Hybrid Coronary Revascularization: The Future of Coronary Artery Bypass Surgery or an Unfulfilled Promise?

Igor Gosev, MD; Marzia Leacche, MD

Advancement in technique and technology over the past 2 decades has helped improve clinical outcomes in both surgical and interventional percutaneous coronary revascularization. Hybrid coronary revascularization (HCR) procedures introduced in 2011 by the American Heart Association/American College of Cardiology Foundation updated guidelines for coronary artery bypass grafting (CABG) surgery,1 combine the superiority of the left internal mammary artery (LIMA) to the left anterior descending artery (LAD) revascularization2,3 with percutaneous coronary intervention (PCI) by means of drug-eluting stents (DES) for non-LAD vessels.4 Various minimally invasive surgical approaches are used to perform the LIMA to LAD graft. These approaches and techniques include off-pump coronary revascularization, robotically assisted procedures, small left thoracotomy, and partial sternotomy.

The Concept of HCR

The most common indications for HCR are ungraftable non-LAD vessels, lack of conduit, reoperations, severe aortic atherosclerosis, severe calcification of the mitral annulus, and prior chest radiation. Other indications include high-risk patients (recent myocardial infarction, prior stroke, frailty, end-stage renal disease on dialysis) in whom a less invasive approach may reduce the operative time and ischemic time.1 In a retrospective study5 that compared the outcomes of HCR versus CABG surgery according to preoperative clinical risk stratification (euroSCORE [European System for Cardiac Operative Risk Evaluation] ≤5 or ≥5), there were no differences in 30-day composite index outcome for CABG surgery versus HCR; however, in patients with complex coronary anatomy (SYNTAX [Synergy Between Percutaneous Coronary Intervention With Taxus and Cardiac Surgery] score ≤32 versus ≥33) and with higher preoperative clinical risk (euroSCORE >5), results were worse for HCR than for conventional CABG. Although use of DES has shown lower rates of repeat revascularization and thrombosis in several trials, in reality, DES are often used in more complex patients, such as those with bifurcating lesions, type C lesions, multiple stents, or occluded vessels, than those included in the trials.

How and Where to Perform HCR

Several minimally invasive techniques have been used to perform HCR despite the common theme being the steep learning curve for the surgeon and the need for specialized training in these techniques. Thus, the use of HCR depends significantly on the availability of surgeons trained in minimally invasive procedures.5

References

1. Harskamp et al.5

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The question of where to perform HCR and the best sequence, concurrent versus staged, remains unresolved. The most compelling approach is the concurrent approach (1 stage), in which during the same session, PCI and CABG are performed in the same area. However, this approach is limited by hybrid operating room availability, the need for cross-training of personnel, the potential risk of bleeding after administration of antiplatelet agents, and the risk of contrast-induced nephrotoxicity. The most common approach (staged) reported by Harskamp et al (85% of all HCR procedures) poses several challenges, including the need for 2 procedures and 2 hand-offs among teams. In the staged approach, the optimal sequence (PCI first and then CABG versus CABG first and then PCI) depends on the coronary anatomy of the patient and the patient’s clinical presentation. On one end of the spectrum, there is the risk of performing multivessel stenting in an unprotected LAD territory versus the need for reintervention in the presence of anastomotic problems.

The True Value of HCR

Some studies report reduced length of stay and shorter hospital stay with HCR versus CABG depending on the timing of PCI and CABG and the modality. A recent report by Bachinsky and colleagues compared same-setting robotic-assisted hybrid CABG to off-pump coronary artery bypass. Patients after HCR had improved quality-of-life measures and assisted hybrid CABG to off-pump coronary artery bypass. Patients after HCR had improved quality-of-life measures and the potential risk of bleeding after administration of antiplatelet agents, and the risk of contrast-induced nephrotoxicity. The most common approach (staged) reported by Harskamp et al (85% of all HCR procedures) poses several challenges, including the need for 2 procedures and 2 hand-offs among teams. In the staged approach, the optimal sequence (PCI first and then CABG versus CABG first and then PCI) depends on the coronary anatomy of the patient and the patient’s clinical presentation. On one end of the spectrum, there is the risk of performing multivessel stenting in an unprotected LAD territory versus the need for reintervention in the presence of anastomotic problems.

Another financial analysis of hospital costs and reimbursements showed that HCR results in not only higher procedural costs but also a higher reimbursement rate, with improved resource utilization because of less blood transfusion, shorter ventilation time, and shorter length of stay than with off-pump coronary artery revascularization. Therefore, the wide application of HCR is limited by the uncertainty of the long-term effectiveness of DES and the higher cost.

Conclusions

Unless the overall patient experience, outcomes, and financial implications of HCR are significantly better than for standard CABG alone in the long-term, HCR will continue to play a limited role in coronary revascularization. Harskamp and colleagues delineate the current practice of HCR in the United States. HCR remains a valuable alternative to conventional CABG surgery in the hands of expert centers where there is integration between cardiac surgery and cardiologists and where cardiac surgeons are trained in minimally invasive procedures. Patients with complex lesions in the LAD (high SYNTAX score derived from LAD lesions) are most amenable to LIMA-to-LAD bypass and PCI to non-complex, non-LAD lesions. The ideal subset of patients in whom the medical and financial risks of a minimally invasive procedure are acceptable is still to be determined.

Disclosures

None.

References


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