Reversal Flow in the Left Anterior Descending Artery After Internal Thoracic Artery Grafting

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Case report

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Abstract

Background: The flow capacity of the in situ internal thoracic artery (ITA) is not necessarily sufficient and can be a cause of hypoperfusion syndrome. We present a catastrophic case of in situ ITA grafting for an isolated left main trunk obstruction 13 years after modified Bentall operation.

Case presentation: A 33-year-old woman had previously undergone a modified Bentall operation. Coronary angiography showed a critical stenosis in the left coronary artery. The patient underwent emergent off-pump CABG with the left internal thoracic artery (ITA) to the left anterior descending artery (LAD). On the seventh day, the patient had severe dyspnoea and hypotension. Catheter angiography showed that the ITA was patent, but blood flow from the in situ ITA was delayed, and reversal flow from the apex to the proximal LAD was found. The patient underwent implantation of a left ventricular assist device.

Conclusions: In conclusion, concomitant aortocoronary bypass to the circumflex branch will minimise the risk of hypoperfusion, especially for a young patient without atherosclerotic disease.

Background

Hypoperfusion syndrome is defined as myocardial ischaemia that occurs despite a fully patent lumen of a coronary artery bypass graft. It typically occurs in the operation room or intensive care unit. We present a case of such a lethal sequela that occurred 1 week after coronary artery bypass grafting (CABG).

Case Presentation

A 33-year-old woman with Marfan syndrome had previously undergone a modified Bentall operation at the age of 20 years. She recently experienced progressive chest pain on exertion. Coronary angiography showed a critical stenosis in the left coronary artery, which was anastomosed with a 10-mm-diameter artificial vascular graft (Fig. 1). The right coronary artery, which had been directly anastomosed with the aortic root, was intact.

The patient underwent emergent off-pump CABG with the left internal thoracic artery (ITA) to the left anterior descending artery (LAD) through a left anterior mini-thoracotomy, because of the risk of redo median sternotomy and the possibility of future aortic surgery in the setting of Marfan syndrome. On the fifth postoperative day, catheter angiography showed that the ITA graft was patent with normal flow to entire LAD (Video 1). On the same day, contrast-enhanced computed tomography revealed that the interposing artificial graft to the left coronary artery was completely occluded by thrombosis, despite administration of heparin and warfarin.

On the seventh day, the patient had severe dyspnoea and hypotension during rehabilitation. Emergent catheter angiography showed that the ITA was patent, but blood flow from the in situ ITA was delayed, and reversal flow from the apex to the proximal LAD and left circumflex coronary artery was found (Video

2). Intra-aortic balloon pumping and cardiopulmonary circulatory support were immediately started, and an additional bypass graft was created from the left subclavian artery to the left circumflex artery with a saphenous vein.

On the 11th postoperative day, the patient was transferred to our hospital and underwent implantation of a left ventricular assist device. However, she died of intracranial haemorrhage 3 months later. Autopsy revealed a broad subendocardial myocardial infarction. The cause of the severe ostial stenosis of the left coronary artery was intimal hyperplasia, which was associated with a defect of adventitia (Fig. 2). The defect was presumably caused by surgical trauma that occurred during the initial aortic root operation.

Discussion And Conclusions

Loop and colleagues postulated that a principle mechanism of hypoperfusion syndrome was graft–recipient artery mismatch (1). Specifically, hypertrophic heart, small ITA graft, $\geq 90\%$ stenosis of the large LAD and normal ventricular contraction were reported to be common features (2). Additional bypass grafting with a saphenous vein graft has been recommended for such a deleterious situation (2, 3). In patients with chronic atherosclerotic disease, a single ITA could be reliably used to revascularise the large area, such as three-vessel coronary regions (4). Chronic exposure to low perfusion pressure will induce collateral vasculature and hibernation of the myocardium, probably causing the myocardial tissue to become adaptable to lower perfusion pressure.

Our patient had some particular characteristics of note. First, she was young and had an isolated left main trunk stenosis. At the beginning of the postoperative course, the ITA graft was functioning normally. However, the interposing artificial graft was unexpectedly thrombosed. The created bypass graft could not attain the required flow. Adaptation to low perfusion pressure from the ITA was impossible as the sole blood source of the left coronary artery.

In conclusion, concomitant aortocoronary bypass to the circumflex branch will minimise the risk of hypoperfusion, especially for a young patient without chronic atherosclerotic disease.

Abbreviations

ITA = internal thoracic artery

LAD = left anterior descending artery

Declarations

Availability of data and materials:

Datasets used or analyzed during the current study are available from the corresponding author on reasonable request.

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Authors' contributions:

HN carried out data collection and writing manuscript. AT and AY supported writing manuscript. AI participated in the design of the study and data collection.

Ethics approval and consent to participate:

All authors read and approved the final manuscript.

Approval of the institutional review board of Saitama Medical University International Medical Center was waived.

Consent for publication:

The patient provided informed consent for publication of the image.

Competing interest:

The authors declare that they have no competing interests.

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Figures

Figure 1

Modified Bentall procedure with artificial graft interposition between the orifice of the left main coronary artery and the aortic root was performed. A critical stenosis occurred at the anastomotic site.

Figure 2

(Left) Haematoxylin–eosin stain. (Right) Masson’s trichrome stain. Stenosis of the left coronary artery was caused by intimal hyperplasia, which was associated with a defect of adventitia (D).

Supplementary Files

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