

angiographic parameters cannot and should not be used as a surrogate for coronary flow.

Finally, recent data by Sant'Anna et al. (12) challenge our assumptions regarding whether angiographic 3-vessel disease is truly physiological 3-vessel disease. Of the 250 patients undergoing angiography, when the 27% of patients with angiographic 3-vessel disease had FFR measured in all 3 of these vessels, only 9% were found to have physiologically significant 3-vessel coronary disease. Had bypass grafting been performed, a considerable incidence of graft failure would be expected at follow-up. Fortunately, in this setting graft failure is often clinically silent with the consequences of graft closure across nonsignificant lesions reverting to the native vessel, which remains patent and functional (unless the lesion progresses).

Whereas the debate about the use of the GEA graft continues, a critical question before the surgery for those vessels with intermediately severe stenoses should be answered by direct physiologic measurements: is a graft on this particular vessel going to be of any use if the physiology is nearly normal (13)?

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Please note: Dr. Kern is a speaker for Radi Medical and Volcano Therapeutics, 2 companies that manufacture the pressure guidewire used in the physiologic assessment of coronary artery disease.

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**Reply**

Dr. Kern wisely raised several points that were not discussed in our article (1). We are convinced of the interest of fractional flow reserve (FFR) as a tool to assess the physiological relevance of coronary stenoses, and we recently used this tool to compare the resistance to blood flow of several coronary graft configurations (2,3). Unfortunately, if all patients referred to bypass surgery underwent a pre-operative angiographic evaluation and if most of those angiographic documents could be analyzed quantitatively, very few patients would be referred to surgery with a full mapping of FFR on the different coronary segments.

In daily clinical practice, the use of FFR remains generally restricted to the evaluation of stenoses of intermediate severity and mainly in patients with <3-vessel disease who are planned to be treated by interventional cardiology. For patients referred to surgery with a 2- or 3-vessel disease, the decision to measure FFR for an intermediate stenosis associated with angiographically severe narrowing on other coronary segments is much less frequent, because the surgical indication is already present, on the basis of the critical lesions. In these cases, most cardiac surgeons choose to graft the intermediate lesion as well, even if this bypass is at risk of competitive flow. This attitude, although somewhat empirical, is based on the low risk expected from the possible occlusion of such nonfunctional grafts, on the hope that these grafts will remain patent long enough to provide some help in the case of progression of the intermediate lesion, and on the fear of a redo intervention, if lesion severity is underestimated. It still remains uncertain whether this is preferable to a more conservative attitude consisting of graft implantation only on severely narrowed coronary segments.

Several observations have illustrated the capacity of the internal thoracic artery (4) or right gastroepiploic artery (RGEA) (5) to recover function in the long term after having been found not functional (string sign) at early follow-up. This capacity seems related to endothelial protection mechanisms that are probably less prominent or totally absent in saphenous vein graft. Considering the natural progression of the disease on native vessels, this property could act in favor of RGEA in the longer term. The ongoing angiographic re-evaluation of the grafts at 3 years post-operatively could thus provide information susceptible to clarifying the meaning of these early findings, particularly in RGEA grafts with a balanced flow.

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