Commentary: Off-pump surgery—Choice, not religion

Bruce Lytle, MD

From Baylor Scott and White—The Heart Hospital Plano, Plano, Tex.

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Address for reprints: Bruce Lytle, MD, 1100 Allied Dr, Plano, TX 75093 (E-mail: lytlebw@gmail.com).

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For more than 2 decades, we have examined the value of off-pump coronary artery bypass grafting surgery. It has been the subject of single-institution and single-surgeon reports, randomized trials, and observational studies that have used a myriad of statistical adjustment strategies in attempts to allow comparisons with a variety of on-pump strategies. The most common question addressed has been “Should off-pump surgery be the standard strategy used by most surgeons for most patients undergoing coronary artery bypass grafting surgery?” As their stories have unfolded, the largest studies involving heterogeneous groups of surgeons and patients have shown that off-pump surgery appears to achieve slight decreases in perioperative morbidity, most consistently the rates of blood transfusion, stroke, and renal complications (as in the study Rufa and colleagues¹), but at the price of a decrease in the rate of complete arterial grafting (itself a strategy with incomplete acceptance), a decrease in complete revascularization, and, at least in some studies, a slight decrease in long-term graft patency rate and patient survival. The short term outcomes of off-pump surgery may be a little better, the long term outcomes a little worse. Advocates of off-pump surgery have cited surgeon inexperience with that strategy as a confounding factor, and advocates of on-pump surgery have pointed out the necessity that to become standard practice a technique must be scalable to the general populations of both surgeons and patients. After 20 years, however, the verdict on off-pump surgery has been no: off-pump surgery has not become the standard strategy for coronary artery bypass grafting surgery.

But if off-pump surgery is not a superior strategy when performed by many surgeons for most patients, is it superior for some patients when performed by some surgeons? In their study in this issue of the *Journal*, Rufa and colleagues¹ attempt to investigate this question in regard to reoperations for coronary surgery. Patients undergoing reoperation for coronary artery bypass grafting have been at increased risk throughout the history of coronary surgery. It is important to note that reoperations constituted only 3% to 4% of the coronary surgery at this institution during the period under study, an observation consistent with the decrease in

Bruce Lytle, MD

Central Message

Off-pump surgery has not become the standard strategy for coronary artery bypass grafting surgery but should be an option for some patients when performed by some surgeons.

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coronary reoperations seen at many centers. Rufa and colleagues¹ investigate the on-pump versus off-pump question by comparing nonrandomized groups of patients undergoing surgery by a stable group of surgeons, pursuing equalization of those patient groups with multiple statistical adjustments, including propensity matching. In reality, however, this is not a comparative study, despite these attempts to equalize the comorbidities of the on- and off-pump groups. Those patients undergoing operation on pump had more extensive coronary disease, worse left ventricular function, and, seemingly, more active ischemia. Not only were those patients added to the on-pump group, they were removed from the off-pump group. In addition, the surgical missions for on- and off-pump surgery groups clearly differed, because the on-pump group received more posterior and lateral wall grafts and the off-pump group had a higher rate of complete revascularization despite having fewer grafts. During the course of the study, the surgeons involved used changing criteria in choosing off- versus on-pump surgery. And the dividing line, when the advantages of off-pump surgery seemed to outweigh its disadvantages, changed throughout the period of the study, presumably in response to their improving skills in off-pump surgery.

A side point of the publication, not the main thrust of the investigation but an important observation nonetheless, is that patients operated within 48 hours of a myocardial infarction had a particularly high operative mortality (9 of

27, if I interpret their data correctly), confirming that in coronary surgery, “there are emergencies and there are reoperations, but there are not emergency reoperations.” All medical management strategies, including anticoagulation, intravenous blood pressure and heart rate control, intra-aortic balloon pump placement, and limited percutaneous coronary intervention, should be used to control acute cardiac ischemia such that coronary reoperations can be undertaken in a controlled, elective manner.

When performing coronary artery bypass grafting surgery, surgeons make many choices about the conduct of the operation, including timing, incision, perfusion, conduit selection, vessels chosen for grafting, grafting patterns, and many others. The use or not of cardiopulmonary bypass is one of those choices. Off-pump surgery has pluses and minuses. (In fact, the use of the left internal thoracic artery to graft the anterior descending coronary artery is the only operative choice to be mandated for all patients undergoing this operation or, I believe, any operation.) Rufa and colleagues¹ have shown that when the surgeon can achieve the surgical mission of a reoperation for coronary surgery by doing that operation off pump, the operation can be done at relatively low risk, primarily by ameliorating noncardiac comorbidities. That selectivity is good. Patients are different. They will

present many different situations with regard to the surgical mission, cardiac morbidities, and noncardiac morbidities. When faced with differing surgical options, it is the job of the surgeon to choose those most likely to be effective in their hands at that time for that patient, for the purpose of achieving the best combination of short- and long-term outcomes. What we can say at this point, and what this report seems to emphasize, is that both on- and off-pump surgery are tools that should be included in the armamentarium of a coronary surgery center. The ability to perform both off-pump surgery and on-pump surgery, to construct the best mix of the advantages and disadvantages of both, and to maximize the long-term benefit of bypass surgery while minimizing its short-term risks are capabilities that should be cultivated by serious coronary surgeons. The choice of whether to use cardiopulmonary bypass as a tool to aid in achieving an effective bypass operation should be based on the ability of the surgeon at that moment and the profile and needs of the patient, not made to prove a principle.

Reference

1. Rufa MI, Ursulescu A, Nagib R, Shahmuganathan S, Albert M, Reichert S, et al. Off-pump versus on-pump redo coronary artery bypass grafting: a propensity score analysis of long-term follow-up. *J Thorac Cardiovasc Surg.* 2020;159:447-56.e2.