Hybrid coronary revascularization: Ready for prime time, but who should star?

William Hiesinger, MD, and Pavan Atluri, MD

From the Division of Cardiovascular Surgery, Department of Surgery, University of Pennsylvania School of Medicine, Philadelphia, Pa.

Disclosures: Authors have nothing to disclose with regard to commercial support.

Received for publication Dec 1, 2015; accepted for publication Dec 2, 2015; available ahead of print Jan 22, 2016.

Address for reprints: Pavan Atluri, MD, Division of Cardiovascular Surgery, Department of Surgery, University of Pennsylvania School of Medicine, 6 Silverstein Pavilion, 3400 Spruce St, Philadelphia, PA 19072 (E-mail: pavan.atluri@uphs.upenn.edu).

J Thorac Cardiovasc Surg 2016;151:1090-1
0022-5223/\$36.00

Copyright © 2016 by The American Association for Thoracic Surgery
<http://dx.doi.org/10.1016/j.jtcvs.2015.12.015>

Dr Halkos and colleagues¹ have provided a preponderance of evidence over a wide variety of settings that hybrid coronary revascularization (HCR) is safe, feasible, and potentially advantageous in selected populations when compared with conventional coronary artery bypass. Compared with off-pump coronary artery bypass grafting (CABG), HCR has been shown to have a similar incidence of major adverse cardiac and cerebrovascular events and similar short- and mid-term survivals, although with an increased need for repeated revascularization.¹ When compared with CABG including cardiopulmonary bypass, in both diabetic² and nondiabetic³ populations, HCR had equivalent rates of 30-day death, myocardial infarction, and stroke; had equivalent mid-term mortality; and was associated with less blood product use and shorter length of stay without the increased need for repeated revascularization. In addition, the safety and efficacy may well extend to every strata of patient risk, with the greatest benefits going to those with the greatest risk.⁴ These findings have been demonstrated in a number of meta-analyses.^{5,6}

In this excellent study, Dr Rosenblum and colleagues⁷ seek to up the ante and compare HCR with the platinum standard of coronary revascularization, notably with the use of multiple arterial grafts. Once again, HCR has proven safe and efficacious, and the study demonstrates similar outcomes (both short- and mid-term) in HCR versus CABG with single or bilateral internal thoracic artery conduits, as well as a lower incidence of perioperative complications, including fewer blood transfusions, no deep sternal wound infections, shorter ventilation time, and a shorter length of stay. The authors also sought to better delineate preoperative patient selection criteria predictive of the use of HCR and found that older patients, patients with lower body mass index or prior percutaneous coronary intervention, and patients with stable 2-vessel disease were more likely to undergo HCR and that patients who underwent CABG with a single arterial conduit, compared with bilateral arterial conduits and HCR, had significantly higher Society

Pavan Atluri, MD

Central Message

HCR is safe, feasible, and potentially advantageous in selected populations; however, randomized trials are needed to determine widespread application.

See Article page 1081.

of Thoracic Surgeons predicted risk of mortality with the highest rates of diabetes, peripheral arterial disease, prior myocardial infarction, and heart failure.

So what do we do with this information now? It is unsurprising that a group of smart, technically excellent surgeons can take a population of “carefully selected patients” and achieve outstanding results with HCR, but how will we now divide the pie chart of coronary revascularization? In light of these findings and with data showing that drug-eluting stents are equivalent if not better than saphenous vein grafts,⁸ should we not be pushing the envelope and greatly expanding our use of HCR at the expense of traditional left internal thoracic artery–left anterior descending + saphenous vein graft CABG regardless of whether or not they slot nicely into historical patient selection brackets? The use of bilateral internal thoracic grafts improves overall long-term survival and repeat revascularization-free survival without increasing the incidence of operative complications, including deep sternal wound infection (especially with the addition of thoracic skeletonization).^{9,10} The short- and mid-term end points in this study would be unlikely to tease out these differences, so perhaps we should be more aggressive with

bilateral internal thoracic artery grafting in any patient undergoing surgical myocardial revascularization, including those who fit the ideal 2-vessel HCR case, and not just the young and relatively healthy. Even with complex statistical methods, propensity score matching, careful matching algorithms, and risk-adjustment strategies, these are questions that will not be answered with retrospective, observational research. Although this study provides an excellent proof-of-concept and suggests a change in clinical practice, it also highlights our need for aggressive multicenter randomized controlled trials to determine the optimal surgical coronary revascularization and patient-selection strategies in an all-comers fashion. Initial randomized control trial forays into HCR¹⁰ are a good start, but we are now ready to move beyond safety and feasibility and into the realm of widespread application as opposed to niche deployment.

References

1. Halkos ME, Vassiliades TA, Douglas JS, Morris DC, Rab ST, Liberman HA, et al. Hybrid coronary revascularization versus off-pump coronary artery bypass grafting for the treatment of multivessel coronary artery disease. *Ann Thorac Surg*. 2011;92:1695-701.
2. Harskamp RE, Walker PF, Alexander JH, Xian Y, Liberman HA, de Winter RJ, et al. Clinical outcomes of hybrid coronary revascularization versus coronary artery bypass surgery in patients with diabetes mellitus. *Am Heart J*. 2014;168:471-8.
3. Harskamp RE, Vassiliades TA, Mehta RH, de Winter RJ, Lopes RD, Xian Y, et al. Comparative effectiveness of hybrid coronary revascularization vs coronary artery bypass grafting. *J Am Coll Surg*. 2015;221:326-34.
4. Shen L, Hu S, Wang H, Xiong H, Zheng Z, Li L, et al. One-stop hybrid coronary revascularization versus coronary artery bypass grafting and percutaneous coronary intervention for the treatment of multivessel coronary artery disease: 3-year follow-up results from a single institution. *J Am Coll Cardiol*. 2013;61:2525-33.
5. Harskamp RE, Bagai A, Halkos ME, Rao SV, Bachinsky WB, Patel MR, et al. Clinical outcomes after hybrid coronary revascularization versus coronary artery bypass surgery: a meta-analysis of 1,190 patients. *Am Heart J*. 2014;167:585-92.
6. Zhu P, Zhou P, Sun Y, Guo Y, Mai M, Zheng S. Hybrid coronary revascularization versus coronary artery bypass grafting for multivessel coronary artery disease: systematic review and meta-analysis. *J Cardiothorac Surg*. 2015;10:63.
7. Rosenblum JM, Harskamp RE, Hoedemaker N, Walker P, Liberman HA, de Winter RJ, et al. Hybrid coronary revascularization versus coronary artery bypass surgery with bilateral or single internal mammary artery grafts. *J Thorac Cardiovasc Surg*. 2016;151:1081-9.
8. Farooq V, Serruys PW, Zhang Y, Mack M, Stähle E, Holmes DR, et al. Short-term and long-term clinical impact of stent thrombosis and graft occlusion in the SYN-TAX trial at 5 years: Synergy Between Percutaneous Coronary Intervention with Taxus and Cardiac Surgery trial. *J Am Coll Cardiol*. 2013;62:2360-9.
9. Benedetto U, Amrani M, Gaer J, Bahrami T, de Robertis F, Simon AR, et al; Harefield Cardiac Outcomes Research Group. The influence of bilateral internal mammary arteries on short- and long-term outcomes: a propensity score matching in accordance with current recommendations. *J Thorac Cardiovasc Surg*. 2014;148:2699-705.
10. Gąsior M, Zembala MO, Tajstra M, Filipiak K, Gierlotka M, Hrapkowicz T, et al; POL-MIDES (HYBRID) Study Investigators. Hybrid revascularization for multivessel coronary artery disease. *JACC Cardiovasc Interv*. 2014;7:1277-83.