Myocardial ischemia due to a coronary-pulmonary fistula treated with coil embolization

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We describe one case of myocardial ischemia due to a coronary-pulmonary fistula, successfully treated with coils. Coronary fistulae are a rare cause of angina in adults with normal coronary arteries. Percutaneous treatment represents an alternative to surgery and may be offered as a relatively low risk procedure. The choice between surgical and percutaneous treatment must take into account clinical and anatomical considerations.

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Introduction

Coronary artery fistulae (CAF) are a rare cause of myocardial ischemia even in the absence of coronary atherosclerosis, and may occasionally cause serious complications. In the past, surgical treatment was the only therapy for this coronary anomaly. In the last decade, percutaneous methods of closure have been developed and have proved safe and effective, representing for such patients a tangible alternative to surgery. Transcatheter occlusion of CAF with coils is actually the most widely used treatment. We report a case of myocardial ischemia due to a coronary-pulmonary fistula treated percutaneously with coil occlusion.

Case report

A 62-year-old female was referred for effort angina with a positive exercise test. The rest electrocardiogram was normal. Physical examination revealed a grade 2/6 continuous murmur, with a maximum intensity at the left sternal border. Coronary angiography revealed no obstructive disease and a large fistula connecting the proximal portion of the right coronary artery with the trunk of the pulmonary artery (Figs. 1A and 1B). Cardiac catheterization demonstrated a mild left-to-right shunt (Qp/Qs = 1.2). Percutaneous occlusion with coils was attempted. A 6F guiding catheter was engaged at the ostium of the right coronary artery. A 3F Tracker-18 infusion catheter (Target Therapeutics/ Boston Scientific Cork Ltd, Cork, Ireland) was advanced over a 0.014" guidewire in the distal part of the fistula. One 7 × 70 mm helical shaped, and two 3 × 23 mm diamond shaped coils (Target Therapeutics/Boston Scientific Cork Ltd) were deployed through the 3F microcatheter into the mid and distal segments of the fistula. Angiography showed complete fistula occlusion (Figs. 1C and 1D).

After 6 months of follow-up, the patient is asymptomatic and exercise testing is negative.

Discussion

Although CAF are rare, they are the most common hemodynamically significant congenital coronary anomaly[1]. CAF are occasionally due to cardiac trauma or iatrogenic factors such as chest irradiation, surgery, coronary angioplasty, or repeated endomyocardial biopsies. CAF often drain into a cardiac chamber, and rarely, may constitute a communication between a coronary artery and a great vessel (coronary sinus, pulmonary artery). The majority of coronary-pulmonary artery fistulae arise from the left anterior descending or right coronary artery, and drain with equal

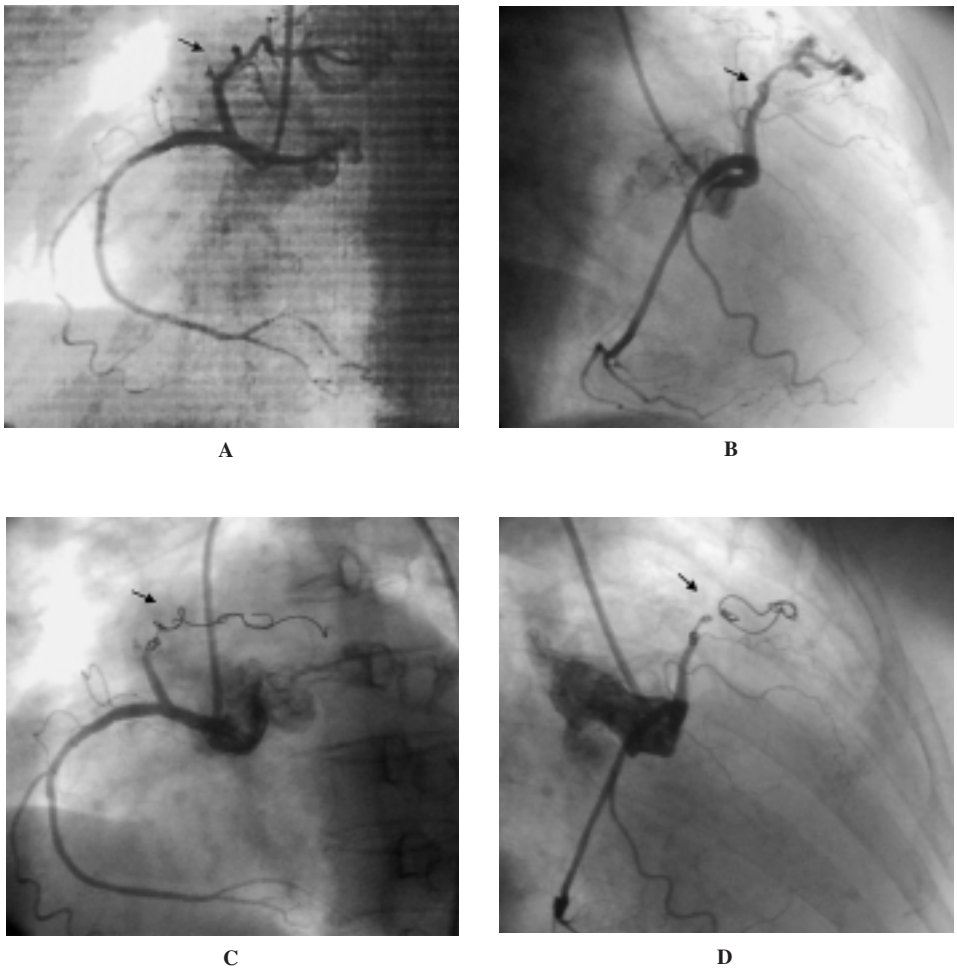

Figure 1. *Right coronary to pulmonary fistula* (arrow) *in the left and right anterior oblique views, before* (A *and* B) *and after* (C *and* D) *the deployment of fibered platinum coils.*

frequency into the left or right pulmonary artery[2-5]. CAF are often diagnosed in asymptomatic children with a continuous murmur. The more commonly reported symptoms in patients with CAF are chest pain, palpitations and syncope, that usually manifest in the fifth and sixth decades of life. CAF rarely give serious complications such as cardiac failure, myocardial infarction, arrhythmias, endocarditis and rupture. Sometimes, as in our report, CAF are discovered during coronary angiography performed for myocardial ischemia in adult patients[6-8].

The exact mechanism of ischemia in the absence of coronary artery disease is not well known. The proposed theory is a "coronary steal phenomenon", with shunting from the high-pressure coronary artery system into the lower resistance pulmonary system[9,10].

There is a general consensus for the treatment of CAF in symptomatic patients, in case of complications and when the shunt is significant. In the past, surgical ligation of the fistulous tract was the only treatment modality. Reidy et al.[11] in 1983 reported the first percutaneous occlusion of a fistula. Since then, transcatheter occlusion of CAF has evolved as the preferred therapy, representing a valid alternative to surgery. Although fistula occlusion with inflatable balloons, polyvinyl alcohol foam, covered stents, and umbrellas has been reported, the use of implantable coils is currently considered as the method of choice in the majority of cases. Developments in catheter and coil technologies have rendered this procedure safe, with a low incidence of complications[12-14]. The coils available in clinical practice are made of stainless steel or platinum and may have a fiber design to increase thrombogenicity. They may be deployed through microcatheters positioned over a 0.014" guidewire previously advanced in the distal part of the fistula. New interlocking detachable coils have a controlled release system that allows their retrieval even after deployment[7,15,16]. In selected cases other catheter-based methods may be used as an alternative to or in combination with coils. In high-flow fistulae, for example, temporary balloon occlusion allows coil deployment and thrombosis of the abnormal vessel[17]. In the report by Sangiorgi et al.[18] coil embolization was associated with alcohol injection in order to increase procedural success. In selected cases of aneurysmal fistulae communicating with cardiac cham-

bers, in which a narrow trait (neck) is clearly detectable, the use of umbrella closure devices allows a straight and complete occlusion[13,19,20]. In case of CAF originating from a coronary stenosis, the use of covered stents should be considered[21,22]. Whenever the fistula originates from a normal coronary artery, the implantation of a covered stent is not justified owing to the potential acute and late complications consequent to side branch occlusion, thrombosis and intimal hyperplasia.

Catheter-based closure of CAF is not always simple, and complications, although rare, may be considerable. A detailed paper by Dorros et al.[23] describes 7 adult patients with 10 CAF. In 3 cases, the occlusion of the fistula failed because of the extreme angulation of the ostium. In one case, the device recoiled into the left main, resulting in cardiac arrest, electromechanical dissociation, and death.

Proximal or distal migration of the embolic device is the most frequent pitfall. The appropriate size (10-30% oversized) and correct positioning of coils are important to avoid this complication[12-16,23].

In conclusion, the choice between surgical and percutaneous treatment of CAF must be made with care and must take into account several factors: the age of the patient, the presence of concomitant cardiac defects and coronary atherosclerosis, the anatomy of the fistula, the expertise of the operator. Surgery should be reserved for fistulae with a complex anatomy, and for cases with planned intervention for associated congenital defects or coronary artery bypass. Transcatheter occlusion may be safely performed in proximally located fistulae with a favorable anatomy and, in particular, in older patients with a higher surgical risk.

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