Coronary bypass surgery performed without the use of cardiopulmonary bypass (off-pump surgery) has been used sporadically since the beginning of the bypass surgery era in 1967, but the use of this strategy increased dramatically during the 1990s. The major reason for the increased use of off-pump surgery was the hope that this strategy would decrease perioperative morbidity and possibly mortality by eliminating cardiopulmonary bypass (on-pump surgery). The fear concerning off-pump surgery has been that the difficulty of operating with the heart beating would lead to less complete and less effective revascularization at the time of surgery and worse long-term outcomes.

Whether these hopes and fears are real has been examined by myriad studies that have compared the outcomes for patients undergoing off-pump and on-pump surgery. Randomized trials usually have shown only small differences in perioperative outcomes, usually slightly in favor of off-pump surgery, but have included mostly low-risk patients. Observational trials often have shown bigger differences in short-term complications, usually in favor of off-pump surgery, but analyses of these trials are complicated by patient selection. Follow-up studies, both randomized and observational, have sometimes noted inferior long-term outcomes after off-pump surgery compared with on-pump surgery, manifest as decreased graft patency, increased risk of repeat revascularization, or increased mortality. Other studies have shown no long-term differences. When present, these differences usually have not been large and often have been attributed to a lack of experience with off-pump surgery.

The article by Hannan and colleagues1 is a review of patients undergoing coronary bypass surgery in the state of New York during 2001 to 2004. This study examined 30-day mortality and complication rates and the occurrence over 3 years after surgery of death and repeat revascularization. This study has strengths. It is inclusive. All residents of the state of New York who underwent bypass surgery in a hospital within the state of New York during the years in question are included in the study. This observational study produces a reasonably accurate definition of practice within the state of New York and showed that 13 889 patients underwent off-pump surgery compared with 35 941 undergoing on-pump surgery during these years. Thus, the use of off-pump surgery in New York appears to have leveled out at 25% to 30% of isolated bypass operations. Many patient descriptors associated with the choice of surgical strategy were identified. Patients with previous myocardial infarction, previous open heart surgery, and diabetes were more likely to undergo on-pump surgery, and patients with cerebrovascular disease, peripheral arterial disease, or calcified ascending aorta; older patients; and women were more likely to undergo off-pump surgery. One weakness of the study is that the authors did not examine the association of the off-pump strategy with other surgical variables, including complete revascularization and the use of internal thoracic artery grafts. The authors used multiple statistical and matching strategies to attempt to ameliorate the impact of patient selection.

The authors concluded that early mortality rates were not significantly different between groups, although a slight risk-adjusted mortality rate favored off-pump surgery. In addition, patients undergoing off-pump surgery had lower risk-adjusted rates for stroke and respiratory failure.

Analysis of the long-term outcomes showed no difference in risk-adjusted mortality but a higher rate of repeat revascularization for patients undergoing off-pump surgery. The follow-up strategy was not ideal in that only repeat revascularization procedures performed within the state of New York were recorded. This will underestimate the overall repeat revascularization rate because some patients will undergo their second procedure in other states. However, no particular reason exists to think that out-of-state repeat revascularization would be unevenly distributed between patients undergoing on- versus off-pump operations primarily.

One interesting observation was that the risk of repeat revascularization did not appear to be related to surgical experience. Examination of patients undergoing surgery by “busy” surgeons who did a high proportion of their cases off pump showed the same risk of repeat revascularization noted for less busy surgeons.

The conclusions reached in this study are similar to those indicated by the bulk of previously published data. When large heterogeneous groups of patients are examined, the short-term risks appear to be a little bit less for patients undergoing off-pump surgery, and the long-term results may be a little bit better for those undergoing on-pump surgery.2–6 Overall, these differences have not appeared to be large.7 We now know that off-pump surgery is here to stay but will not eliminate on-pump surgery in the foreseeable future.

However, the understanding that small differences in outcomes exist when overall patient populations are examined does not really help us very much in selecting a strategy for the individual patient. What we really should be interested in at this point, and the direction in which our research needs...
to go, is the identification of patient subsets in which major differences in outcomes exist based on surgical strategy. This type of information will allow us to select the best strategy for each patient and to maximize the advantages and minimize the disadvantages of both techniques.

For the present, observational data seem to suggest that patients with a high risk of stroke, particularly in the presence of known aortic atherosclerosis or cerebrovascular disease, derive the most benefit from off-pump surgery in regard to the avoidance of perioperative complications. Studies of elderly and female patients also seem to indicate a benefit for off-pump surgery. The benefit of the on-pump strategy relates most clearly to situations in which revascularization is complex and difficult to accomplish such as in diabetic patients, patients with coronary calcification, those with diffuse disease, or those for whom extensive internal thoracic artery grafting is contemplated. Low-risk patients do not seem to pay a measurable penalty for on-pump surgery and may receive more effective revascularization.

Disclosures

None.

References


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