

## Right Coronary Artery to Left Ventricle Fistula Associated With Three-Vessel Coronary Artery Disease: A Case Report

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### Abstract

Right coronary artery to left ventricle fistula is a rare type of coronary artery fistula among congenital coronary artery anomalies. Most patients exhibit no symptoms and some experience chest pain. Coronary angiography sometimes detects the presence of coronary artery fistula, but not coronary arteriosclerosis. A 76-year-old man with unstable angina was admitted because he did not respond to drug therapy. Coronary angiography showed three-vessel coronary artery disease and the contrast agent entered the left ventricle from the terminal of the right coronary artery during diastole. Multidetector-row computer tomography showed similar findings. The patient subsequently underwent coronary artery bypass grafting and obliteration of the coronary artery fistula. The chest pain was relieved and he is now in good condition.

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### Key Words

- Coronary artery disease (coronary ventricular fistula, three-vessel disease)
- Interventional cardiology (coronary artery bypass grafting)
- Computed tomography (multidetector-row)

### INTRODUCTION

Coronary ventricular fistula is an anomalous anastomosis in which the coronary blood flows directly into the ventricle without running through the ventricular capillaries. This condition is now reported more frequently due to advanced cardiac catheterization tests. Right coronary arterial flow into the ventricle was found in 3 of 31 patients (9.7%) with coronary ventricular fistula.<sup>1)</sup> An opening in the left ventricle was found in 11 out of

363 patients (3%).<sup>2)</sup> The incidence of ventricle openings has varied considerably in previous studies, and in many patients there are multiple sites of opening and flow. However, the right coronary artery opens more frequently into the right heart, not the left ventricle,<sup>1,2)</sup> and right artery-left ventricular fistula was a rare coronary artery anomaly in 126,595 patients undergoing coronary angiography.<sup>3)</sup>

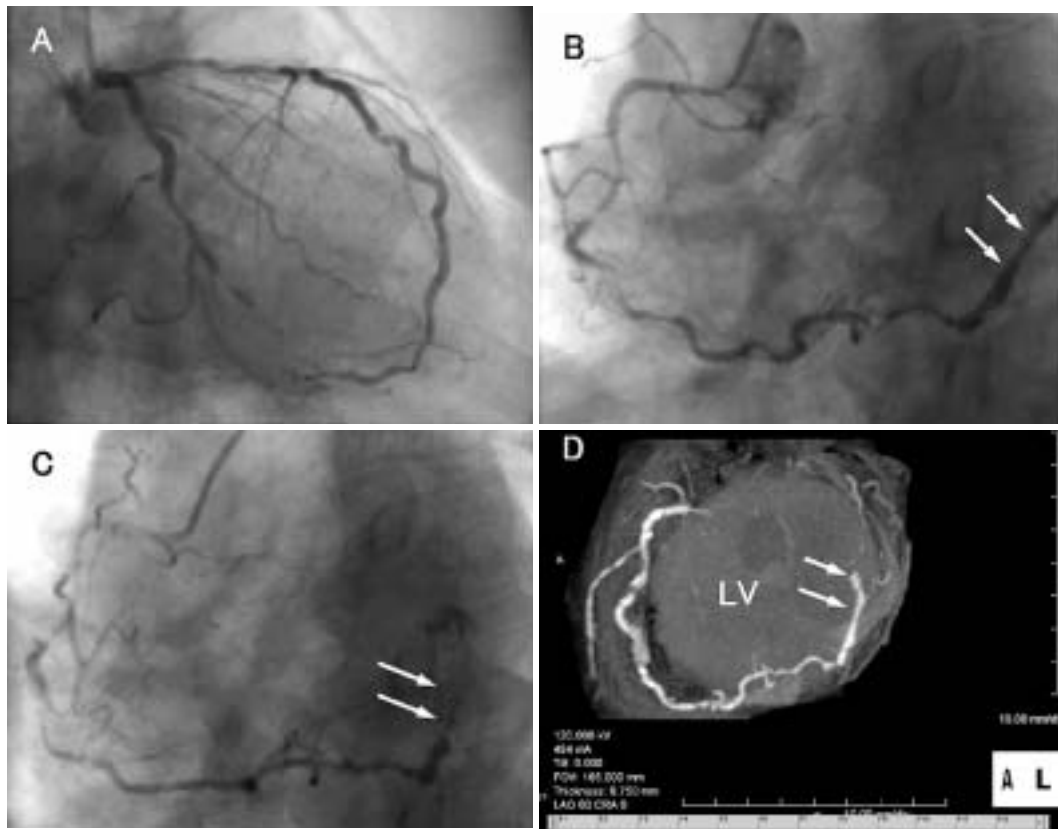
Coronary ventricular fistula can be diagnosed by coronary angiography, but some cases are difficult

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**Fig. 1** Coronary angiograms and multidetector-row computer tomography scan

Selective left coronary arteriography showed diffuse atherosclerotic lesion in the proximal left anterior descending artery with branch lesions and multiple stenotic lesions in the left circumflex artery (A). Selective right coronary arteriography in diastole showed multiple stenotic lesions in the right coronary artery and the coronary fistula (arrows) with the contrast agent draining into the left ventricle (B). Coronary arteriography in systole showed fistulous coronary vessel (arrows) compressed during myocardial contraction (C). Multidetector-row computer tomography showed the fistulous right coronary artery (arrows). The left ventricle also exhibited opacity (D).  
LV = left ventricle.

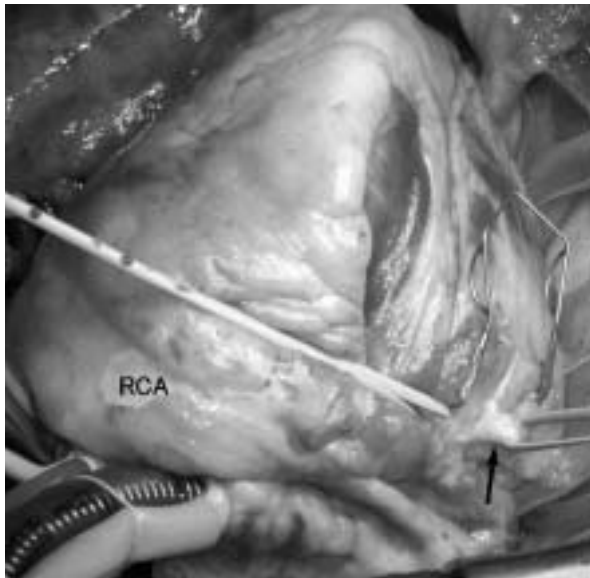
to detect. Here, we report a patient with unstable angina and right coronary artery to left ventricle fistula associated with three-vessel coronary artery disease detected by coronary angiography and multidetector-row computed tomography (MDCT). The patient underwent obliteration of the coronary artery fistula and coronary artery bypass grafting (CABG).

### CASE REPORT

A 76-year-old male was admitted to our hospital and complained of exertional chest pain that continued at rest. He underwent coronary angiography in another hospital and three-vessel coronary artery disease was found. He was treated with nitrates, a calcium channel blocker, and a  $\beta$ -blocker, but the

symptoms aggravated and the patient underwent detailed examination in our hospital. He had no previous illness or significant family history. On the first visit, no heart murmur was detected and chest radiography, ECG and blood tests showed no abnormal findings. Echocardiography indicated good left ventricular function and normal wall motion. No abnormal color flow signal was shown. Second coronary angiography found 50% to 90% stenoses and diffuse atherosclerotic lesion at several sites of the left anterior descending and circumflex arteries (Fig. 1–A). Diffuse atherosclerosis was also observed throughout the right coronary artery and no collateral coronary flow was found. Furthermore, the contrast agent flowed into the left ventricle from the slightly dilated peripheral right

coronary artery during diastole (**Fig. 1–B, arrows**), and from the fistulous coronary vessel in the compressed myocardium during systole (**Fig. 1–C, arrows**). MDCT showed the peripheral posterolat-



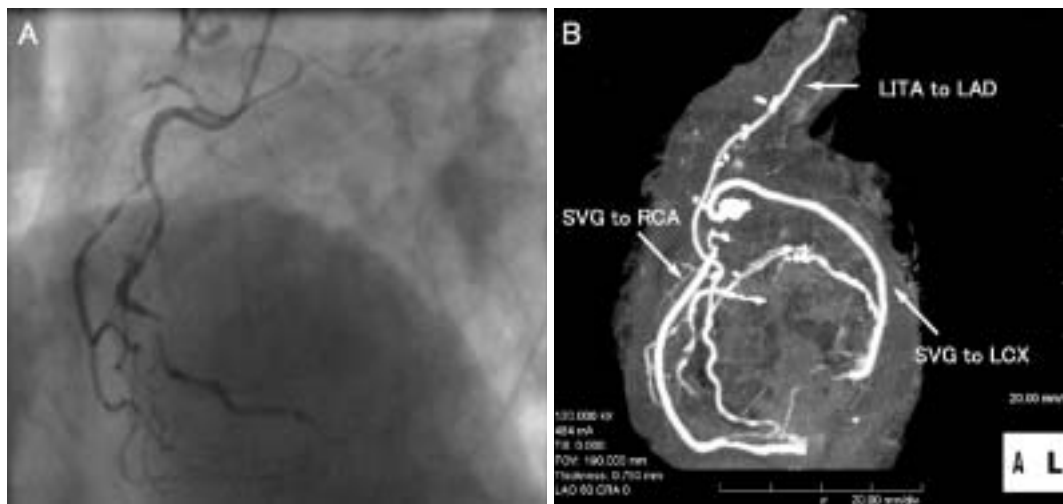
**Fig. 2 Intraoperative photograph**  
Surgical findings showed a right coronary artery draining into the left ventricle. The *arrow* indicated the exposed fistulous vessel.  
RCA = right coronary artery.

eral branch of the right coronary artery ascending the posterior interventricular branch and connecting directly to the upper left ventricular posterior wall, because the contrast agent filled the left ventricle (**Fig. 1–D**). MDCT confirmed the communication between the right coronary artery and the left ventricle.

The patient underwent ligation of the coronary artery fistula and CABG. During surgery, the fistulous artery was found in the myocardium and exposed. The opening of the coronary fistula was observed in the initial part of the posterior interventricular branch at the base of the left ventricular posterior wall (**Fig. 2**). After surgery, the contrast agent did not flow into the left ventricle from the peripheral right coronary artery during diastole (**Fig. 3–A**), and coronary blood flow through the graft was good without blood flow from the right coronary artery to the left ventricle (**Fig. 3–B**). The chest pain was relieved and the patient is now in good condition.

## DISCUSSION

Coronary ventricular fistula is sometimes found in infants and children during examinations for congenital heart disease and heart murmur.<sup>4–6</sup> Huge fistula, dilated coronary artery, and aneurysm formation can appear as cardiac hypertrophy on



**Fig. 3 Coronary angiogram and multidetector-row computer tomography scan after operation**  
Selective right coronary arteriography after surgical treatment showed obliteration of the anomalous drainage (**A**). Multidetector-row computer tomography after the operation for fistula ligation and coronary artery bypass grafting demonstrated the patency of the coronary bypass grafts (**B**).  
LITA = left internal thorax artery; LAD = left anterior descending artery; SVG = saphenous vein graft; LCX = left circumflex artery. Other abbreviation as in Fig. 2.

chest radiographs in cases of right coronary artery to left ventricular fistula.<sup>7,8)</sup> In many cases of chest pain, there is no evidence of coronary arteriosclerosis,<sup>4,9-12)</sup> even in patients with myocardial infarction.<sup>13,14)</sup> Some cases of dilated fistulous coronary artery were found by coronary angiography.<sup>8,15)</sup> Coronary spasm unrelated to the fistula was observed in one patient.<sup>10)</sup> Myocardial ischemia of coronary ventricular fistula is likely to be due to shunting of blood flow and the so-called "steal" phenomenon.<sup>10-12)</sup>

The current patient exhibited no heart murmur. Abnormal shadow and cardiac hypertrophy on chest radiographs were not observed. This patient complained of chest pain at rest and the diagnosis was unstable angina pectoris due to three-vessel coronary disease associated with right coronary artery to left ventricular fistula. As this condition was unresponsive to drug treatment, surgical CABG and ligation of the fistula were performed. The severity of the coronary arterial lesions may have led to aggravation of the symptoms and the lack of response to medical treatment, but any relationship between the coronary ventricular fistula and the occurrence of angina pectoris was not clear. However, no significant electrocardiogram change and chest pain were observed after ligation of the coronary artery fistula.

Selective coronary angiography is generally very

useful as a diagnostic method for coronary ventricular fistula. Recently, echocardiography, especially color Doppler flow mapping,<sup>1,15)</sup> and MTCT<sup>8)</sup> have also been used for confirmation. In this case, the diagnosis was established by coronary angiography and confirmed by MDCT, but was not indicated by two-dimensional imaging with color Doppler flow mapping. In this case, MDCT and selective coronary angiography were useful to confirm the location and size of the coronary artery-left ventricle fistula.

Medical treatment options include nitrates, calcium channel blockers and  $\beta$ -blockers. However, drugs may enhance the steal phenomenon and may not improve myocardial ischemia.<sup>12)</sup> Surgical treatment, including ligation of the coronary artery and fistula obliteration, can be performed to prevent aortic valve regurgitation-like hemodynamics, congestive heart failure, infectious endocarditis, thrombosis, arrhythmia and sudden death.<sup>4,6,15)</sup> Our patient did not respond to drug therapy due to the severe coronary lesions, so underwent simultaneous obliteration of the coronary artery fistula and CABG. Postoperative coronary blood flow was good due to open grafts, myocardial ischemia was improved, and chest pain was relieved. This treatment has improved the patient's quality of life and increased his social activities, and we continue with the follow-up.

## 要 約

### 冠動脈3枝病変を伴った右冠動脈左室瘻の1例

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右冠動脈左室瘻は先天性冠動脈異常の中でもまれである。多くの患者は無症状であるが、胸痛を訴え、冠動脈造影検査でときどき冠動脈瘻を発見されることがあるが、冠動脈病変は認められない。我々は、冠動脈3枝病変を伴った右冠動脈左室瘻で冠動脈グラフト術と冠動脈瘻閉塞術を施行した症例を報告する。症例は76歳、男性、不安定狭心症で薬剤が無効で増悪したため入院した。冠動脈造影検査所見は、高度び慢性動脈病変を呈する3枝病変で、また拡張期に右冠動脈房室結節動脈末梢部がやや拡張し、造影剤が房室間側壁付近から左室あるいは左房へ流入する所見を得た。収縮期にはこの血管は圧縮され確認できなかった。マルチディテクターコンピューター断層撮影で右冠動脈末梢部にやや拡張した血管と左室の造影を認めた。冠動脈3枝病変を伴った右冠動脈左室瘻と診断し、冠動脈グラフト術および右冠動脈瘻閉塞術を施行した。術後、胸痛は消失し経過良好である。

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