Successful Percutaneous Coil Embolization of a Large and Tortuous Coronary Artery to Pulmonary Artery Fistula

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Abstract

We herein report the case of a 73-year-old woman with a large and tortuous coronary artery to pulmonary artery fistula treated with percutaneous coil embolization. The patient was hospitalized due to unstable angina with an elevated serum troponin-T level. Coronary angiography revealed no significant atherosclerotic stenosis, with a large and tortuous coronary artery to pulmonary artery fistula originating from the proximal portion of the left anterior descending artery. We successfully performed percutaneous coil embolization of the fistula. In this case, 320-slice multidetector computed tomography played a pivotal role in the diagnosis and percutaneous intervention.

Key words: coronary artery fistula, coil embolization, multidetector computed tomography (MDCT)

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Introduction

A coronary artery fistula is a relatively rare anomaly, observed as an incidental finding on 0.05-0.2% of coronary angiograms (1-4). Coronary artery fistulas can result in heart failure (4-7), myocardial ischemia (4, 6, 8-10), endocarditis (11) and rupture of aneurysmal vessels (12-14). The majority of coronary artery fistulas originate from the right coronary artery or left anterior descending artery (LAD) and connect with a pulmonary artery, pulmonary vein, cardiac chamber, coronary sinus or the vena cava (15-17). Symptomatic coronary artery fistulas should be treated with percutaneous intervention or surgery (4, 10, 15, 18-20). We herein report a case of successful percutaneous coil embolization of a large and anatomically complex coronary artery to pulmonary artery fistula. In this case, 320-slice multidetector computed tomography (MDCT) provided essential preprocedural information.

Case Report

A 73-year-old woman with no coronary risk factors was referred to our hospital with a chief complaint of chest pain on exertion lasting for the previous two weeks. She had been prescribed 100 mg of aspirin daily at another hospital on the suspicion of coronary artery disease. However, she complained of an increasing frequency of chest pain, consistent with worsening angina. Her physical examination findings were normal, except for a continuous heart murmur heard at the left upper sternal border. Electrocardiography revealed nonspecific ST-T segment changes (Fig. 1), and blood testing showed elevated serum levels of cardiac troponin-T (0.190 ng/mL) and brain natriuretic peptide (103.4 pg/mL). Transthoracic echocardiography demonstrated a normal left ventricular size and contractility. She was admitted with a diagnosis of unstable angina.

Diagnostic coronary angiography revealed no significant atherosclerotic stenosis of the coronary arteries, with a large and tortuous coronary artery to pulmonary artery fistula originating from the proximal portion of the LAD.
(Fig. 2a, b). The diameter of the fistula was larger than the diameter of the distal LAD. A delayed antegrade coronary flow (Thrombolysis in Myocardial Infarction (TIMI) grade 2) due to coronary artery steal was observed in the distal LAD. Right heart catheterization with oximetry revealed a normal pulmonary arterial pressure and a pulmonary-to-systemic flow ratio of 1.35. We concluded that the angina was caused by the fistula and coronary artery steal. Considering the risk of severe myocardial ischemia and future heart failure or endocarditis, we planned to perform percutaneous coil embolization of the fistula.

MDCT was performed to obtain more precise anatomical information regarding the fistula. The findings confirmed a large and tortuous coronary artery to pulmonary artery fistula originating from the proximal portion of the LAD (Fig. 3a, b). The anomalous vessel measured approximately 5 mm in diameter. Although we could not visualize the orifice of the fistula on coronary angiography, it was clearly visualized on MDCT, just proximal to the first major septal branch of the LAD (Fig. 3b).

Percutaneous intervention was performed. An 8-Fr Judkins Left 4 coronary guiding catheter (Brite Tip®, Cordis, Miami, FL, USA) was inserted into the femoral artery and engaged into the left coronary artery. A 0.014-inch coronary guidewire (SION Blue, Asahi Intecc, Aichi, Japan) was introduced into the fistula, and a 2.5-Fr Renegade™-18 microcatheter (Boston Scientific, Natick, MA, USA) was successfully advanced into the middle of the fistula. We initially placed a 6-mm Interlock™ coil (Boston Scientific) in the middle of the fistula, followed by deployment of three 4-mm Interlock™ coils and one 3-mm Interlock™ coil in the fistula. The final coronary angiogram showed no flow through the shunt with an improved flow (TIMI grade 3) in the distal LAD (Fig. 4a, b). The pulmonary-to-systemic flow ratio improved to 1.05. The aspirin was discontinued after the procedure to promote thrombus formation in the embolized fistula. The patient’s postprocedure course was uneventful, and no major complications, such as coil migration or distal coronary embolization, were observed. Although the electrocardiographic findings did not change after the procedure, the patient’s symptoms and cardiac murmur resolved. The serum cardiac troponin-T level normalized to 0.014 ng/mL. The fistula was not detectable on follow-up MDCT six weeks later.

**Discussion**

We successfully performed percutaneous coil embolization of an anatomically complex coronary artery to pulmonary artery fistula. The prevalence of coronary artery anomalies in the general population is approximately 1.3% (1), and coronary artery fistulas are relatively rare, observed as an incidental finding on 0.05-0.2% of coronary angiograms (1-4). Successful transcatheter closure of a coronary artery fistula was first reported in 1983 (21). Since then, this treatment method has become more popular and is now widely avail-
Because of the low prevalence of coronary artery fistulas, the optimal management remains unclear and there are no established therapeutic guidelines. Treatment with percutaneous intervention or surgery is recommended for patients with symptoms such as chest pain and dyspnea (4, 10, 15, 18-20) and to prevent the development of heart failure (4-7), myocardial ischemia (4, 6, 8-10), endocarditis (11) or rupture of aneurysmal vessels (12-14). Cebi et al. indicated that symptomatic coronary artery fistulas should be closed irrespective of the size of the left-to-right shunt (4). However, these recommendations are based on reports of anecdotal cases or small retrospective series, and the optimal management strategy for treating asymptomatic coronary artery fistulas remains unclear (15). Although there is no clear evidence that percutaneous coil embolization of coronary artery fistulas can reduce the risk of complications, it is generally considered that occlusion of the shunt can reduce the risk of endocarditis and heart failure, as observed in patients with patent ductus arteriosus (19). In adult patients with a patent ductus arteriosus, there is a class A indication for percutaneous closure even when the shunt is small and asymptomatic (22).

Our patient presented with unstable angina and an elevated serum cardiac troponin-T level. In addition, coronary angiography revealed a delayed antegrade coronary flow (TIMI grade 2) in the distal LAD. The majority of coronary artery fistulas are congenital in origin, and most adult patients are asymptomatic (9, 15, 16). However, it has previously been reported that coronary artery fistulas can cause unstable angina and myocardial infarction in adults (8, 9). We did not perform stress myocardial perfusion scintigraphy or other stress testing to evaluate myocardial ischemia caused by the fistula due to the risk of inducing severe myo-
cardiac ischemia. The coronary steal phenomenon has been reported even in patients with small coronary artery fistulas caused by decreased diastolic perfusion pressure of the coronary arteries (8).

Coronary artery fistulas have diverse anatomical variations. Percutaneous intervention is considered to be a reasonable therapeutic choice, especially for fistulas with a single origin and single drainage site without extreme tortuosity (4, 23). In patients with extremely tortuous fistulas, multiple fistulas or additional cardiac disease requiring surgery (e.g., ventricular septal defects, coronary artery aneurysms, or atherosclerotic coronary artery disease requiring coronary artery bypass grafting), surgical treatment is preferred (4, 10, 23-26). However, surgery carries risks associated with cardiopulmonary bypass and median sternotomy. In this case, we successfully performed percutaneous coil embolization even though the fistula was large and tortuous. Recent improvements in endovascular techniques and devices have resulted in the increased use of percutaneous intervention for the noninvasive treatment of coronary artery fistulas (6, 7, 9, 18-20).

Although percutaneous intervention is less invasive than surgery, it can result in serious complications, including coil migration and distal embolization (15, 26-28), especially in patients with a large fistula and a high-flow shunt. Coil migration into a pulmonary artery can cause life-threatening complications, such as pulmonary embolism. In order to prevent coil migration, it is essential to select coils of optimal size and release the coils only at a curve in the vessel (6).

Our patient had an anatomically complex coronary artery fistula. We carefully evaluated the anatomy of the fistula prior to performing percutaneous intervention, and 320-slice MDCT played a pivotal role in the diagnosis and percutaneous intervention. The origin and precise course of an anomalous coronary artery including coronary artery fistulas may be unclear on conventional coronary angiography (19). In this case, we were unable to visualize the orifice of the fistula on coronary angiography. MDCT provides a good three-dimensional view of complex anomalous vessels and has recently become an essential noninvasive tool for the diagnosis of coronary artery disease, including anomalies (10, 19, 29-31). With the growing popularity of MDCT, more patients with coronary artery anomalies including fistulas may be identified and undergo percutaneous intervention. Conducting a multicenter registry or randomized trial with a larger cohort is desirable in order to investigate the long-term safety and efficacy of percutaneous intervention in patients with coronary artery fistulas.

The authors state that they have no Conflict of Interest (COI).

References


