

## Percutaneous Management of Coronary Artery Fistula in an Adult and Clinical Outcome

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### Introduction

Coronary artery fistulae are rare congenital or acquired anomalies that usually communicate the coronary circulation with other vascular structures or cardiac chambers<sup>1-3</sup>. Although they might represent only an incidental finding on diagnostic angiography<sup>1</sup>, they can manifest clinically during childhood or adulthood as a shunt or coronary flow “steal”, motivating its closure via surgical or endovascular management<sup>4,5</sup>. In most cases, endovascular treatment has become the preferential option, not only due to the advantages of a percutaneous procedure, but also because of its confirmed efficacy and safety<sup>6,7</sup>.

### Case report

The patient is a 59-year-old male with arterial hypertension, complaining of easy fatigability, dyspnea, and chest discomfort on moderate exertion, which improved after rest, for six months. He reported neither coronary artery disease in his family, nor other risk factors for atherosclerotic disease. After cardiac assessment, drug treatment was initiated with acetylsalicylic acid, beta-blocker, and angiotensin-converting-enzyme inhibitor (ACEi). Myocardial scintigraphy was performed.

The scintigraphic images obtained after physical stress associated with dipyridamole administration (due to the use of beta-blocker) showed an ischemic pattern in the apical and inferior wall of the left ventricle, and transient myocardial dilation after stress, evidencing left ventricular systolic dysfunction.

The electrocardiogram showed a 1.5-mm depression of the ST segment on the precordial leads, and a 1.0-mm depression on DII and aVF after 3 minutes of exertion, in addition to frequent ventricular extrasystoles after dipyridamole injection. A transthoracic echocardiogram performed a few days after scintigraphy evidenced

preserved systolic function at rest and mild, concentric left ventricular hypertrophy, with no segmentary contractility change.

The patient reported only a partial improvement of the symptoms with the medications, being referred to cardiac catheterization. Coronary angiography showed coronary circulation free from significant obstructive atherosclerotic lesions (only parietal irregularities), with a right dominance pattern. A large fistula (Figure 1) was identified communicating the dilated proximal third of the anterior descending artery (ADA) with the trunk of the pulmonary artery (PA). After discussing the case with the patient and his cardiologist, percutaneous closure of the fistula was indicated.

The procedure was performed with puncture of the right femoral artery and use of a 7F introducer. After selective catheterization of the left coronary artery with a JL guide catheter, a long extra-support 0.014” guidewire with flexible tip was advanced up to the ADA and inside the fistula. A microcatheter was advanced over the guidewire into the fistula, until the curved segment closer to the PA. Eleven platinum detachable coils (Axiom™, eV3, Irvine, CA, USA) were sequentially released inside the fistula (Figure 2A), until total blood flow obstruction was achieved (Figure 2B). The procedure was uneventful.

After closure of the coronary artery fistula, the patient was followed up on an outpatient basis, with no beta-blocker, and reported total improvement of the symptoms and of his functional limitation. A control angiography performed seven months later (Figure 2C) revealed preserved patency of the ADA, with good distal flow and no fistula. The patient remained asymptomatic after two years of clinical follow-up, maintaining regular physical activities. New ischemia-provoking tests were not performed, because of the good clinical outcome and medical option.

### Discussion

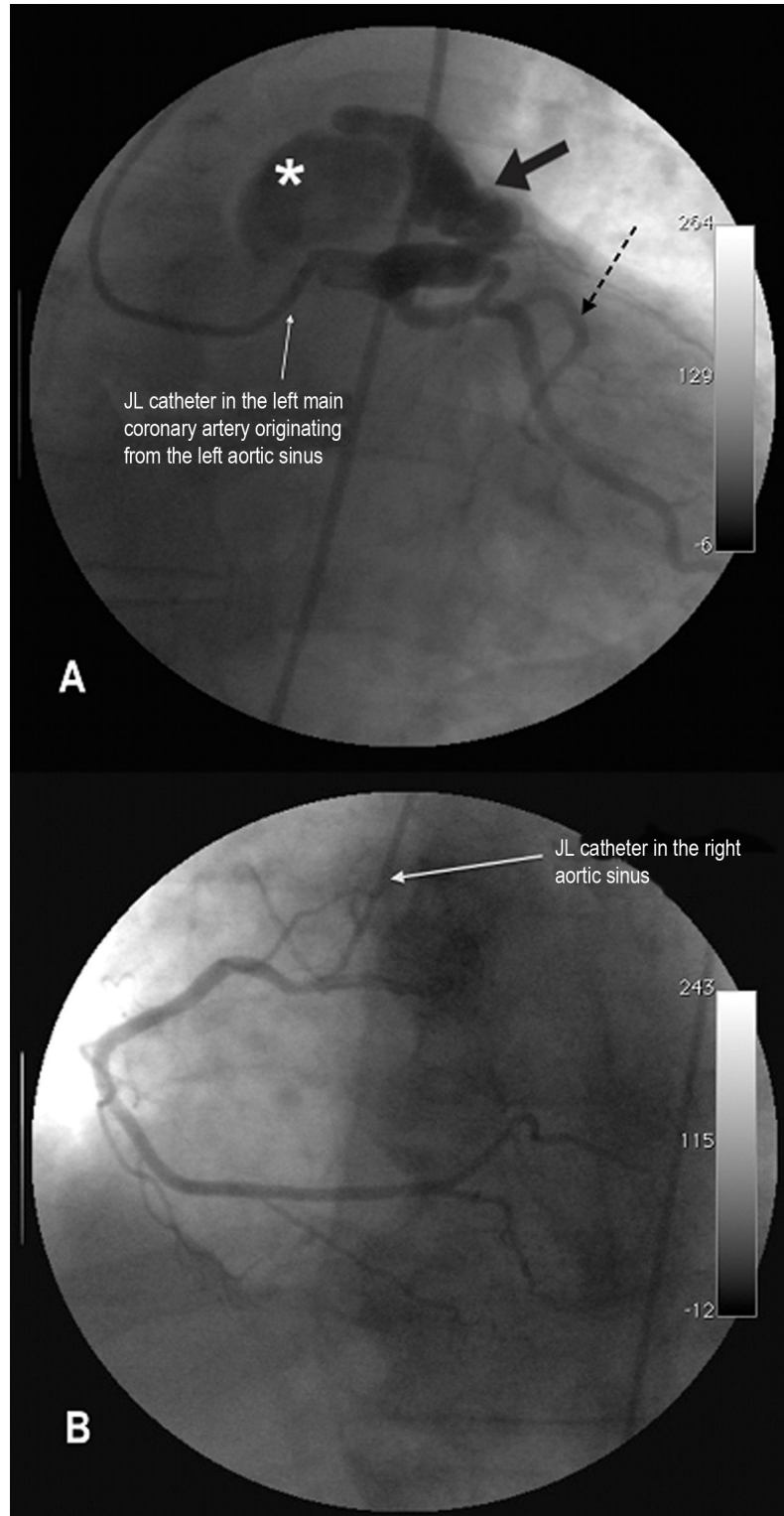
A coronary artery fistula can be defined as a direct communication between a coronary artery and a cardiac chamber, a great vessel or another vascular structure, occurring rarely as an incidental finding in 0.1% to 0.2% of the coronary angiographies<sup>1</sup>. It can be either congenital or acquired. Acquired fistulae can originate from thoracic traumas or cardiac surgeries (mainly when the internal mammary artery is used), endomyocardial biopsy, Takayasu’s arteritis or coronary angioplasties<sup>2,3</sup>. In our patient, the fistula was considered congenital due to absence of interventions or preceding traumas.

### Keywords

Arteriovenous Fistule / complications; Embolization, Therapeutic / methods; Myocardial Ischemia.

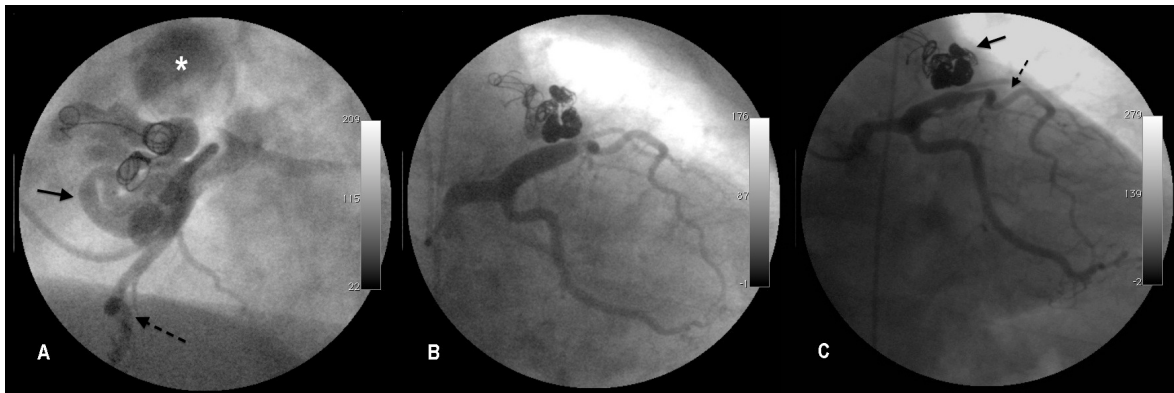
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**Figure 1 -** (A) Angiography of the left coronary artery showing the left main coronary artery (LMCA) and proximal anterior descending coronary artery (ADA), both dilated, and a large tortuous fistula (arrow) draining to the pulmonary trunk (\*). The distal segment of the ADA shows a slow and delayed opacification compared with the others (dotted arrow). (B) Angiography of the right coronary artery.

## Case Report



**Figure 2** - (A) Release of the coils inside the fistula (arrow) draining to the pulmonary trunk (\*). (B) Immediate result after embolization and closure of the fistula. (C) Control angiography after seven months showing a reduction in the dilation of the left main coronary artery and proximal anterior descending coronary artery, as well as an improvement in the flow in the distal anterior descending coronary artery (dotted arrow).

Usually, congenital coronary artery fistulae drain to the right ventricle, right atrium, PA or coronary sinus (in decreasing order of frequency). Those draining to the right ventricle are usually diagnosed during infancy due to the presence of a heart murmur or symptoms resulting from a large fistula<sup>4</sup>. Those draining to the PA usually have an insidious presentation with no heart murmur, being diagnosed later<sup>5</sup>, and should be differentiated on angiography from cases of left coronary artery originating from the trunk of the PA, another rare congenital coronary anomaly with potential risk for sudden death<sup>1</sup>.

Our patient had symptoms equivalent to functional class II to III angina, and a positive provocative test for ischemia associated with a component of transient myocardial systolic dysfunction during stress. The symptoms regarding coronary heart disease and left ventricular failure might have resulted from coronary flow “steal” associated with the presence of a fistula in the coronary circulation with incipient atherosclerotic disease. In addition, the concentric myocardial hypertrophy due to hypertensive disease might have contributed to the mild symptoms, because of the increased oxygen myocardial consumption.

Percutaneous or surgical closure of coronary artery fistula is indicated when the fistula has a measurable hemodynamic repercussion (usually  $Q_p/Q_s > 2.0$  or symptoms of heart failure) or causes myocardial ischemia (documented by symptoms or by use of provocative tests). Currently several centers choose the percutaneous management, which has proven to be safe, preventing sternotomy and extracorporeal circulation<sup>6,7</sup>. The use of coils for the percutaneous closure of fistulae was first described in 1990, and, since then, with the development of new catheters and coils, the procedure has become increasingly safe. In 1996, Mavroudis et al<sup>8</sup> recommended the percutaneous closure in cases without multiple fistulae,

well-defined drainage to a single site, absence of large lateral branches and good accessibility to the coronary artery that supplies the fistula<sup>8</sup>. However, well-succeeded percutaneous closure of multiple fistulae in the same patient has been reported, making that the preferential approach in most cases<sup>9,10</sup>.

In our patient, 11 coils were used to completely close the fistula. The size of the first coil was estimated based on the measure of the greatest diameter of the fistula, and chosen to be 20% greater, reducing the risk of embolization beyond the fistulous trajectory<sup>10</sup>. Then, coils of progressively smaller diameters were sequentially used, until the local flow was interrupted. Usually the coils are released inside curved segments of the fistula to reduce the risk of embolization to the pulmonary circulation.

The possible complications of the percutaneous closure of a coronary artery fistula, although rare, can include embolization of coils to the coronary bed or to the fistula draining bed, coronary dissection, fistula dissection, transient myocardial ischemia, and transient atrial arrhythmias<sup>7</sup>.

### Conclusion

This case report describes the late presentation of a coronary artery fistula of the ADA to the PA, which manifested as myocardial ischemia and heart failure, as well as its percutaneous closure, performed safely and efficiently by use of coil embolization.

### Author contributions

Conception and design of the research, Acquisition of data and Writing of the manuscript: Souza FSF; Critical revision of the manuscript for intellectual content and Participation in patient care: Souza FSF, Goyanna A, Gonçalves HA, Avelar AL, Godinho AGL, Ramos NB

### Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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### Study Association

This study is not associated with any post-graduation program.

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