Is conventional coronary artery surgery being replaced by the hybrid approach?

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Central Message

Conventional or off-pump coronary artery bypass surgery is being replaced by the hybrid approach, possibly even for diabetic patients.

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Nearly 2 decades ago, Angelini and colleagues¹ proposed the concept of hybrid myocardial revascularization. The concept was to incorporate the benefits of a reliable arterial graft (left internal mammary artery to left anterior descending artery [LIMA-LAD]), eliminating some of the inherent risks of complete revascularization due to cardiopulmonary bypass, aortic manipulation, and stroke, and avoidance of morbidity associated with venous conduit harvesting. Despite the attractiveness of this approach, however, the hybrid procedure was plagued by the somewhat disorienting experience of logistically combining the 2 procedures. At that time, hybrid operating room/catheterization suites were not yet in widespread use to allow both procedures to be done in a single setting. Staging the procedures created a vexing dilemma of either performing first the LIMA-LAD graft and having the benefit of evaluating graft patency at the time of stenting the lateral/inferior vessels, but risking a second operation if a catastrophic complication occurred during the stenting procedure. Alternatively, perform stenting first and then LIMA-LAD anastomosis on dual antiplatelet therapy, thus adding a significant risk of bleeding.

Over the last 20 years, surgery has evolved to incorporate various combinations of arterial conduit options, Y-grafting, off-pump surgery, and endoscopic vein harvesting. Stenting technology also is evolving, with more reliable, ever-improving drug-eluting platforms, bioabsorbable polymers and scaffolds, and new techniques for addressing chronic occlusions and complex lesions. It appeared that the 2 competing fields were moving apart, as each attempted to provide the most complete revascularization with the lowest possible morbidity.

Recent advances in structural heart procedures and widespread investment in hybrid procedure rooms, along with the creation of heart teams, have brought collaboration between interventional cardiologists and cardiac surgeons to new heights. Contemporaneously, long-term trials with DES have reported patency rates of >80% at 10 years,²

apparently superior to the <50% rate of vein graft patency from surgical trials.³ Furthermore, recent clinical trials, including SYNTAX (Synergy Between PCI With Taxus and Cardiac Surgery)⁴ and FREEDOM (Future Revascularization Evaluation in Patients With Diabetes Mellitus: Optimal Management of Multivessel Disease),⁵ have added to the evidence reported from the BARI (Bypass Angioplasty Revascularization Investigation) trial⁶ linking the survival advantage of surgery, particularly in patients with diabetes, to the use of an LIMA graft. Revisiting a hybrid strategy became unavoidable.

The question then is: If the patency rate of a stent is superior to that of a vein graft, why should surgeons subject a patient to full sternotomy with either off-pump coronary artery bypass (OPCAB) or conventional coronary artery bypass grafting? The claim has been made that in patients with diabetes, clinical trials have shown the superiority of surgery over stenting. Now that stent technology has mostly surpassed venous conduits, should patients with diabetes then receive a hybrid approach of arterial grafts (LIMA-LAD), followed by stents of lateral and inferior vessels?

In this issue of the *Journal*, Song and colleagues,⁷ in a retrospective single-center study of patients with diabetes undergoing a hybrid surgical approach (n = 120) and a propensity-matched cohort of patients undergoing OPCAB (n = 240), report clinical benefits of the hybrid approach, including less chest tube drainage, lower transfusion rate, shorter mechanical ventilation time, and shorter intensive care unit stay. At 30 months postsurgery, the 2 groups had

a similar rate of major adverse cardiac and cerebrovascular events, except for a lower rate of stroke in the hybrid group.

Along with the retrospective single-center nature of the study population and the relatively short duration of follow-up, this study may have a number of potential confounders. First, the statistical method of propensity matching can only partially account for all potential variables for allocation bias. Although at first glance it appears that baseline clinical characteristics are matched, a number of clinical variables, although available, were not included in the propensity score model. Second, although the total number of diseased vessels was the same in the 2 groups, it appears that the total number of stents used was lower than the number of vein grafts performed, suggesting that the OPCAB population either had more extensive disease or underwent more complete revascularization. Third, the cutoff for stenosis severity at 50% might be appropriate for deciding which vessels to graft. Because the great majority of those 50% lesions are not hemodynamically significant, as in the FAME trial,⁸ and flow measurements were not made to assess severity and guide stent utilization, a number of those lesions could have been left untreated, further improving the results of the hybrid population. Fourth, the great majority of patients were treated with first-generation drug-eluting stents (DES). Newer-generation DES, by virtue of their thinner struts and more biocompatible polymers, may be associated with better deliverability, less side branch occlusion, faster healing, and lower risk of thrombosis. Finally, the short duration of the study may underestimate some of the true benefits of stents in allowing patency of native vessels. Grafted native vessels frequently

occlude, and intervention of degenerated vein grafts, mainly when performed more than 5 years after implantation, is frequently complicated by distal embolization, absence of reflow, and periprocedural infarct, even when filters are used.

As noted by Angelini and colleagues,¹ by foresight or serendipity, “the most effective way of predicting the future is inventing it.” Despite the lack of randomized trial data, all of the available clinical evidence points to a hybrid approach as the way of the future.

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