In view of recent technological advances in off-pump cardiac surgery, off-pump CAB provides superior outcome to conventional on-pump CABG

PRO:

A renewed interest in off-pump coronary artery bypass grafting (OPCAB) occurred in the mid 1990s and presented surgeons with the option of revascularization without the potential complications of extracorporeal support. However, wide spread acceptance and use of this technique has remained sporadic. While this approach has been adopted by some as their primary mode of coronary revascularization, most surgeons still prefer to operate on an arrested heart most of the time. Although there was a steady increase in the percent of coronary bypass surgery performed off-pump in the 1990s, it has remained static at 20-25% of all coronary bypass procedures in the United States for the last four years. Reasons for the lack of further penetration in the percent of coronary bypass procedures performed off-pump include:

1. A technically more demanding surgical technique
2. The perceived lack of compelling evidence for universal benefit
3. A single report by Khan in a high profile journal (New England Journal of Medicine) raising concerns about decreased graft patency in off-pump surgery
4. Increased complexity and deteriorating quality of target vessels in patients currently undergoing coronary bypass surgery making the procedure more challenging

The ability to routinely perform multivessel coronary artery bypass grafting in virtually all patients is within ability of most surgical teams. The ingredients for success include a total commitment to the program by all members of the team including the surgeon, anesthesiologist, surgical assistant, scrub nurse, and perfusionist. The components of a successful procedure have now been well defined and include both anesthetic management and surgical technique. Anesthetic management specific to off pump CABG is absolutely critical for a successful program. Routine monitoring using transesophageal echo and pulmonary artery catheter monitoring is critical. The principles of volume preloading, intravenous nitroglycerin, Trendelenburg and rotational positioning, as well as proactive input from the anesthesiologist during various positioning maneuvers is critical. The conversion rate to cardiopulmonary bypass is less than five percent and the immediate extubation rate in patients not preoperatively ventilated exceeds ninety five percent. The use of suction stabilization and suction exposure devices allow virtually all vessels including the lateral and inferior surfaces to be revascularized in a hemodynamically stable condition. We have found that having our perfusionist becoming a member of the surgical team and using the misted blower to facilitate coronary visualization adds significant value.

The recent successful clinical introduction of distal anastomotic connectors with early data showing increased graft patency compared to conventional hand sewn anastomoses with minimization of the time required for the heart to stay in a distracted, hemodynamically unstable position, may significantly facilitate the use of OPCAB by more surgeons. This anastomotic connector, the Cardica C-Port device, is an integrated arteriotomy and anastomosis with eight stainless steel staples completed in a matter of seconds between positioning and the completed anastomosis... It is anticipated that broader use of the anastomotic connector device and the minimal time needed for the heart to stay in the distracted position will increase the percentage of CABG procedures performed off-pump.

Although there have been at least 37 randomized trials comparing off-pump versus on-pump coronary artery bypass surgery and at least five metaanalysis of these trials, consensus is still lacking. Two large reviews, one by Cheng and the other by Puskas, offer the most unbiased statistically robust analysis of the field. Cheng undertook a metaanalysis of 37 randomized trials of 3,369 patients. No significant differences were found for 30-day mortality, myocardial infarction, renal dysfunction, intra aortic balloon pump, wound infection, rethoracotomy, or reintervention. However, off-pump coronary artery bypass surgery significantly decreased atrial fibrillation, transfusion, inotrope requirement, respiratory infections, ventilation time, ICU stay, and hospital stay. Patency and neurocognitive function results were inconclusive. In hospital and one-year direct cost were generally higher for conventional coronary artery bypass surgery versus OPCAB. A consensus statement from the 2004 ISMICS consensus conference by Puskas et al concluded that:

1. OPCAB should be considered a safe alternative to conventional CAB with respect to mortality
2. With the appropriate use of modern stabilizers, heart positioning devices, and adequate surgeon experience, similar completeness of revascularization and graft patency can be achieved
3. OPCAB is recommended to reduce perioperative morbidity
4. OPCAB may be recommended to minimize mid-term cognitive dysfunction
5. OPCAB should be considered as an equivalent alternative to conventional CABG in regard to quality of life

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6. OPCAB is recommended to reduce the duration of ventilation, ICU, hospital stay, and resource utilization.

7. OPCAB should be considered in high-risk patients to reduce perioperative mortality, morbidity, and resource utilization.

A recent sub-analysis of the Prevent IV study by Magee et al examined graft patency of off-pump versus on-pump surgery in the Prevent IV trial. In one-year angiographic outcomes of 2,100 patients of which 20% were performed off-pump, there was no difference in graft patency off-pump versus on-pump.

Currently when patients with high-risk profiles are increasingly being referred for coronary revascularization at a minimum, the ability to comfortably perform OPCAB should be in every cardiac surgeon’s and anesthesiologist’s armamentarium. Patients who present at particular risk for mortality and morbidity and therefore are most likely to benefit from OPCAB include the very elderly (>80 years old), those with low ejection fractions, reoperative procedures, and patients with significant comorbidities including cerebral vascular disease, peripheral vascular disease, hepatic disease, bleeding disorders, unwillingness to take blood transfusions due to religious or ethical reasons, severe chronic obstructive pulmonary disease, and renal dysfunction. Those with atheromatous or calcified aortas should also optimally be performed off-pump. At a minimum all patients undergoing coronary revascularization should undergo epiaortic scanning of the ascending aorta and off-pump surgery with avoidance of the ascending aorta altogether or a clampless technique for proximal anastomosis be used. Another common application we have used for off-pump coronary artery bypass grafting is in those patients who present for CABG with platelet inhibition from clopidogrel. We have found that the postoperative bleeding diathesis is significantly less off pump when platelet inhibitors are a factor than when performed on-pump.

With the current state of technology and surgical and anesthetic techniques now mature, it is possible for virtually every patient to undergo coronary revascularization without cardiopulmonary bypass with equivalent graft patency to on-pump surgery. Significant benefit has been clearly demonstrated in high-risk profile patients and decreased morbidity and resource utilization has also clearly been demonstrated in all patients. Randomized trials to demonstrate a mortality or stroke benefit will not be forthcoming because of the size of the studies necessary to be powered to show a difference between techniques. At an absolute minimum, every cardiac surgical team should be comfortable with off-pump techniques so that when a patient most likely to benefit from those techniques is encountered the learning curve has already been surmounted and that patient can receive optimal care tailored to his/her individual risk.