

New  
Method

# Minimally Invasive Multiple Coronary Artery Bypass Grafting with Composite Graft Using *in situ* Right Gastroepiploic and Radial Arteries

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**Minimally invasive surgery/coronary artery bypass grafting (MICS CABG) via left thoracotomy and multiple CABG is a reported alternative to the standard sternotomy approach. However, harvesting the right internal thoracic artery (RITA) under direct vision requires high surgical skill. We describe MICS CABG with the left internal thoracic artery (LITA) and a composite graft using the *in situ* right gastroepiploic artery (GEA) and radial artery (RA) to achieve complete coronary revascularization. No complications occurred, and postoperative computed tomography showed patency of all grafts. Our experience suggests that this composite graft can be used safely and effectively in MICS CABG for complete arterial revascularization without difficulty.**

**Keywords:** minimally invasive coronary artery bypass grafting, gastroepiploic artery, radial artery

## Introduction

Minimally invasive surgery/coronary artery bypass grafting (MICS CABG) via left thoracotomy and multivessel coronary artery grafting is reportedly an alternative to the standard sternotomy approach. In standard median sternotomy, our basic strategy involves total arterial revascularization for elective procedures in young patients and an aorta no-touch or off-pump technique for

atheromatous aortas. Our strategy does not change even when performing MICS CABG. However, harvesting the right internal thoracic artery (RITA) under direct vision requires high surgical skill. We herein describe a new MICS CABG technique for multiple total arterial revascularization using the left internal thoracic artery (LITA) and a composite graft comprising the *in situ* gastroepiploic artery (GEA) and radial artery (RA).

## Patient

A 73-year-old man with type 1 diabetes mellitus was admitted to our department with episodes of effort angina. Ultrasonography revealed an ejection fraction of 51%, mild inferior wall hypokinesis, and normal left ventricular diameter. Coronary angiography revealed a significant lesion in the proximal left anterior descending artery (LAD) and total occlusions of the right coronary artery and left circumflex artery (**Fig. 1**). The GEA was clearly depicted by computed tomography angiography, with a 2.2-mm inner lumen diameter in the middle segment (**Fig. 2A**). The patient was scheduled for surgical revascularization. Considering the diabetes-associated risk of

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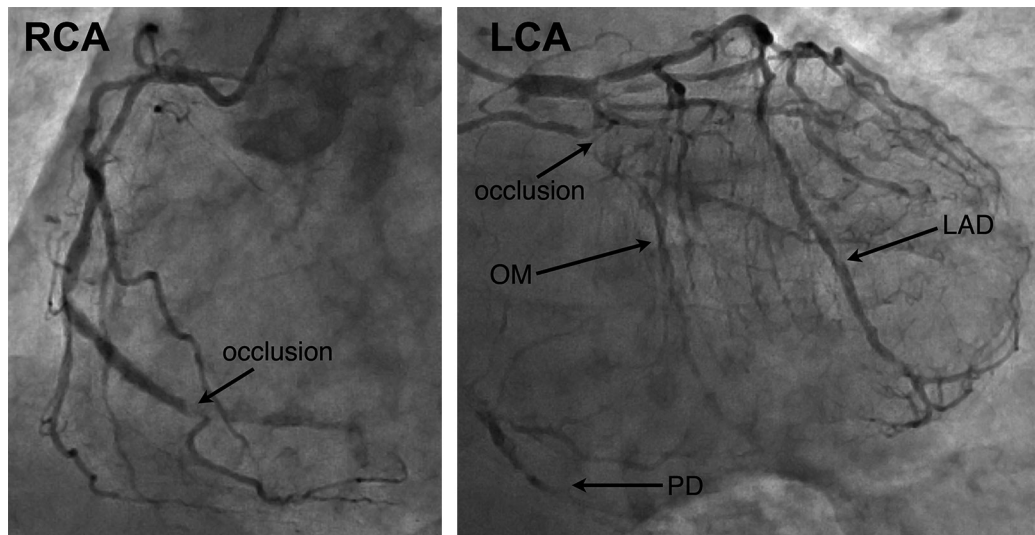
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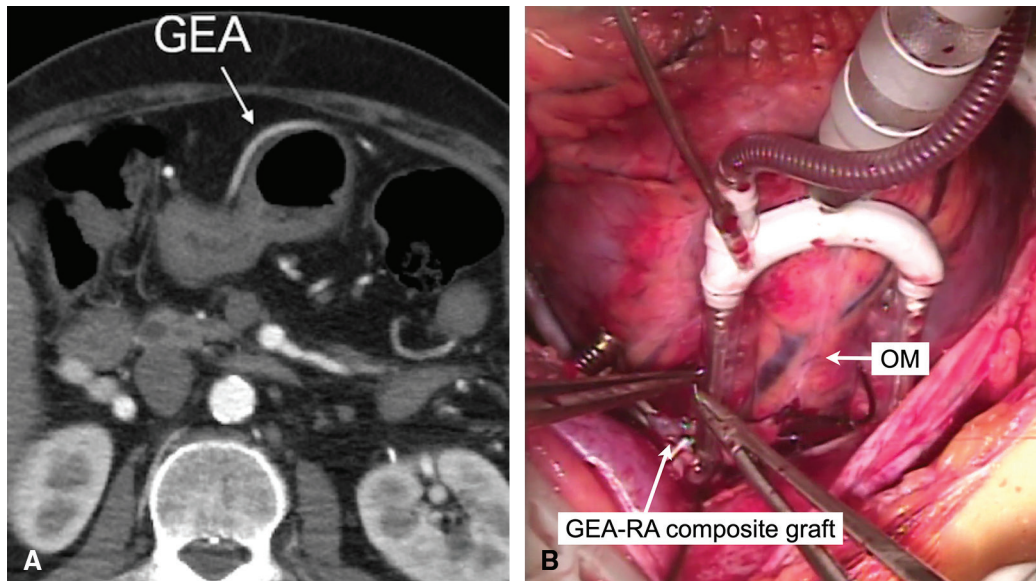


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**Fig. 1** Coronary angiography showing a significant lesion in the proximal LAD and total occlusion of the right coronary artery and left circumflex artery. LAD: left anterior descending artery; OM: obtuse marginal; PD: posterior descending



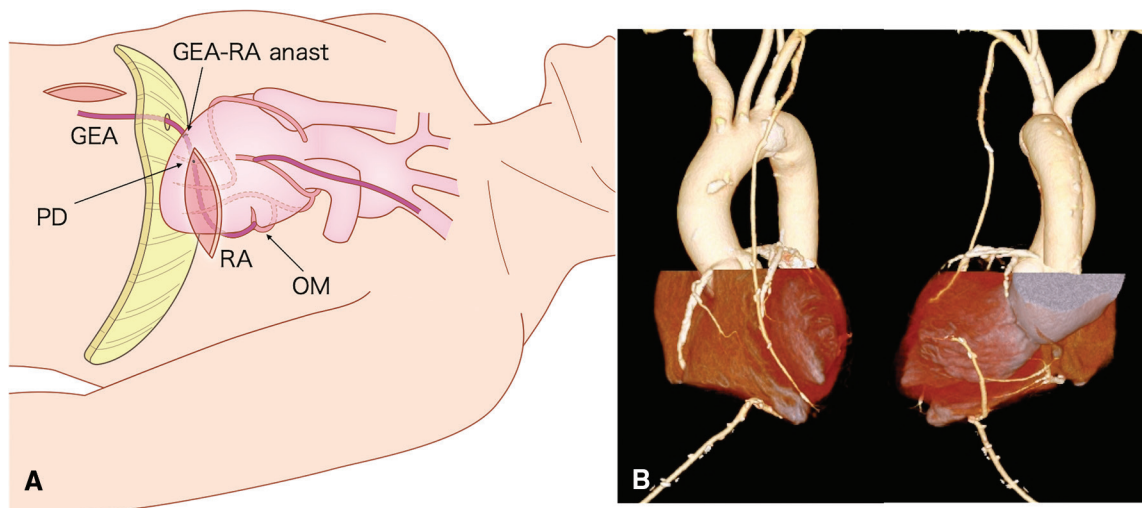
**Fig. 2** (A) The GEA (>2 mm in diameter) is clearly depicted by computed tomography angiography. (B) Intraoperative photo of the GEA-RA composite graft, which is anastomosed to the OM branch using an epicardial tissue stabilizer. GEA: gastroepiploic artery; OM: obtuse marginal; RA: radial artery

mediastinitis using standard median sternotomy, we performed MICS CABG via small left thoracotomy.

### Surgical Strategy

An 8-cm subxiphoid incision was made, and the GEA and RA were harvested simultaneously. The GEA was harvested with a semi-skeletonized technique. A 10-cm incision was made in the fifth intercostal space, and the LITA was harvested under direct vision using

electrocautery. After general heparinization, an “I-shaped” composite graft was made using the GEA and RA. The LAD was revascularized first using the LITA in the standard manner with an epicardial tissue stabilizer (ACROBAT-i; Maquet, Rastatt, Germany). The GEA-RA composite graft was passed through the diaphragmatic opening and the composite graft was sequentially anastomosed to the posterior descending (PD) branch following the obtuse marginal branch (OM) using an epicardial tissue stabilizer (**Figs. 2B** and **3A**).



**Fig. 3** (A) Schema of the surgeon's view. The LITA was harvested under direct vision via the left intercostal space. The GEA was harvested via a subxiphoid incision without a median sternotomy. The GEA-RA composite graft was introduced to the pericardial sac through the diaphragm. The composite graft was sequentially anastomosed to the PD branch following the OM branch. (B) Computed tomography angiography shows patent grafts. GEA: gastroepiploic artery; LITA: left internal thoracic artery; OM: obtuse marginal; PD: posterior descending; RA: radial artery

The operative time was 365 min, and the patient was discharged from the hospital 19 days after the operation. The postoperative course was uneventful; however, hospitalization was prolonged because of the need to control his severe diabetes mellitus, and postoperative multislice computed tomography angiography images (**Fig. 3B**) were performed after complete healing of the wound during hospitalization.

## Discussion and Conclusion

In several reports, MICS CABG showed less wound infection and much faster postoperative physical recovery than off-pump coronary artery bypass (OPCAB).<sup>1)</sup> MICS CABG is not yet widely accepted because complex techniques are required to harvest the RITA and manipulate the ascending aorta via the small left intercostal space alone.

Kamiya et al.<sup>2)</sup> described the safety and effectiveness of GEA grafting as a composite graft with the RA for revascularization on the inferior, posterolateral, or lateral ventricular walls in OPCAB. We found that their technique is also useful in MICS CABG because complex techniques are not required to harvest the RITA or manipulate the ascending aorta. Furthermore, the LAD is revascularized by the *in situ* LITA with no composite branches. Nakajima et al.<sup>3)</sup> performed ITA-to-LAD bypass grafting

and reported that the incidence of competitive flow was significantly higher in the composite Y-graft than *in situ* ITA graft and that the patency rate of the bypass graft was significantly lower with competitive flow than antegrade flow. Thus, we prefer to revascularize the LAD with the *in situ* LITA without composite grafts.

Regarding competitive flow in the GEA, Ochi et al.<sup>4)</sup> suggested that the GEA graft cannot revascularize a coronary artery with low-grade stenosis because of flow competition.

Voutilainen and colleagues<sup>5)</sup> also noted occluded GEA grafts in which the recipient coronary artery had <70% stenosis and supposed that a cause for GEA occlusion was competitive flow. In our previous study<sup>6)</sup> of postoperative angiography, the GEA graft was anastomosed most often to the right coronary artery, which had less critical stenosis and was often nonfunctioning because of competitive native flow. Therefore, we consider that the indications for a GEA and RA composite graft are as follows: (1) the luminal diameter of the GEA is large enough (>2.0 mm), (2) graft free flow is sufficient, and (3) stenosis in the coronary arteries is >90%.

Our experience suggests that an "I-shaped" composite graft using the GEA and RA is a safe and effective operative technique in MICS CABG for complete arterial revascularization without difficulty in the presence of a suitable target coronary artery and a good GEA graft.

## Disclosure Statement

The authors declare that they have no competing interests.

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