
Comparative Effectiveness of Hybrid Coronary Revascularization vs Coronary Artery Bypass Grafting



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BACKGROUND: Hybrid coronary revascularization (HCR) combines minimally invasive left internal mammary artery to left anterior descending bypass with percutaneous coronary intervention of non-left anterior descending vessels. Its safety and effectiveness compared with conventional CABG have been under studied.

STUDY DESIGN: Patients with multivessel disease and/or left main disease who underwent HCR at a US academic center between October 2003 and September 2013 were included. These patients were matched 1:3 to patients treated with CABG using a propensity-score matching algorithm. Conditional logistic regression and Cox regression analyses stratified on matched pairs were performed to evaluate the adjusted association between HCR and short- and long-term outcomes.

RESULTS: The 30-day composite of death, MI, or stroke after HCR and CABG was 3.3% and 3.1% (odds ratio = 1.07; 95% CI, 0.52–2.21; $p = 0.85$) in the matched cohort of 1,224 patients (HCR, $n = 306$; CABG, $n = 918$). Hybrid coronary revascularization was associated with lower rates of in-hospital major morbidity (8.5% vs 15.5%; $p = 0.005$), lower blood transfusion use (21.6% vs 46.6%; $p < 0.001$), lower chest tube drainage (690 mL; 25th to 75th percentile: 485 to 1,050 mL vs 920 mL, 25th to 75th percentile: 710 to 1,230 mL; $p < 0.001$), and shorter postoperative length of stay (<5-day stay: 52.6% vs 38.1%; $p = 0.001$). During a 3-year follow-up period, mortality was similar after HCR and CABG (8.8% vs 10.2%; hazard ratio = 0.91; 95% CI, 0.55–1.52; $p = 0.72$). Subgroup analyses in patients stratified by 2-vessel, 3-vessel, left main disease, and by Society of Thoracic Surgeons risk scores rendered similar results.

CONCLUSIONS: The use of HCR appeared to be safe, with faster recovery and similar outcomes when compared with conventional CABG. These findings were consistent irrespective of anatomic or predicted procedural risk. (J Am Coll Surg 2015;221:326–334. © 2015 by the American College of Surgeons)

Coronary artery bypass grafting is considered the gold standard for management of patients with complex multivessel coronary artery disease (CAD).^{1,2} The unparalleled patency and freedom from atherosclerosis of the left internal mammary artery (LIMA) to left anterior descending

artery (LAD) graft is thought to be responsible for the long-term advantage of CABG over percutaneous coronary intervention (PCI).³ However, PCI offers a much lower level of invasiveness, with faster recovery and less short-term complications, including fewer strokes.⁴ Therefore, patients at high surgical risk, as well as those with less complex CAD (and without diabetes) are believed to be better off with PCI. Although the debate about surgical vs percutaneous revascularization remains unsettled, a relatively new concept of hybrid coronary revascularization (HCR) has been introduced in an attempt to combine the strengths of CABG and PCI by combining the durability of the LIMA-LAD bypass graft with PCI for non-LAD lesions. A single LIMA-LAD grafting does not require a large operating field, and allows the use of sternal-sparing incisions without aortic manipulation and

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Abbreviations and Acronyms

CAD	= coronary artery disease
HCR	= hybrid coronary revascularization
IMA	= internal mammary artery
LAD	= left anterior descending
LIMA	= left internal mammary artery
OR	= odds ratio
PCI	= percutaneous coronary intervention
STS	= Society of Thoracic Surgeons

mitigates the need for cardiopulmonary bypass. This has the theoretical potential for reducing the incidence of adverse neurologic events, bleeding, infection, and pulmonary complications associated with conventional on-pump CABG, and permits the long-term survival advantage conferred by LIMA-LAD bypass.⁵ For revascularization of non-LAD lesions, the use of PCI has been shown to offer similar patency compared with saphenous vein grafts used in conventional CABG, particularly when drug-eluting stents are used.⁶ However, the safety and effectiveness of hybrid coronary revascularization is understudied, particularly in patients at higher procedural risk and those with left main or 3-vessel disease, a population usually referred for conventional revascularization. To address this, we compared 30-day and long-term clinical outcomes

in a contemporary cohort of patients undergoing either HCR or conventional CABG at a US academic institution.

METHODS**Study population and definitions**

The starting population included all eligible cases from the Emory University Institutional Society of Thoracic Surgeons (STS) Adult Cardiac Database between October 2003 and September 2013. At Emory, a custom data field was created within the STS database, which defined hybrid patients on an intent-to-treat basis to capture patients who either were converted to sternotomy for multi-vessel CABG, or to identify those who underwent only PCI or LIMA-LAD grafting without the second part of the hybrid procedure. To be considered a hybrid procedure, the case should involve a planned nonsternal LIMA-LAD bypass with PCI of one or more non-LAD lesions that were performed either in one setting or as 2-staged procedures. Those who underwent emergent PCI or angioplasty for acute coronary syndrome, then traditional multivessel CABG through median sternotomy, were not defined as a hybrid procedure for this study. In total 9,901 underwent CABG surgery or HCR on an intent-to-treat basis during the study period. From this starting population, we selected patients with

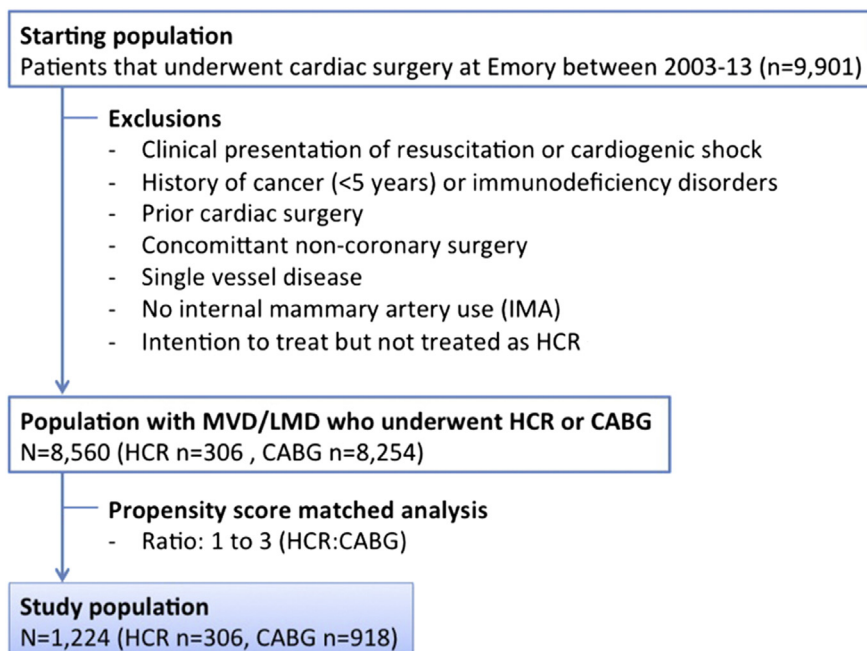


Figure 1. Flow diagram of the study population. Steps that led from the starting population to the propensity score–matched study population. These patients were included in a sensitivity analysis of intention-to-treat for hybrid coronary revascularization (HCR). LMD, left main coronary artery disease; MVD, multivessel coronary artery disease.

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