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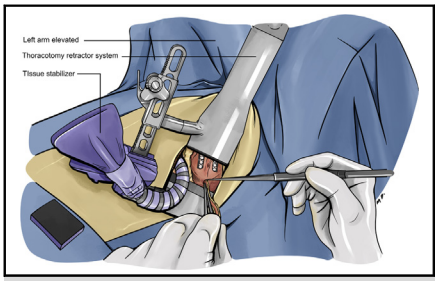
Commentary: In the hands of the few, less is more

Dominique Vervoort, MD, MPH, MBA,[a]
Mimi Xiaoming Deng, MD,[b] and
Stephen E. Fremes, MD, MSc[a,b]

In most patients with coronary artery disease requiring revascularization, the long-term superiority of coronary artery bypass grafting (CABG) has been well-established. However, the invasiveness remains a concern for patients, leading to the consideration of less-invasive CABG techniques to avoid sternotomy and minimize or even avoid cardiopulmonary bypass use. The 2018 European Society of Cardiology/European Association for Cardio-Thoracic Surgery guidelines on myocardial revascularization[1] recommend that, "where expertise exists, minimally-invasive CABG through limited thoracic access should be considered in patients with isolated left anterior descending artery lesions or in the context of hybrid revascularization" (Class IIa, Level of Evidence B). Dr Ruel shares the experience at the University of Ottawa Heart Institute[2] with multivessel minimally invasive CABG (MICS-CABG) through a small anterior thoracotomy. This technique can be performed with or without cardiopulmonary bypass support and typically occurs without robotic assistance. In theory, this approach retains the benefits of CABG (long-term survival advantage and complete revascularization) with less invasiveness. Their published results are promising, but the question remains: is this generalizable?

MICS-CABG has many merits. Angiographic patency is 92% for all grafts and 100% for the left internal thoracic artery at 6 months' post-MICS-CABG.[3] Although operative mortality and morbidity are similar to open CABG, patients who undergo MICS-CABG receive fewer blood products and experience a shorter intensive care unit and hospital length of stay, culminating in a median total cost reduction of 25% compared with standard CABG.[4] However, MICS-CABG demonstrates an average total cost that is 10% greater to off-pump CABG (OPCAB).[5] One of the benefits of MICS-CABG is the quality of life associated with avoiding a sternotomy, where chronic pain is observed in 1 in 3 patients at 1 year postsurgery.[2] Compared with OPCAB via median sternotomy, MICS-CABG is associated with fewer wound infections, shorter hospital length of stay, faster recovery, and comparable 30-day survival.[6,7]

Despite promising results, there are limitations to MICS-CABG. In a propensity-matched analysis, MICS-CABG was associated with greater rates of incomplete revascularization compared with open CABG: 69.8% versus 15.1% ($P < .001$).[4] This concern is reminiscent of the ROOBY trial during the early years of OPCAB.[8] MICS-CABG is also contraindicated in severe 3-vessel disease, emergent cases, ischemic cardiomyopathy, severe chronic obstructive pulmonary disease, and chest wall deformity, limiting its utility to a stable and less comorbid patient population where operative outcomes are already favorable.[9] Lastly, most published series are single-institution (or even single-surgeon), and there is a lack of long-term follow-up data



Minimally invasive cardiac surgical coronary artery bypass grafting (MICS-CABG) approach.

CENTRAL MESSAGE

Minimally invasive coronary artery bypass grafting is associated with improved quality of life, shorter length of stay, and fewer wound infections yet may only be attainable in the hands of experts.

From the [a]Institute of Health Policy, Management and Evaluation, and [b]Division of Cardiac Surgery, Schulich Heart Centre, Department of Surgery, Sunnybrook Health Sciences Centre, University of Toronto, Toronto, Ontario, Canada.

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Address for reprints: Stephen E. Fremes, MD, MSc, University of Toronto Schulich Heart Centre, Sunnybrook Health Sciences Centre, 2075 Bayview Ave, Room H4 05, Toronto, Ontario M4N 3M5, Canada (E-mail: stephen.fremes@sunnybrook.ca).

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to conclusively define the role of MICS-CABG over standard practice.

Increased adoption of MICS-CABG is faced with substantial challenges. Reproducing the superb results presented in literature to date requires competency that is only available in select referral centers, often with expertise residing in the hands of a single surgeon. In addition, mastering MICS-CABG requires traversing a steep learning curve with careful patient selection to build the necessary expertise. Importantly, proficiency of MICS-CABG should follow mastery of OPCAB first, which in itself requires dedicated practice.[10] This is complicated by geographic variations in technical expertise as OPCAB volumes are declining in North America, even though they constitute as much as 65% of CABG procedures in Japan.[9] Similarly, training the next generation of cardiac surgeons may be difficult, with minimal case volumes and technical difficulty, although simulation training has shown to be beneficial for OPCAB and minimally invasive direct coronary artery bypass and may be expanded to MICS-CABG in the future.[11] MICS-CABG may thus be a skillset only developed through super-fellowship training.

Nonetheless, various opportunities do arise. The Minimally Invasive versus STernotomy (MIST) clinical trial (NCT03447938) is the first trial comparing MICS-CABG versus conventional sternotomy CABG.[12] The trial spans 13 centers across 7 countries and is currently halfway in its recruitment toward 176 patients, who will be followed for up to 5 years. The primary end point of MIST is patient-reported early postoperative quality of life (the Physical Component Summary of the SF-36 questionnaire) at 4 weeks after surgery, and the trial is powered for a mean difference of 5 points between groups—the minimally important difference. The multicenter, multinational study design will help with generalizability, although the small sample size will mean that comparisons of clinical outcomes will likely be underpowered unless the differences are very large. In addition, there is ongoing debate about the benefits of OPCAB, given variable outcomes across trials and observational studies. While OPCAB is technically easier to perform than MICS-CABG, the inconsistent outcomes have resulted in gradually declining OPCAB volumes in North America.

In the end, we must place patients first. Quality of life should be considered with every treatment decision, beginning with minimizing the invasiveness of surgical approaches in a safe and quality manner. However, we should retain cautious optimism: MICS-CABG, while promising, may only ever be advantageous in the hands of the few.

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