A 76-year-old man who had a history of diabetes mellitus, hypertension, and hyperlipidemia was referred to our hospital for surgical intervention of his coronary artery. He does not have any history of chest trauma previously. This patient also had a history of 2 previous percutaneous coronary artery interventions. In 2000, he underwent stent insertion to the right coronary artery (RCA) and the left circumflex artery (LCX) because of posterior acute myocardial infarction. In 2007, stent insertion was performed for a newly developed lesion of the RCA. Since that procedure, the patient was stable without chest pain. However, in 2013, he complained of severe chest pain on exertion and was emergently admitted to a local hospital. An ECG showed anterior wall ischemia. Acute coronary syndrome was suspected. Emergency coronary angiography was performed and revealed tight left main stenosis, 75% stenosis of the proximal left anterior descending artery, 99% stenosis of the proximal LCX, and 90% stenosis of the RCA. There was flow competition between the native LCX and the collateral artery (Figure 1, Movie I in the online-only Data Supplement). An internal mammary artery angiography was performed and showed that 1 of the pericardial branches of the right internal mammary artery (RIMA) arose from the proximal part of the RIMA, communicated with the proximal LCX, and perfused the entire LCX area (Figure 2, Movie II in the online-only Data Supplement). There was no communication between the left internal mammary artery (LIMA) and the coronary arteries.

This patient underwent coronary artery bypass grafting as follows: the LIMA to the left anterior descending artery, the RIMA to the first diagonal branch, and the saphenous vein graft to the posterior descending artery and the posterior lateral artery. When the RIMA was harvested, a large pericardial branch of the RIMA was identified right to the thymic tissue. The branch coursed caudally and posteriorly toward the pericardium. This branch was preserved, and the RIMA was used for in situ grafting to the first diagonal branch as usual. The postoperative course was uneventful, and the patient was extubated the next morning. A postoperative coronary angiography indicated that all grafts were patent. An angiography of the saphenous vein graft to the diagonal branch showed that the graft was patent and showed retrograde filling of the pericardial branch of the RIMA (Figure 3, Movie III in the online-only Data Supplement).

Extracardiac coronary collateral perfusion from the internal mammary artery has been described previously by postmortem studies. By injecting a colloidal suspension of carbon particles to the coronary arteries at autopsy, those studies found that the largest arteries was the pericardiacophrenic branches of internal mammary arteries. Other arteries, such as the anterior mediastinal, pericardial, bronchial, superior, and inferior phrenic, and intercostal and esophageal branches of the aorta were described as extracardiac arteries anastomosed with coronary arteries. The principal anastomoses of the pericardial vessels with branches of the coronary arteries appeared to be where the pulmonary veins and vena cava passed through the pericardium. Another postmortem angiographic study revealed that there was an anatomic connection between the internal mammary artery and the coronary artery in 4 of 49 patients with coronary artery disease.

Although the clinical importance of extracardiac collateral circulation to the coronary artery is still unknown, an experimental study showed that extracardiac anastomoses may provide significant nutritive flow to coronary arteries and may also improve left ventricular function. Clinically, 1 case report using scintigraphy showed that RIMA to RCA collateral circulation with proximal RCA occlusion sufficiently perfused the RCA. Another recent clinical study evaluated the function of naturally existing internal mammary-to-coronary artery bypasses and their quantitative effects on myocardial ischemia. In this clinical study, myocardial ischemia was evaluated by balloon occlusion of the coronary artery with or without internal mammary artery occlusion. The researchers concluded that there was a functional ischemia reducing extracardiac coronary artery supply via the ipsilateral but not the contralateral natural internal mammary artery bypasses.

In living subjects, angiography is rarely used to describe the structural existence of collateral circulation between the coronary arteries and internal mammary artery. Only a few case reports have shown angiographic evidence of this collateral circulation. In our case, collateral blood flow from the RIMA to the LCX was found before coronary artery bypass surgery. Because the patient’s condition was unstable, coronary

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scintigraphy could not be performed preoperatively. Therefore, it is uncertain whether the collateral circulation was sufficient enough to perfuse the LCX area. However, when the patient complained of chest pain on admission, an ECG showed only anterior wall ischemia, and a transthoracic echocardiography revealed no lateral wall motion abnormality. This collateral circulation may play an important role in reducing myocardial ischemia at the lateral wall preoperatively.

To the extent that we searched the literature, this is the first angiography report showing extracardiac coronary artery supply via contralateral internal mammary artery. It should be noted that the occluded coronary artery might communicate with the contralateral internal mammary artery.

**Disclosures**

None.

**References**


**Figure 1.** An angiography of the left coronary artery showed there was flow competition between the native left circumflex artery and the collateral artery.

**Figure 2.** An angiography of the right internal mammary artery (blue arrows) revealed 1 of the artery branched from the proximal right internal mammary artery (yellow arrows) perfused the whole left circumflex artery (white arrows).
Figure 3. Postoperative angiography of saphenous vein graft showed patent saphenous vein graft to obtuse marginal branch and retrograde filling of the pericardial branch of the right internal mammary artery (yellow arrows). OM indicates obtuse marginal branch; PL, posterior lateral branch; and SVG, saphenous vein graft.
Natural Right Internal Mammary Artery to Left Circumflex Artery Bypass
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