of coronary stenosis during maximal hyperemia. This test is particularly useful when noninvasive functional studies are not available or when functional studies are discordant with angiographic findings. The severity assessment of coronary lesions can be tricky when it is based only on coronary angiography; a moderate lesion in one operator's opinion may be 50% stenosis, whereas it may be 70% for a different operator. Should we treat it or not? FFR came in to fill this gap. Several randomized clinical trials have shown a reduction in cardiac death, myocardial infarction, and hospitalization cost in patients treated with an FFR-guided strategy for percutaneous coronary intervention, and today it is the standard of care.^{1,2}

Can FFR be useful to guide the surgeon on which vessel to bypass prior to coronary artery bypass grafting (CABG), thereby improving the prediction of competitive flow? Bypassing hemodynamically significant lesions may reduce the competitive flow, increase patency rates, and lead to better outcomes. In their article in this issue of the *Journal*, Paterson and colleagues³ demonstrate that this is not exactly the case, at least considering available data. On the one hand, FFR-guided CABG may reduce the number of coronary anastomoses and subsequent angina.⁴ On the other hand, failure to bypass major vessels with greater than 50% stenosis at the time of surgery has been associated with reduced survival.⁵ FUTURE,⁶ a multicenter, controlled, randomized trial, explored FFR-guided revascularization in comparison with angioplasty alone among patients with multivessel coronary artery disease, but it left more questions than answers because it was prematurely halted as a result of excess 12-month all-cause mortality in the FFR assessment group.

There has been much discussion regarding a favorable graft configuration that will increase long-term graft patency rates. Although there is no evidence that any configuration of bilateral internal thoracic arteries is better than another, Paterson and colleagues³ conclude that the presence of competitive flow in moderate stenotic branches of the left coronary system does not seem to reduce internal

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Central Message

This article helps guide the role of fractional flow reserve and graft configuration in patients undergoing coronary artery bypass grafting.

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thoracic artery graft patency rates below that of vein grafts. Obviously, there are different factors that contribute to the graft patency that should be taken into consideration. Technical issues of the anastomosis site, size of the vessel, and presence of residual disease after the anastomosis are important factors. FFR results should also be interpreted with caution. The FFR can be artificially elevated in patients with microvascular dysfunction and conditions that can lead to it, such as left ventricular hypertrophy, severe aortic stenosis, and severely elevated right atrial pressure, leading to an underestimation of lesion severity.

Strength of this article includes its primary focus on 2 important topics related to competitive flow: assessment by FFR and management by arterial graft configuration. FFR provides additional useful information for surgeons, and this article discusses implications and limitations related to this procedure.

The scope of this article is limited in that a discussion of all issues that affect competitive flow and graft patency is not feasible. Factors such as target vessel diameter, extent of myocardial territory, and changes in coronary flow with exercise, among others, all contribute to the effects of competitive flow on arterial graft patency. Furthermore, a patient group not discussed in this article is that of patients with isolated intermediate left main disease. FFR-guided strategy has shown favorable outcomes in these patients, indicating that angiography alone does not allow appropriate individual decision-making about the need for CABG because it often underestimates the functional significance of the stenosis.⁷

Studies designed to determine the most appropriate graft configuration for each individual patient will optimize myocardial revascularization in the future. To achieve this end, more accurate assessments of graft function and of the preoperative status with evaluation tools such as FFR are important. Future multicenter, randomized, controlled trials that incorporate FFR use for patients with moderate stenosis before CABG with different types of anastomoses will shed light on the issue of competitive flow and optimal treatment strategies.

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