



## A Systematic Review of Coronary Revascularization Surgery

Hernandez F, Gaggin Y, Sugeng G\*, Roger J

Department of Health Services, Hodeidah University, Yemen

**\*Corresponding Author:** Sugeng G, Department of Medical Sciences, Kampala University, Coromos.

**Received Date:** August 03, 2022; **Accepted Date:** August 21, 2022; **Published Date:** September 05, 2022

**Citation:** Hernandez F, Gaggin Y, Sugeng G\*, Roger J, A Systematic Review of Coronary Revascularization Surgery, V1(4).

**Copyright:** © 2022 Sugeng G, This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

### Abstract

Coronary Revascularisation was originally developed in the mid 1990s as minimally invasive direct coronary artery bypass (MIDCAB) grafting is a less invasive approach compared to conventional coronary artery bypass grafting (CABG) to address targets in the left anterior descending coronary artery (LAD). Since then, MIDCAB has evolved with the adoption of a robotic platform and the possibility to perform multivessel bypass procedures. Minimally invasive coronary revascularisation surgery also allows for a combination between the benefits of CABG and percutaneous coronary interventions for non-LAD lesions – a hybrid approach. Hybrid coronary revascularisation results in fewer blood transfusions, shorter hospital stay, decreased ventilation times and patients return to work sooner when compared to conventional CABG.

**Keywords:** Coronary artery bypass grafting; minimally invasive direct coronary artery bypass; totally endoscopic coronary artery bypass

### Introduction

Cardiovascular diseases (CVDs) are responsible for approximately 17.9 million deaths annually. Ischemic heart disease (IHD) is the most prevalent CVD in the general population, as 49.2% of CVD deaths are among IHD patients. Revascularization methods, including percutaneous coronary intervention (PCI) and coronary artery bypass grafting (CABG), are the primary therapies in IHD. CABG is one of the most common cardiac surgeries, considered the preferable therapeutic approach in patients with multivessel or left main coronary artery disease (CAD) or in case of left ventricular dysfunction.

With the prevalence of one in every three adults in the United States, hypertension is a major modifiable risk factor for CAD irrespective of sex and age. Hypertensive patients tend to have different risk factor patterns from other CABG patients. Moreover, increased postoperative complications, early mortality, and 2-year mortality have been reported, compared to nonhypertensive patients. This was reported to be an up to 40% increase in perioperative morbidity in hypertensive patients undergoing CABG.

Nowadays, minimally invasive direct coronary artery bypass (MIDCAB) grafting is the routine procedure for patients with isolated proximal LAD stenosis and also as part of a hybrid approach in selected patients with MVCAD. In general, avoidance of sternotomy and cardiopulmonary bypass (CPB) has allowed for faster recovery, resulted in less bleeding and fewer transfusions and helped to prevent wound infections. While MIDCAB initially mainly encompassed the revascularisation of the LAD with the LIMA, minimally invasive techniques are not restricted to patients with single-vessel disease, but can also be applied to selected cases of MVCAD.

The use of both IMAs through a non-sternotomy approach was described by Balkhy et al. in 2017, using a totally robotic approach and recently by Davierwala et al. via a mini-thoracotomy incision. In both cases, the sternal sparing technique enhances the adoption of both internal thoracic arteries as conduits and nullifies the risk of deep sternal wound infection, while providing the benefit of multiarterial bypass grafting.

Minimally invasive surgical revascularisation has been found to be safe in single vessel disease as well as a selected group of patients with

MVCAD, where it has been shown to have low complication rates, good long-term results and acceptable conversion rates. Furthermore, Al-Ruzzeh et al. found that patients had excellent subjective mid-term outcomes concerning their general health and quality of life. Nonetheless, it is important to keep in mind that any minimally invasive coronary operation remains more challenging than conventional CABG and that the choice of treatment strategy remains a controversial topic.

### Minimally Invasive Direct Coronary Artery Bypass Grafting

MIDCAB grafting is currently the most standardised of all minimally invasive coronary procedures. It is performed through a small (mini) thoracotomy in the fourth left intercostal space (ICS) underneath the nipple. Surgeons perform both the LIMA takedown as well as the distal anastomosis of the LIMA to the LAD through this access. Grafting of mid-LAD and diagonal branches can be performed with this approach.

### Robotic-assisted Minimally Invasive Direct Coronary Artery Bypass Grafting

Robotic-assisted MIDCAB refers to the combination of a robotic takedown of the left internal thoracic artery and a direct anastomosis of the LIMA to the LAD accomplished at the bedside of the patient by the surgeon through a small anterior thoracotomy. This procedure has become popular because it has several advantages with respect to the traditional MIDCAB procedure, where the LIMA is harvested through the anteriorthoracotomy:

1. By using the robotic platform, the visualisation of the LIMA is enhanced with lower risk of vessel injury and typically a longer IMA graft (until the distal bifurcation) can be harvested. If needed, the longer LIMA graft can be used to perform an additional sequential anastomosis on the diagonal coronary artery, thus enabling multivessel MIDCAB.

### Totally Endoscopic Coronary Artery Bypass Grafting

The TECAB procedure was initially developed and performed to graft the LAD with the LIMA using the support of CPB in an arrested heart, as an even less invasive option than robotic-assisted MIDCAB. After demonstrating the safety and reproducibility of this approach in a case



series, and through significant technological improvements of the following generations of the da Vinci robotic system, multiple conduit harvesting for more complex, off-pump grafting strategies became possible. It has been extensively demonstrated that robotic-assisted, endoscopic, multivessel CABG procedures are safe, feasible and reproducible and lead to excellent outcomes.

### Hybrid Coronary Revascularisation

The rationale for hybrid coronary revascularisation (HCR) lies in the well-established survival benefit conferred by LIMA-to-LAD grafts and the use of new stent platforms featuring lower stent restenosis and thrombosis rates compared with venous graft stenosis and occlusion rates, respectively. When comparing CABG to PCI, CABG remains the gold standard in MVCAD, with lower mortality and lower repeat vascularisation risks. Despite the higher stroke risk suggested by CABG, that risk does not outweigh its benefits in long-term survival, leading physicians to combine the two procedures in what is known as HCR. Here, both surgical bypass and PCI are encompassed in that they are either performed during the same procedure or within 60 days of each other.

### Conclusion

In the five decades since it has been introduced, CABG has been subject to continuous improvements and changes. The way in which the procedure is now performed has been transformed by technological advances that have propelled forward multiple CABG techniques. In the current era, CABG has become less invasive and emphasis has been given

to more patient-friendly approaches and more durable results. MIDCAB was first described by Calafiore et al. and since then, many studies have highlighted the beauty of minimally invasive coronary procedures, accentuating it as an attractive alternative to conventional CABG as it bypasses the need for sternotomy.

### References

1. Balkhy H., Nisivaco S., Kitahara H et al. Robotic multivessel endoscopic coronary bypass: impact of a beating-heart approach with connectors. *Ann Thorac Surg.* 2019;108:67-73.
2. Park SJ., Kim YH., Park DW et al. Randomized trial of stents versus bypass surgery for left main coronary artery disease. *N Engl J Med.* 2011;364:1717-27.
3. Palmerini T., Serruys P., Kappetein AP et al. Clinical outcomes with percutaneous coronary revascularization vs coronary artery bypass grafting surgery in patients with unprotected left main coronary artery disease: a meta-analysis of 6 randomized trials and 4,686 patients. *Am Heart J.* 2017;190:54-63.
4. Peev M.P., Nisivaco S., Torregrossa G., Arastu A., Shahul S., Balkhy H.H. Robotic off-pump totally endoscopic coronary artery bypass in patients with low ejection fraction. *Innovations (Phila)* 2022;17:50-55.
5. Balkhy H.H., Kitahara H., Hirai T., Matsukage H., Nathan S. Residual SYNTAX score after advanced hybrid robotic totally endoscopic coronary revascularization. *Ann Thorac Surg.* 2020;109:1826-1832

### Ready to submit your research? Choose Alcrut and benefit from:

- fast, convenient online submission
- rigorous peer review by experienced research in your field
- rapid publication on acceptance
- authors retain copyrights
- unique DOI for all articles
- immediate, unrestricted online access

At Alcrut, research is always in progress.

Learn more: <https://alcrut.com/en/journals/clinical-cardiology-research-and-reports>



This work is licensed under creative commons attribution 4.0

To submit your article Click Here: [Submit Manuscript](#)

