

# Percutaneous closure of coronary-pulmonary fistula with microvascular plug in an adult patient: case report

## Cierre percutáneo de fístula coronario-pulmonar con plug microvascular en paciente adulto: reporte de caso

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### ABSTRACT

Coronary fistulas are rare anomalies that can be asymptomatic or cause serious complications such as myocardial ischemia or heart failure. In the presence of complications, their closure is indicated, either by surgical or percutaneous approach. We present the case of an adult patient with a coronary-to-pulmonary artery fistula, complicated by myocardial ischemia and ventricular arrhythmia, in which percutaneous closure with a Micro Vascular Plug (Medtronic®) was chosen. This is the first report on the use of the device in this clinical scenario in an adult patient in our setting

**Keywords:** coronary fistula, percutaneous closure, microvascular plug.

### RESUMEN

Las fístulas coronarias son anomalías poco frecuentes que pueden cursar asintomáticas o generar complicaciones graves como isquemia miocárdica o insuficiencia cardíaca. En presencia de complicaciones está indicado el cierre, ya sea por abordaje quirúrgico o percutáneo. Presentamos el caso de un paciente adulto con una fístula coronario-pulmonar complicada con isquemia miocárdica y arritmia ventricular, donde se optó por el cierre percutáneo con un plug microvascular (Medtronic®). Se trata del primer reporte de utilización del dispositivo en este escenario clínico en un paciente adulto en nuestro medio.

**Palabras clave:** fístula coronaria, cierre percutáneo, plug microvascular.

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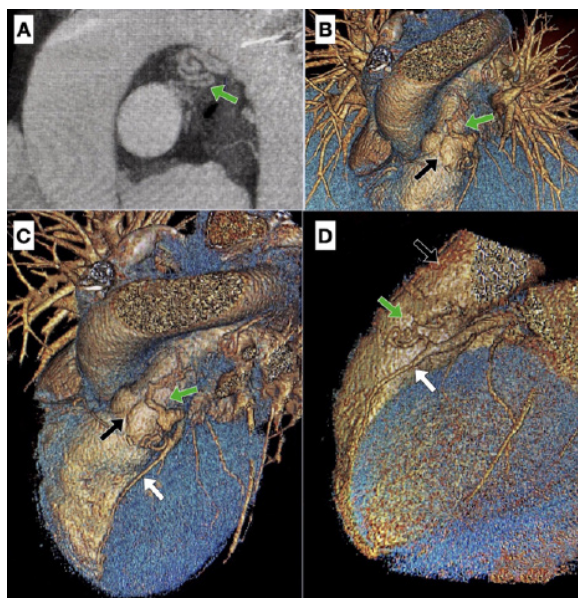
### INTRODUCTION

The coronary fistulas are rare abnormalities, whose incidence varies between 0.1 and 0.2% of the patients to whom a cineangiography<sup>1</sup> is made. They are defined as abnormal communications between the coronary arteries and the cardiac chambers or great vessels. They are usually congenital malformations, although they can also be acquired after the cardiac surgery, thorax trauma, endo-myocardial biopsy, surgical myomectomy or percutaneous coronary interventions<sup>1,2</sup>. The most frequent place of origin varies in the different series. The usual drainage place are the right cavities or the pulmonary artery<sup>2,3</sup>.

The most frequent is that patients have them asymptotically, although in many cases they can generate myocardial ischemia due to the coronary steal, which is one of the main closure indications<sup>3,4</sup>. The available therapeutic strategies are the direct surgical ligation or the percutaneous closure with diverse devices (removable balloons, coils, Amplatzer)<sup>5,6</sup>. The Micro Vascular Plug (MVP, Medtronic®) are devices

that are mainly used for the closure of pulmonary arterial, splenic or renal malformations<sup>7</sup>. They have been used for the coronary fistula closure in children<sup>8-10</sup>, but for the time being there are no reports of use of this device for the coronary fistula closure in adults in our place.

There is a case of a patient with a coronary-pulmonary fistula which caused myocardial ischemia and ventricular arrhythmia where it was closed successfully by percutaneous via with an MVP as occluder device.



**Figura 1.** Coronary tomography and 3D reconstruction showing the ADA-PA fistula from different angles. Green arrow: ADA-PA fistula (anterior descending artery, pulmonary artery). Black arrow: pulmonary artery trunk. White arrow: distal anterior descending artery.

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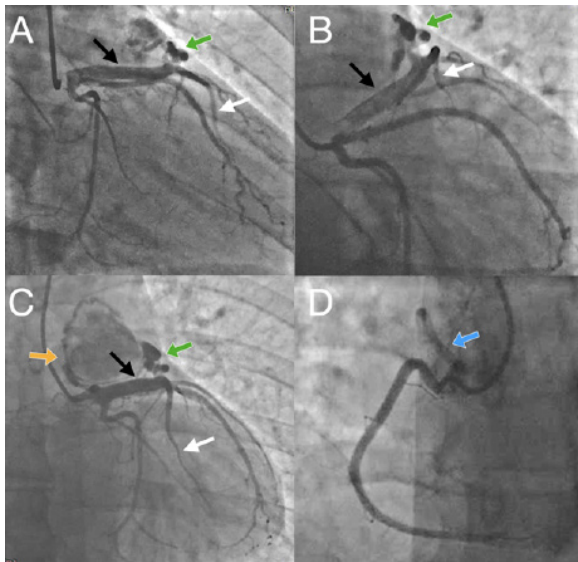
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**Figure 2.** Diagnostic coronary angiography. A, B and C. Left coronary artery. D. Right coronary artery. Black arrow: great caliber proximal ADA. White arrow: thin caliber distal ADA. Green arrow: ADA-PA fistula. Yellow arrow: LMCA-PA fistula (left main coronary artery). Blue arrow: RCA-PA fistula (right coronary artery).

## A CLINICAL CASE

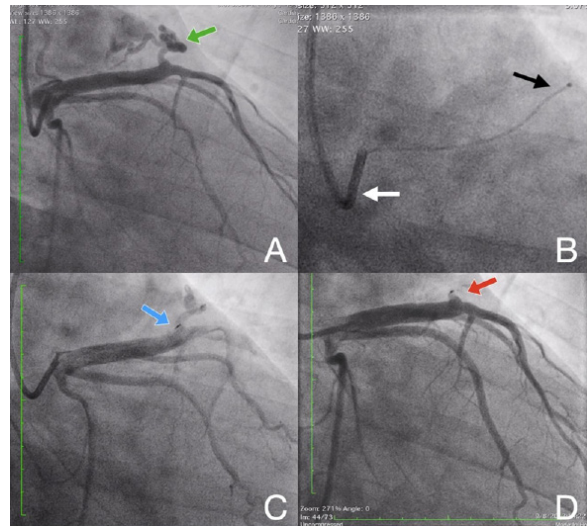
A 44-year-old patient, male, obese and hypertensive. History of atypical angor, without other cardiovascular symptoms. The electrocardiogram and the echocardiogram were normal. In the ergometry the patient presented an episode of non-sustained monomorphic ventricular tachycardia. A cardiac computed tomography (**Figure 1**) and a cineangiography (**Figure 2**) were performed that showed the three coronary fistulas which drained in the pulmonary artery trunk: from the left main coronary artery (LMCA-PA), from the anterior descending artery (ADA-PA) and from the right coronary artery (RCA-PA). Coronary arteries did not show angiographically significant stenosis.

Due to the fact that the fistula ADA-PA was the largest (3.5 mm) and it had suggestive signs of coronary steal (great proximal caliber of ADA and reduction of distal flow to the fistula origin), its closure was decided. The use of an MVP as occluder device was chosen.

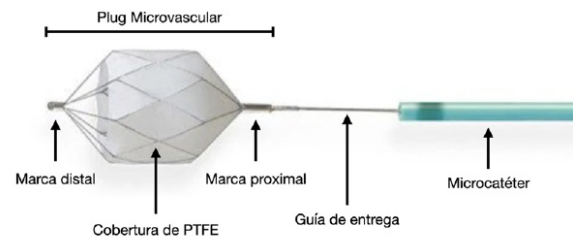
The procedure (**Figure 3**) was performed in a coordinated way, under local anesthesia and through radial access. A SBS 3.5 Fr guide catheter was used in order to cannulate the ostium of the left coronary artery, and a 0.014" coronary guide was crossed through the fistula. After that, a 2.8 Fr (Medtronic®) micro-catheter was positioned in the neck of the fistula and a MVP 5Q (Medtronic®) was released. An angiography of control was made and it proved the total occlusion of the fistula. There were no complications and the patient was discharged from the hospital 24 hours later.

## DISCUSSION

Coronary fistulas are rare abnormalities that communicate the coronary arteries with the cardiac chambers or the great vessels. They can be originated by one or both coronary arteries, and in most of the cases they drain into the right cavities or in the pulmonary artery<sup>2,3</sup>. Its structure is tortuous.



**Figure 3.** Procedure of ADA-PA fistula closure. A. Initial image. B. Micro-catheter passing through the fistula. C. MVP released. D. Final result. Green arrow: ADA-PA fistula. White arrow: SBS 3 Fr catheter. Black Arrow: 2.8 Fr micro-catheter (Medtronic®). Blue arrow: MVP released. Red arrow: ADA-PA occluded fistula.



**Figure 4.** Structure of microvascular plug and its release system (Medtronic®).

The more proximal its origin is in the coronary artery, the higher its dilation degree is<sup>1</sup>.

Most of the coronary fistulas are congenital although they can be also acquired<sup>1</sup>. They are usually asymptomatic and in some cases they can close spontaneously<sup>3</sup>. When this does not happen, they generate a shunt between both cavities, whose size depends on the caliber of the fistula and on the pressure between both extremes<sup>3</sup>. In these cases, the symptoms can be from dyspnea by cardiac failure with high effort up to angor or malign arrhythmias by secondary myocardial ischemia up to a coronary steal<sup>3</sup>. Other less frequent complications are thromboembolism, breakage, dissection or infection (endarteritis)<sup>3</sup>.

The gold standard for the diagnosis of the coronary fistulas is the coronary angiography. It contributes anatomic and hemodynamic data, such as size, place of origin, place of drainage and its own course. These data are useful to define the closure indication and to plan the best treatment strategy.

The importance of the coronary fistulas lies on the complications that they can cause, which in case they occur, they are a closure indication. The size, the hemodynamic impact and the presence of a myocardial ischemia are the main indicators<sup>1,3</sup>. The symptomatic or the ones which cause the

ventricular dysfunction have a formal indication of closure. However, it is contraindicated in asymptomatic and small fistulas<sup>4</sup>. Based on the evolutionary characteristic of the fistulas, the periodical re-evaluation is recommended.

The surgical closure through direct ligation has been the most used method for many years. It has 0-6% morbimortality rate and a probability of success higher than 95%<sup>3</sup>. The percutaneous closure is an efficient and safe alternative which was first introduced in 1980<sup>2,6</sup>, whose probability of success is comparable, reducing time of recovery and of hospitalization<sup>3</sup>. This approach is preferred in those patients with proximal fistulas with a unique drainage site or with high surgical risk<sup>1,6</sup>.

There are several devices of mechanical occlusion which can be used for the percutaneous closure: removable balloons, coils, Amplatzer<sup>5,6</sup>. Coils are the most usually used devices, but its main disadvantage lies on the eventual need of several coils to achieve a successful embolization, which extends the procedure. Removable balloons are practically not used these days and the vascular Amplatzer are little used in our place because they are very expensive.

MVP (**Figure 4**) are devices composed by nitinol and covered by a polytetrafluoroethylene (PTFE) membrane, which are delivered by a micro-catheter and they generate immediate occlusion of the vessel<sup>7</sup>. As they come in different sizes, they have been used in different clinical scenarios (pulmonary, renal, splenic, gastroduodenal, peripheral emboliza-

tions). Its main advantage is that a unique device can achieve the successful occlusion, with the resulting saving of time and money. In spite of its multiple advantages, the experience regarding its usage for the closure of coronary fistulas is little for the time being and it mainly predominates in children<sup>8-10</sup>.

There was a clinical case of an adult patient with three coronary fistulas, one of them was identified as the cause of the myocardial ischemia by coronary steal, and its closure was decided. As there was a proximal fistula and it was easy to reach through percutaneous way, this approach was chosen. The occlusion device chosen was an MVP, being the first report of usage of this device on this clinical scenario in an adult in our place.

## CONCLUSIONS

Coronary fistulas rarely occur and they usually happen asymptotically. They can sometimes appear with secondary symptoms such as myocardial ischemia and malign arrhythmias. When these complications take place, its closure is decided. A percutaneous approach is practicable, having a low probability of complications and a high effectiveness rate. The use of MVP in this scenario is a novel alternative and it is highly favorable.

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