See Article page 645.

Commentary: Coronary artery bypass surgery and percutaneous coronary intervention: Optimal revascularization for the younger patient

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Coronary artery bypass surgery (CABG) was the first reliable intervention to treat coronary artery disease until percutaneous coronary intervention (PCI) emerged.^{1,2} There has been more 30 years of debate over which coronary revascularization strategy yield better results.^{3,4} Several randomized controlled trials (RCTs) have compared these techniques, with CABG typically having greater early risk but providing more complete revascularization, and hence, better long-term outcomes compared with PCI, especially for patients diabetes or with complex coronary anatomy.^{5,6} However, RCTs have certain disadvantages, despite being considered the holy grail of medical science. First, specific subpopulations are underrepresented, such as very young, female, and non-white patients.³ Second, most RCTs comparing PCI and CABG have limited follow-up, usually reporting outcomes up to 5 years only.⁷ Lastly, the funding of RCTs comparing PCI and CABG has often come from industry. RCTs supported by industry are more likely to be positive than studies funded through other means, which suggest that biases

CENTRAL MESSAGE

This study adds to the vast body of literature. As CABG can be performed safely with low mortality, this should be the treatment of choice for young patients with long life-expectancy.

may exist in the design or implementation phases. Also, there is a strong advantage for industry to have an early study answer, whereas the relative benefit from CABG may come later.⁸⁻¹⁰

Robich and colleagues¹¹ compare the early and late outcomes of CABG versus PCI in patients younger than 60 years from the registries of the Northern New England Cardiovascular Disease Study Group (NNECDG), with up to 10-years of follow-up.¹¹ The investigators must be congratulated for their effort to evaluate this question, which address the main RCT's limitations, mentioned previously. Despite the shortcomings of a retrospective analysis using non-mandatory databases, we wish to highlight multiple interesting points in this study.

The study's patient population of complex multivessel coronary artery disease (2-vessel disease with left anterior descending [LAD] artery involvement and 3-vessel disease) comprised 4883 cases. Exclusions included left main $\geq 50\%$, ST-elevation myocardial infarction, cardiogenic shock, emergency status, younger than 25 years of age, previous PCI or previous cardiac surgery, and patients who had an additional procedure along with the CABG, ie, conditions in which there may be a strong preference for one form of revascularization. From this group, 2938 of 4883 (60.2%) underwent PCI. Before adjustment, patients were younger, and there was a greater prevalence of female patients in the PCI group. Young patients might prefer PCI

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Disclosures: Dr Tam is supported by a CIHR Fellowship (Canada). Dr Fremes is supported by the Bernard S. Goldman Chair in Cardiovascular Surgery (Toronto, Ontario). All other authors reported no conflicts of interest.

The *Journal* policy requires editors and reviewers to disclose conflicts of interest and to decline handling or reviewing manuscripts for which they may have a conflict of interest. The editors and reviewers of this article have no conflicts of interest.

Received for publication April 11, 2020; revisions received April 11, 2020; accepted for publication April 13, 2020; available ahead of print May 6, 2020.

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J Thorac Cardiovasc Surg 2022;163:657-8

0022-5223/\$36.00

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<https://doi.org/10.1016/j.jtcvs.2020.04.108>

over CABG, since they can resume work and physical activity earlier, which might have influenced the choice of treatment strategy in this study. Nonetheless, we were still surprised by the high proportion of patients undergoing PCI, as the 2011 and 2012 American College of Cardiology Foundation/American Heart Association guidelines recommend CABG as a Class I indication for patients with 3-vessel disease and 2-vessel disease with proximal LAD, and Class IIa for 2-vessel without proximal LAD cases in patients with stable ischemic heart disease. Although PCI is often appropriate in patients presenting with acute coronary syndromes, PCI is recommended only as Class IIb (uncertain benefit) for the entire study patient population.¹²

One of the main CABG disadvantages is the upfront greater risk compared with PCI. Robich and colleagues describe excellent 30-day results, with no differences in early mortality. Perhaps the expected greater early mortality with CABG compared with PCI in an unselected population is not actually observed in younger patients. Nonetheless, even after risk-adjustment, stroke remained greater in the CABG group (1.2 vs 0.05%, $P < .001$) in this young cohort. The authors did not provide surgical details such as aortic manipulation (on pump, off-pump, use of side-biting clamp), although we do know that bilateral internal mammary usage was low, a strategy that is usually associated with less aortic manipulation.¹³ An important message from the analysis of Robich and colleagues is that surgeons should always strive to employ techniques to minimize the risk of perioperative stroke, even in a young population (which would have theoretically low risk of this adverse event).

CABG was associated with better 10-year results. In the current study, the proportional hazards assumption was violated, as it typically occurs when comparing CABG versus PCI (greater early hazards with CABG following greater late hazards with PCI). Hence, the analysis was dichotomized into the first 6 months, with no difference in the outcomes, and after 6 months, which showed an association of CABG with better outcomes. Given the advantage of completeness of revascularization and protection against non-flow-limiting lesions, CABG is usually associated with improved long-term results compared with PCI.¹⁴

The low use of multiarterial grafting in this young population with an anticipated long life-expectancy is disappointing. Although the advantages of multiarterial grafting remain uncertain in older patients, the patient cohort included in this analysis would almost certainly be candidates for a multiarterial strategy.¹⁵ The observed results may have even more favorable in the CABG population with a multiarterial grafting strategy, as suggested by most observational studies.^{16,17} In the PCI group, we have no data regarding the use of drug-eluting stents. These stents have been associated with improved results compared

with bare-metal stents, and it's uncertain whether in the early era of this study (2005-2010), drug-eluting stents were routinely used to treat the PCI group.¹⁸

In the continuing debate of which is the best revascularization strategy for complex coronary disease, the study of Robich and colleagues adds to the vast body of literature. As CABG can be performed relatively safely with low mortality, this should be the treatment of choice for young patients with long life expectancy.

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