hospital mortality, although a single postoperative arrest required extracorporeal membrane oxygenation, and there was 1 perioperative myocardial infarct. A single patient had a mortality event within 30 days. Respiratory complications were more common, with 12 outcome events. Multivariable regression demonstrated increased odds of respiratory complications with an increased length of surgery (odds ratio, 1.02, 1.008-1.034). Internal thoracic artery patency was excellent postoperatively, with an overall angiographic patency of 96.8%.

This study needs to be interpreted within the context of some major limitations. This is a small noncomparative series. The patient population is heavily selected, with patients having more optimal body habitus, ejection fraction, and ventricular dimensions. The right coronary system was grafted far less frequently in this series (9 patients), suggesting selection against right coronary territory grafting. Although multivariable regression was used to determine predictors of respiratory complications, a small study population with relatively few outcome events makes these results less reliable. Finally, although angiography demonstrated excellent early patency, what really matters is how these grafts fare in the long term.

This study demonstrates that minimally invasive multiarterial revascularization is safe and reproducible without requiring advanced endoscopic or robotic assistance. Although more comprehensive and long-term study is required, this represents an important incremental step in the evolution of minimally invasive CABG.

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Check for updates

Commentary: The evolution of coronary artery bypass surgery: Toward a better operation

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"Insanity is doing the same thing over and over again and expecting different results."

—Albert Einstein

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A better CABG operation on the horizon.

CENTRAL MESSAGE

Sternal-sparing surgery completely avoids sternal wound infection.

The evidence for the potential long-term benefits of multiple arterial grafts has been available for approximately 3 decades. The survival benefit of the use of bilateral internal thoracic artery and multiarterial grafting techniques

has been suggested in large institutional case series with longitudinal follow-up and multiple meta-analyses.¹ More recently, the clinical benefits of the use of the radial artery over saphenous vein grafting have also been shown.² However, the most common coronary artery bypass grafting (CABG) operation performed worldwide is the single internal thoracic to the left anterior descending artery grafting, with vein grafts to other targets, performed on bypass with aortic crossclamping.

The major obstacle (other than surgical inertia) to the more routine use of bilateral internal thoracic arteries would seem to be the fear of deep sternal wound infection. Although this fear is not borne out in the literature provided the internal thoracic artery is taken routinely in a skeletonized fashion and a liberal use of common sense is applied to morbidly obese patients with diabetes,³ it still seems to be a factor preventing more widespread adoption of the technique.

The benefits of complete avoidance of aortic manipulation (anaortic CABG) have also been demonstrated in multiple case series over 2 decades⁴ and more recently in a network meta-analysis comparing increasing degrees of aortic manipulation.⁵ In the recent European Society guidelines for myocardial revascularization, anaortic CABG is a Class I recommendation for patients with a diseased ascending aorta.⁶

The series presented by Davierwala and colleagues⁷ is a superb example of innovative application of both multiple arterial grafting and anaortic CABG and represents the best that CABG can offer in 2020. This is an example of the ability of innovative surgeons who work in supportive institutions to achieve a totally new level in CABG. The technique is not for beginners or the faint of heart. There is definitely a learning curve, and patient selection is key. However, as the Leipzig series shows, minimally invasive anaortic CABG appears to be reproducible and safe in the hands of experienced surgeons and completely avoids the risk of deep sternal wound infection.

The sternal-sparing technique also lends itself to a hybrid revascularization strategy with the deployment of multiple arterial grafts to the left coronary system and percutaneous therapy to the right coronary system.⁸ This may bring cardiac surgeons and cardiologists closer together and apply the principles of the heart team to provide the best, individualized therapy to patients with complex coronary artery disease.

It is interesting to observe that although coronary artery surgery remains, by a significant margin, the most common surgical procedure performed in adult cardiac surgical units,⁹ it is perhaps the one procedure that has changed the least over the past 3 decades. Mitral surgery, aortic valve surgery, and other adult cardiac surgical procedures are being routinely performed using minimal access techniques, often involving incisions other than a median

sternotomy. Patients and the all-important referring cardiologists have observed this phenomenon, and although multivessel stenting remains a lesser therapy for multivessel coronary disease,¹⁰ the prospect of a median sternotomy remains less appealing than an arterial puncture and a stent for most patients and their referring physicians.

The specter of stroke and cognitive dysfunction after cardiopulmonary bypass and aortic crossclamping remains another reason for patients not being referred for coronary artery surgery. This is particularly evident in elderly patients with diseased ascending aortas and peripheral vascular disease. However, these patients often have complex, heavily calcified coronary arteries and therefore will obtain a suboptimal result from multivessel percutaneous coronary intervention. The complete avoidance of aortic manipulation using anaortic off-pump techniques with composite grafts based on internal thoracic artery inflow negates many of these fears.

It behooves us, as coronary artery surgeons, to observe this phenomenon and to look to leading, innovative centers offering sternal-sparing multivessel coronary artery surgery and to learn these techniques so more patients can benefit from the life-extending procedure that is multiarterial CABG. A familiarity, indeed a mastery, of multiarterial grafting and anaortic techniques is the first step in this journey. A team approach to training, proctoring, and case selection before embarking on a sternal-sparing program is the next step. However, as Davierwala and colleagues⁷ have clearly demonstrated, it is a journey worth taking.

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