



# Minimally invasive direct coronary artery bypass in a patient with combined severe coronary artery disease and pancreatic ductal adenocarcinoma

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**Abstract:** Treatment of severe coronary artery disease in patients with a malignancy is challenging. A 74-year-old man was presented in critical condition because of cardiac rupture after inferior myocardial infarction. Pericardiocentesis rescued the patient from shock. A pancreatic tumor, which was suspected to be malignant, was an incidental discovery on computed tomography (CT). Coronary artery angiography revealed severe stenosis of the left anterior descending (LAD) artery and moderate stenosis of the left circumflex (LCX) artery. Minimally invasive direct coronary artery bypass (MIDCAB) for the LAD artery was performed, and 3 months after the MIDCAB, the patient underwent distal pancreatectomy. Pathological evaluation revealed pancreatic ductal adenocarcinoma. Both surgical treatments were successfully performed and the postoperative course was uneventful. MIDCAB for the LAD artery prior to surgical tumor resection is an effective and reliable myocardial revascularization in patients with combined severe coronary artery disease and a malignancy.

**Keywords:** Coronary artery disease; pancreatic ductal adenocarcinoma; minimally invasive direct coronary artery bypass (MIDCAB)

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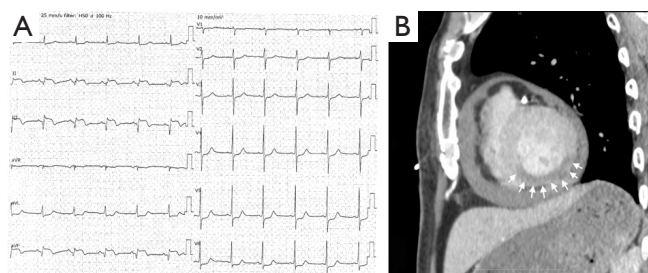
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## Introduction

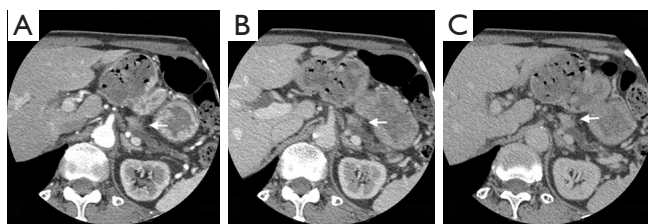
Patients with coronary artery disease and a malignancy are not uncommon because of increasing life expectancy and improved diagnosis (1). Pancreatic ductal adenocarcinoma has a poor prognosis, and surgical tumor resection is the only curative treatment (2). In cancer patients with severe coronary artery disease involving the left anterior descending (LAD) artery or left main trunk, myocardial revascularization has priority over treatment of cancer (3). The optimal myocardial revascularization procedure for severe coronary artery disease with a concomitant malignancy is controversial. We here report the treatment of a patient with severe coronary artery disease and pancreatic ductal adenocarcinoma.

## Case presentation

A 74-year-old man was presented in the emergency department with a sudden loss of consciousness. He had a history of diabetes with severe retinopathy and nephropathy, and was under insulin treatment. The patient arrived in a state of coma with a blood pressure of 70/44 mmHg. Abnormal Q waves with ST elevation in II, III, and aVF induction were seen on electrocardiography (*Figure 1A*). Transthoracic echocardiography (UCG) revealed hyperechoic pericardial effusion. Computed tomography (CT) ruled out acute aortic dissection, but found that the coronary arteries were highly calcified and the inferior wall of the left ventricle was insufficiently enhanced (*Figure 1B*). The patient was diagnosed with cardiac rupture following



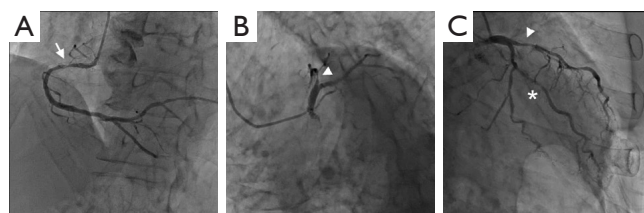
**Figure 1** Preoperative electrocardiogram and computed tomography (CT). (A) Preoperative electrocardiogram showing acute myocardial infarction of the RCA. Abnormal Q waves with ST elevation are seen in II, III, and aVF induction. ST depression is seen in I, aVL, and V3-6 induction; (B) preoperative CT showing an insufficient enhancement of the inferior wall of the left ventricle (arrows) and massive pericardial effusion. RCA, right coronary artery.



**Figure 2** Dynamic CT showing a pancreatic tumor. (A) Arterial phase; (B) portal phase; (C) delay phase. The pancreas is highly atrophic, and the pancreatic tumor is slowly enhanced (arrows).

inferior myocardial infarction. Emergent coronary revascularization was not performed because of late reperfusion. Pericardiocentesis resolved the shock, and after admitting to the intensive care unit, the patient's condition gradually improved with medical treatment. About 1 month after hospitalization, the patient's activity recovered to the level before admission.

On admission, CT incidentally detected a pancreatic tumor. Subsequent dynamic CT showed a highly atrophic pancreas with a slowly enhancing tumor (*Figure 2*). The finding was consistent with pancreatic ductal adenocarcinoma, and the preoperative stage was classified as IIA (T3N0M0). Clinical re-evaluation showed severe diabetic nephropathy with a serum creatinine level of 4.5 mg/dL. Coronary artery angiography revealed severe stenosis of the proximal right coronary artery (RCA) and LAD artery (*Figure 3A,B*) and moderate stenosis of the left circumflex (LCX) artery (*Figure 3C*). UCG and cardiac magnetic resonance imaging



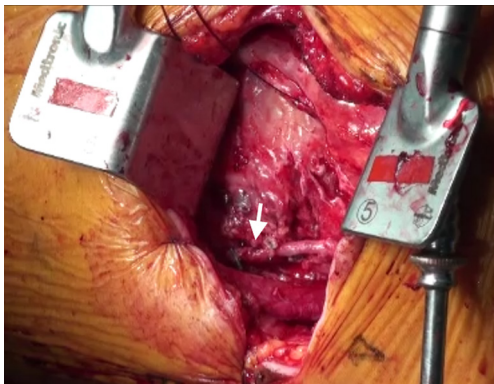
**Figure 3** Coronary artery angiography showing triple vessel disease. (A) The proximal RCA has a severe stenosis, which is a reperfused culprit lesion of recent myocardial infarction (an arrow); (B,C) the proximal LAD artery has a tight stenosis (arrowheads), whereas the LCX artery has a moderate lesion (an asterisk). LAD, left anterior descending; LCX, left circumflex.



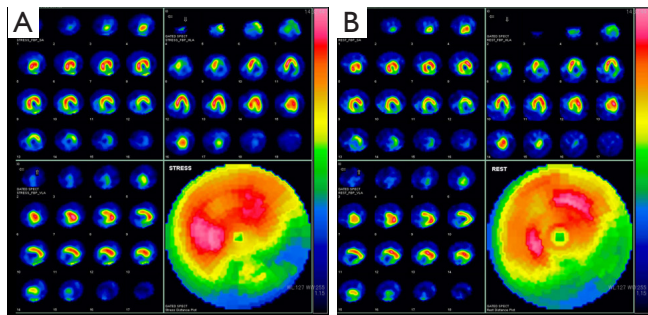
**Figure 4** Cardiac magnetic resonance imaging showing aneurysmal morphology of the inferior wall of the left ventricle (arrows).

showed aneurysmal morphology of the inferior wall of the left ventricle, suggesting no myocardial viability of the RCA territory (*Figure 4*). We scheduled minimally invasive direct coronary artery bypass (MIDCAB) for the LAD artery prior to resection of the pancreatic tumor.

The patient was placed in a 30° right lateral decubitus position. An 8 cm incision was made in the left fourth intercostal space beginning 2 cm from the left border of the sternal bone and extending laterally. After cutting the fourth costal cartilage, a ThoraTrak rib spreader (Medtronic, Minneapolis, Minn) was inserted. The left internal thoracic artery (LITA) was fully harvested under direct vision. Although severe adhesion in the pericardial space interfered with the dissection and confirmation of the LAD artery, the LITA was anastomosed side-to-side to the LAD artery



**Figure 5** Intraoperative photograph showing an anastomosis between the LITA and LAD artery via the left fourth intercostal mini-thoracotomy (an arrow). LITA, left internal thoracic artery; LAD, left anterior descending.



**Figure 6** Single-photon emission CT showing no irreversible ischemia in the territory of the LAD artery. The territory of the RCA shows no myocardial viability. (A) Images after pharmacological stress; (B) images at rest. LAD, left anterior descending; RCA, right coronary artery.

using an 8-0 polypropylene suture (*Figure 5*).

The postoperative course was uneventful. Postoperative single-photon emission CT showed no irreversible ischemia in the LAD territory (*Figure 6*). The patient was discharged, and then, readmitted for distal pancreatectomy 3 months after the MIDCAB. Postoperative pathological evaluation confirmed a stage IIB pancreatic ductal adenocarcinoma. The patient returned to daily life without hemodialysis.

## Discussion

Surgical management of patients with combined coronary artery disease and a malignancy is challenging (1). Pancreatic ductal adenocarcinoma has an extremely poor

prognosis with 5-year survival of 5% to 10%, and surgical tumor resection is the only curative therapy (2).

In cancer patients with severe coronary artery disease involving the LAD artery or the left main trunk, myocardial revascularization takes priority over cancer treatment (3). Myocardial revascularization for coronary artery disease with a concomitant malignancy includes percutaneous coronary intervention (PCI) and coronary artery bypass grafting (CABG). PCI entails the placement of either bare-metal stents (BMS) or drug-eluting stents (DES), both of which require dual antiplatelet therapy (DAPT) to prevent thrombotic complications (4). The placement of BMS is followed by 1 month of DAPT, but in-stent restenosis occurs in 16% to 44% of patients with BMS (5). Although DES are superior to BMS in all types of lesions, 6 to 12 months of DAPT are required after placement (6). Early discontinuation of DAPT may cause myocardial ischemia because of in-stent thrombosis, and non-cardiac surgery with continuation of DAPT has been associated with a high incidence of bleeding complications (7).

Surgery for coronary artery disease and a malignancy can be performed simultaneously as a combined procedure or separately as two-stage procedures. Each approach has its own advantages and disadvantages regarding cost, hospital stay, and tumor treatment (8). In this patient, we considered that the risk was too high to perform combined CABG and distal pancreatectomy because of weakness and frailty. In two-stage procedures, off-pump CABG is an effective myocardial revascularization in patients with combined coronary artery disease and a malignancy (8). However, this patient was predisposed to mediastinitis because of severe diabetes and chronic kidney disease (9). MIDCAB is coronary artery bypass for the LAD artery using the LITA via a left anterior mini-thoracotomy, and has the advantages of rapid recovery, reduced pain, decreased bleeding, and avoidance of mediastinitis (10). A major concern of two-stage operations for patients with combined coronary artery disease and a malignancy is the interval between cardiac surgery and cancer treatment (8). Delay in cancer treatment may result in progression of the malignancy. Therefore, MIDCAB prior resection of the pancreatic tumor was considered to be a reasonable treatment in this case.

## Conclusions

We reported the treatment of a patient with severe coronary artery disease and pancreatic ductal adenocarcinoma. Pancreatic ductal adenocarcinoma is a malignancy

with an extremely poor prognosis, with surgical tumor resection as the only curative treatment. PCI should be avoided immediately before non-cardiac surgery, because discontinuation of DAPT risks in-stent thrombosis. Two-stage surgery with MIDCAB, followed by tumor resection, is effective and reliable for patients with combined coronary artery disease and a malignancy, especially if the patient is weak and frail.

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### Footnote

*Conflicts of Interest:* All authors have completed the ICMJE uniform disclosure form (available at <http://dx.doi.org/10.21037/jxym.2017.07.07>). The authors have no conflicts of interest to declare.

*Ethical Statement:* The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent was obtained from the patient for publication of this manuscript and any accompanying images.

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