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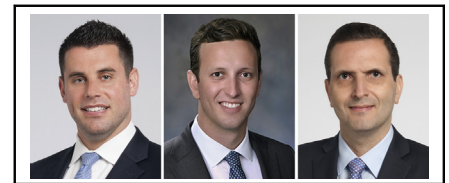


Commentary: Beyond the horizon of evidence in robotic totally endoscopic coronary artery bypass grafting

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Coronary artery bypass grafting (CABG) has been a mainstay of the cardiac surgeon's armamentarium for decades. In this issue of *JTCVS Techniques*, Dr Balkhy from the University of Chicago provides an impassioned review of the current state of robotic totally endoscopic coronary artery bypass (TECAB).¹ Certainly, his enthusiasm for innovation and evolution in the field of coronary revascularization is inspiring. Along with other advocates of robotic TECAB, he highlights the intriguing benefits of the operation, including avoidance of sternotomy, low morbidity and mortality, and faster recovery time. These theoretical benefits catalyzed fervent investigation into robotic CABG around the turn of the century, culminating in a Food and Drug Administration–sponsored trial.² However, despite considerable initial interest, the adoption of robotic TECAB remains limited to very few dedicated centers.

There are several possible explanations for the lack of widespread adoption of this technique. First, robotic TECAB is a technically complex operation, and although a pathway for acquisition of the requisite skills is outlined, the learning curve remains ill-defined. Second, the overall lack of enthusiasm within the cardiac surgical community has led to insufficient incentive for industry to invest in the necessary technology. In fact, several important



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CENTRAL MESSAGE

In the face of emerging technologies, including robotic totally endoscopic coronary artery bypass grafting, it is imperative to maintain the established priorities of coronary revascularization.

instruments are not compatible with the latest robotic platform (da Vinci Xi). Furthermore, the safety and efficacy of robotic anastomotic devices remain controversial. Although the Multicenter Assessment of Grafts in Coronaries (MAGIC) study³ reported comparable patency rates between an automated anastomotic device and hand-sewn anastomoses in open sternotomy, most surgeons remained reluctant, and as a result, it is no longer commercially available.

Last, and perhaps most important, there is a paucity of rigorous prospective data comparing clinically meaningful outcomes between robotic and open techniques for CABG. This “data dilemma” is compounded by the limited generalizability of existing studies that originate from dedicated centers and include highly selected patients who may not mirror the current landscape of patients requiring CABG. A recent report from the Society of Thoracic Surgeons Adult Cardiac Surgery Database revealed that ~95% of contemporary CABG cases involve multiple bypass grafts.⁴ In contrast, a systematic review of robotic TECAB revealed the use of multiple bypass grafts in only 22% to 39% of cases.⁵ On a more encouraging note, Dr Balkhy alludes to forthcoming data from his experience with 544 patients—including patients with diabetes, obesity, and previous sternotomy—65% of whom received multiple bypass grafts. Although a step in the right direction, the 35% single vessel bypass rate still does not mirror most contemporary CABG practices, including ours at the Cleveland Clinic, despite an active minimally invasive

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direct coronary artery bypass (MIDCAB) program. Nevertheless, given the limited number of centers currently performing robotic TECAB, along with the considerable variation in technique and patient selection, the lack of equipoise between robotic and open techniques may render a randomized clinical trial unfeasible.

In this context, we find it imperative to maintain the established priorities of CABG: complete revascularization with the use of multiple arterial grafts (MAGs) whenever appropriate and feasible. In addition to the left internal thoracic artery-to-left anterior descending artery anastomosis,⁶ there is a mounting body of evidence demonstrating that both completeness of revascularization^{7,8} and MAGs⁸⁻¹⁰ provide superior outcomes. Although robotic TECAB may adroitly provide MAGs, the completeness of revascularization with this technique remains concerning. To date, no study has demonstrated that either on- or off-pump robotic TECAB can reliably achieve a degree of surgical revascularization on par with on-pump CABG through a sternotomy. In the context of current evidence, the operation that most reliably achieves these priorities in patients with multivessel coronary disease continues to be an on-pump CABG through a median sternotomy.

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