Minimally Invasive Coronary Bypass
A Dissenting Opinion

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Minimally invasive techniques for coronary surgery are gaining increased attention, but not without debate. We recognize that in criticizing a new technique, it is necessary to have not only a firm opinion but also a willingness to be wrong; our purpose is to stimulate discussion and debate. Of course, it is difficult to argue against attempts to minimize the invasiveness of any procedure, but it is well to recall that the most obvious successes of minimally invasive surgery have involved technically simple operations, such as arthroscopy or cholecystectomy, which involve a minimum of precision and almost no sewing. The circumstances are different, however, when one attempts to apply the same theory and strategy to physiologically and technically complex cardiac operations.

Advantages of Conventional CABG

The remarkable success of conventional CABG is due to the application of a standardized operation in a wide variety of settings to large numbers of patients with advanced disease by a vast cadre of trained, experienced surgeons who can offer the public an operation that is safe, effective, durable, reproducible, complete, versatile, and teachable and that, over time, offers cost savings because of the low incidence of complications and repeat revascularizations. (Randomized studies such as the RITA trial, which compare CABG with angioplasty, show higher initial costs for surgery but convergence of costs within 2 to 3 years because of the infrequency of repeat revascularizations in the surgical cohort.) These excellent outcomes after surgery depend on a number of critical components: uncompromising selection of the best sites for coronary anastomoses; careful management of unexpected circumstances, such as intramyocardial vessels; use of properly chosen, optimum conduits of exact length; avoidance of trauma to conduits and native coronary vessels; provision of optimum conditions for microvascular anastomoses; and performance of complete, multivessel revascularization. These maneuvers require adequate exposure, which remains a basic ingredient of good surgery. The median sternotomy is a versatile incision that provides exposure for all segments of the coronary arteries; allows palpation and direct inspection of the best sites for coronary and aortic anastomoses; permits careful, atraumatic, and rapid mobilization of both internal mammary arteries; and permits repair of cardiac valves and other structures without altering the basic surgical approach.

Thus, the standard operation ensures the optimum conditions for achieving the best possible results with the widest margin of safety and has provided reproducible results in the hands of surgeons around the world.

Minimally Invasive Techniques

What, then, can we say about the approaches that are being proposed as alternatives? The claims for the nonpump, beating-heart, MIDCAB procedure are that the incisions are better tolerated and are cosmetically more desirable than a full median sternotomy, that the morbidity of cannulation and cardiopulmonary bypass is avoided, and that the costs of equipment and personnel for cardiopulmonary bypass are eliminated. The claims for port-access surgery are that even with the use of the pump, incisional morbidity is lessened, recovery is faster, and costs are reduced because hospital stays are shorter.

In reality, operations through small incisions are prolonged and are technically more difficult. Applicability is limited for mini-incisional and port-access CABG by common problems such as peripheral vascular disease, aortic regurgitation, and ischemic mitral regurgitation. Although it is possible that the novelty of MIDCAB surgery may divert some patients with isolated, proximal LAD disease from the interventional cardiologist, because interventions in the proximal LAD have the highest recurrence rate, it is also true that isolated IMA grafting to the LAD by standard techniques is a remarkably safe, simple, and rapid operation that requires only 75 to 85 minutes in most cases and that has a success rate of >95% graft patency. Contrast this with the MIDCAB procedure, which generally takes longer except in the hands of a few MIDCAB virtuosos and about which there are disturbing reports of early anastomotic failures that provoke early reoperations or PTCA, including some anastomotic occlusions that have occurred at high-profile, live, video teaching conferences despite use of modern stabilization techniques. As a result of the extensive learning curve, for which vulnerable patients pay the price, there have been recommendations for routine early angiography during the so-called learning phase, an additional expense for an operation purported to offer cost savings.

Multiple prospective studies of CABG have shown that the superiority of surgical therapy over medical management in relief of angina and improved survival is related to the severity of disease and the completeness of revascularization. In other words, the benefit of surgery is greatest when...
patients with the most extensive coronary atherosclerosis and left ventricular dysfunction receive complete revascularization. Data from the BARI trial indicate that the most commonly performed surgical revascularization procedure in the United States is CABG in patients with 3-vessel disease. Fewer than 2% of STS Database patients have had single grafts. In the experience at Lancaster General Hospital, only 189 patients have received single grafts to the LAD during a 14-year experience in which 6485 patients required first-time isolated CABG. We must therefore ask whether the increasing numbers of patients undergoing single-vessel bypass with MIDCAB techniques are being completely revascularized. In both port-access and MIDCAB operations, limited exposure encourages and in some cases even mandates incomplete revascularization, as evidenced by recommendations of hybrid approaches that combine CABG with PTCA. Most surgeons have experience with and have been critical of situations in which patients who were judged by interventional cardiologists to have single-vessel disease before PTCA subsequently are found to require multiple bypass grafts when they are referred for CABG after failed PTCA. Will enthusiasm for the MIDCAB approach create a surgical version of this "tunnel-vision" phenomenon?

Cost

The purported cost savings of minimally invasive techniques are unsubstantiated, and there are many factors that actually increase cost, such as the expensive new devices associated with these procedures, the longer operating times, and the recommended studies to judge technical success. Any thoracic surgeon who has performed a mediastinal lymph node biopsy through a small anterior intercostal incision (Chamberlain procedure) knows that these incisions can be painful or may heal poorly in some patients and can occasionally be followed by lung hernias or chronic intercostal neuralgia.

After surgery through small incisions, early discharge from the hospital and reduced incisional pain may result in earlier return to work, which may offset to some extent the higher equipment costs of many of these procedures. Nevertheless, it is now commonplace to discharge patients from the hospital on day 4 or occasionally day 3 after surgery, even after standard multivessel bypass operations. In most patients, the full sternotomy incision is well tolerated and heals firmly. In our experience with lower hemisternotomy for MIDCAB IMA-to-LAD grafts, there is only a modest decrease in patient discomfort and postoperative disability. Long-term studies with thoroughly documented follow-up of comparable patients will be needed to confirm that the early return to work associated with these new approaches cannot be explained simply by the current general trend toward rapid recovery.

Public Demand

One of the arguments made for minimally invasive surgery is that the public demands it. This phenomenon is not surprising. Minimally invasive coronary bypass, with or without the pump, is being promoted to a poorly informed and gullible public in the United States, who are led to believe that these techniques are applicable to most cases, that the completeness of the procedure and the results are as good as with the standard operation, and that patients can expect little pain, few complications, and rapid return to their usual lifestyle. These misconceptions are encouraged by the companies that manufacture the specialized equipment necessary for these new procedures and by some hospitals and surgeons who advertise these techniques aggressively for competitive advantage. The public thus understandably expresses a desire for these procedures, because everyone would like to enjoy the benefits of surgery without the pain and inconvenience of actually undergoing surgery. The circle is completed when the public’s desire provokes other surgeons to carry out these procedures not because of their own convictions that these are better techniques but because they must offer these approaches to maintain their competitive position in the marketplace. In doing so, they risk compromising the safety and effectiveness of conventional CABG, a “gold standard” that has been successful in vast numbers of patients and is certainly the most rigorously studied operation in surgical history. Minimally invasive coronary bypass seductively promises short-term benefits, with no proof as yet that it can match the long-term benefits of the standard operation, which are firmly established and thoroughly documented.

Conclusions

We must have good studies that directly compare minimally invasive surgery with the standard operation. Preliminary information is disturbing in regard to anastomotic failures, and we need reassurance that the standard operation is not being compromised in regard to case selection, conduit selection, completeness of revascularization, graft patency rates, and cost. It is not sufficient, for example, to show that the hospital cost for a single IMA graft to the LAD by the MIDCAB approach is less expensive in a selected group of patients than is a standard operation in another group. It is also necessary to show that the patients were similar in all the important clinical parameters, that they had an equivalent completeness of revascularization, and that the long-term results were comparable. In patients with multivessel disease, for whom port-access surgery or even, more recently, robotic surgery is being advocated, it is hard to believe that the entire strategic approach to the procedure is not being compromised by a desire to minimize invasiveness. The use of sequential arterial grafts with mammary and radial arteries has enhanced the ability of cardiac surgeons to complete a higher percentage of grafts with arterial conduits. It remains to be seen whether this salutary development can be duplicated with port-access surgery.

Just because something can be done does not automatically mean that it should be done. We would also restate this axiom to say that just because something can be done by some surgeons does not mean that it should be done by all

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<th>Selected Abbreviations and Acronyms</th>
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<tr>
<td>CABG = coronary artery bypass graft surgery</td>
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<td>IMA = internal mammary artery</td>
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<td>LAD = left anterior descending coronary artery</td>
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<td>MIDCAB = minimally invasive direct coronary artery bypass</td>
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<td>PTCA = percutaneous transluminal coronary angioplasty</td>
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surgeons. The results obtained by some of the surgeons who have struggled to learn the techniques we are discussing will not necessarily be duplicated by others. Those who propose to alter the refined and highly evolved standard operation have the burden of proving that these new techniques not only are beneficial in the short term but also can be achieved by any competent surgeon without compromising the safety, durability, and sustained improvement that are well documented with the standard operation. We are waiting for the evidence.

References

Key Words: Editorials ■ bypass ■ surgery