

Percutaneous closure of a complex fistula that originates from all coronary arteries and drains to the pulmonary artery

Tüm koroner arterlerden köken alan ve pulmoner artere açılan kompleks fistül yapısının perkütan olarak kapatılması

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Summary– A coronary-to-pulmonary-artery fistula (CPAF) is defined as a connection between the coronary arteries and the pulmonary arteries (PAs). Invasive treatment options for CPAFs include surgical ligation and transcatheter coil or plug embolization. A 60-year-old female patient was referred to our hospital with symptoms of exercise-induced angina (Canadian Cardiovascular Society Class III [CCS-3]). Her relevant history included elective stenting of the left anterior descending (LAD) artery in 2013 and surgery for an LAD to PA fistula in 2015. Upon recurrence of the same fistula in 2017, she underwent a failed antegrade (from LAD to PA) attempt for percutaneous closure of the fistula. A retrograde approach was decided because of the extensive tortuosity of the fistula's proximal part that led to the previous failed attempt and the likelihood of ceasing whole blood flow at the fistula's distal neck. Through right femoral venous access, we advanced a 5 Fr. 45 cm TorqVue low-profile delivery system (St. Jude Medical, Little Canada, MN, USA) over a J-tip 0.035-inch guidewire to the PA. The antegrade imaging guidance enabled us to advance the guidewire to the distal neck of the fistula retrogradely. As the distal part of the fistula was similar to a tunnel-shaped patent ductus arteriosus (PDA) and was measured 4 mm at the narrowest diameter, we opted for an Amplatzer duct occluder II 6 x 6 (Abbott Vascular, Chicago, IL, USA) to close it.

Özet– Koroner-pulmoner arter fistülü (KPAF), koroner arterler ile pulmoner arterler (PA) arasında bir bağlantı olarak tanımlanır. KPAF'lerinin girişimsel tedavi seçenekleri, cerrahi ligasyon ve transkateter koil ya da tıkaç embolizasyonudur. 60 yaşında kadın hasta, merkezimize egzersiz ile indüklenen CCS-3 (Canadian Cardiovascular Society Klas III) angina şikayeti ile başvurdu. Özgeçmişinde 2013 yılında sol ön inen koroner artere (LAD) elektif stent işlemi ve 2015 yılında LAD - PA fistülü nedeni ile operasyon yer almaktaydı. 2017'de aynı fistülün tekrarlaması üzerine, antegrad perkütan fistül kapama denenmiş ancak başarısız olunmuştu. Bir önceki işlemin başarısızlığına neden olan fistülün proksimal boynundaki ciddi tortuoze ve kan akımının fistülün distal boynunda kesilmesi ihtimali dikkate alınarak retrograd yaklaşım seçildi. Sağ femoral ven yoluyla, 5 Fr. 45 cm TorqVue düşük profilli taşıma sistemi (St Jude Medical, Little Canada, MN, USA) 0.035-inç J-uçlu kılavuz tel üzerinden pulmoner artere ilerletildi. Antegrad görüntüleme desteği ile, kılavuz tel retrograd olarak fistülün distal boynuna ilerletilebildi. Fistülün distal kısmı tünel şekilli patent duktus arteriosus'a (PDA) benzediğinden ve en dar yerinde 4 mm ölçüldüğünden, kapatmak için Amplatzer duct occluder II 6x6 (Abbott Vascular, Chicago, IL, USA) tercih edildi.

A coronary-to-pulmonary-artery fistula (CPAF) is defined as a connection between the coronary arteries and the pulmonary arteries (PAs).^[1] Invasive treatment options for CPAFs include surgical ligation and transcatheter coil or plug embolization. The size and type of the involved vessels, presence of symptoms, patient's comorbidities and operator's experience are critical factors while deciding the treatment strategy.^[2]

CASE REPORT

A 60-year-old female patient was referred to our hospital with symptoms of exercise-induced angina (CCS-3). Her relevant history included elective stenting of the left anterior descending (LAD) artery in 2013 and surgery for an LAD to PA fistula in 2015. Upon recurrence of the same fistula in 2017, she underwent a failed antegrade (from LAD to PA) attempt for percutaneous closure of the fistula. Her initial



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electrocardiogram showed the sinus rhythm at a rate of 68 beats per minute, and the transthoracic echocardiogram revealed anteroapical hypokinesis with a left ventricular ejection fraction of 50%. Physical examination was unremarkable. For a detailed evaluation of fistula formation, a multislice computerized tomographic angiogram was performed and showed the fistulas originating from all coronaries and draining into the pulmonary trunk at the same point (Figure 1A). With the aim of treating the fistula in the same procedure, an invasive coronary angiogram was performed, and it demonstrated the fistula between LAD to PA that terminated in the pulmonary trunk with a relatively narrow neck (Figure 1B, green arrow). It also showed remote connections originating from both the circumflex and the right coronary artery that join the fistula before draining into the PA (Figure 1B, black arrow). A retrograde approach was decided because of the extensive tortuosity of the fistula's proximal part that led to the previous failed attempt and the likelihood of ceasing the whole blood flow at the fistula's distal neck (Figure 1B, green arrow).

Through right femoral venous access, we advanced a 5 Fr. 45 cm TorqVue low-profile delivery system

(St. Jude Medical, Little Canada, MN, USA) over a J-tip 0.035-inch guidewire to the PA (Figure 1C, white arrow), and the antegrade imaging guidance enabled us to advance the guidewire to the distal neck of the fistula retrogradely. (Figure 1C, green arrow) (Video 1*). As the distal part of the fistula was similar to a tunnel-shape patent ductus arteriosus (PDA) and was measured 4 mm at the narrowest diameter, we opted for an Amplatzer duct occluder II 6 × 6 (Abbott Vascular, Chicago, IL, USA) to close it (Figure 1E, F). After fine tuning to fit the device's waist to the tunnel's narrowest part (Video 2*), the device was released. A total of 10 minutes later, the last shot showing the fistula's total occlusion was taken, and the procedure was ended without any complications (Figure 1D, Video 3*).

Abbreviations:

CPAF	Coronary-to-pulmonary-artery fistula
CCS	Canadian Cardiovascular Society
LAD	Left anterior descending
PAs	Pulmonary arteries
PDA	Patent ductus arteriosus

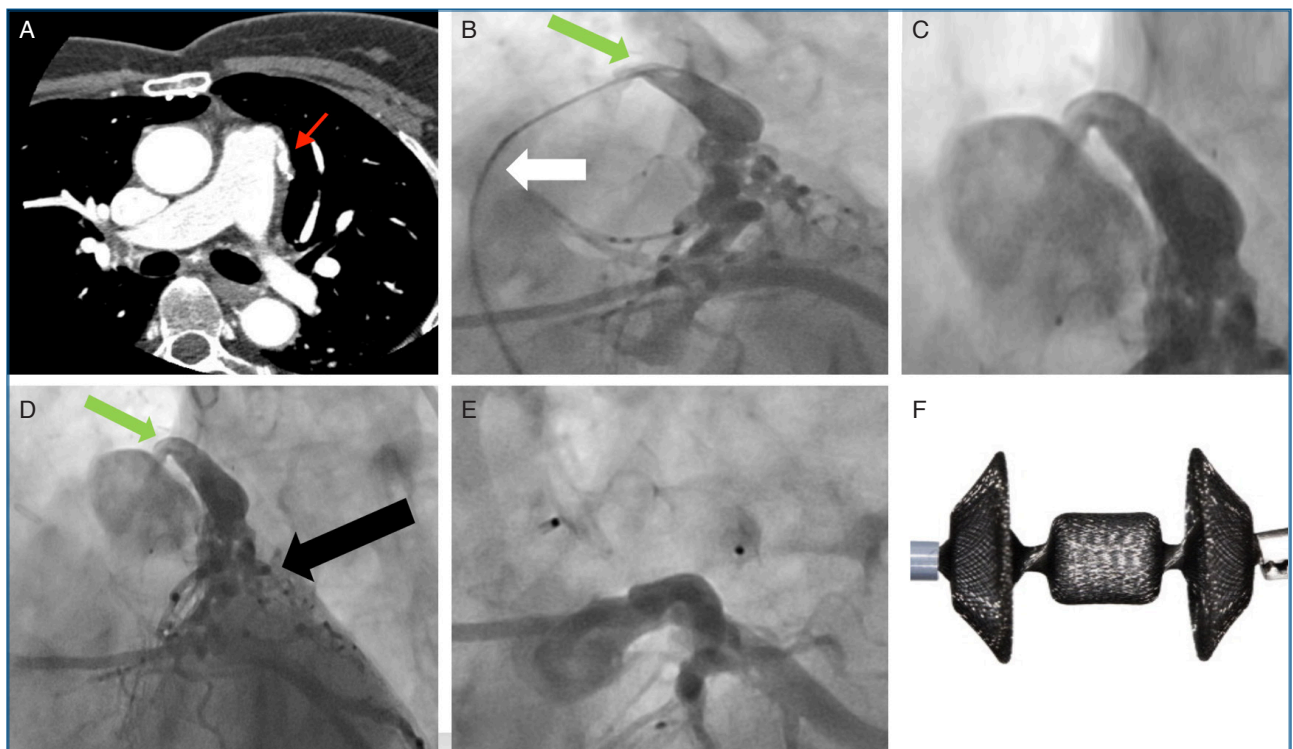


Figure 1. (A, B) Multislice computerized tomography (MSCT) and invasive coronary angiogram of the fistula. (C) Advancing the delivery system over a J-tip 0.035-inch guidewire to the pulmonary artery with the aid of antegrade imaging guidance. (D) The view of the totally occluded fistula with an Amplatzer duct occluder II device. (E, F) The anatomical conformity of the fistula and device.

DISCUSSION

Coronary artery fistulas are rarely-seen abnormalities and are defined as a communication between the coronary arteries and either a heart chamber or pulmonary circulation.^[3] Basically, treatment options include conservative medical as well as invasive therapy that consists of surgical ligation and endovascular treatment. Anatomical features of the fistula (size, course, tortuosity), presence of symptoms, and surgical risk of the patient are the main determinants while deciding the type of treatment strategy.^[4] Recently, endovascular treatment options, either with a transcatheter coil or vascular plug embolization have become the first-line strategies for occluding fistula formations in all vascular territories. Besides the fistula's anatomical characteristics and the operator's experience with these devices, one should always consider the coils' and plugs' advantages and drawbacks while deciding the treatment option. Coils are inexpensive, low profile and easy-to-deliver devices that are generally used to treat small fistulas (2-4 mm). However, distal embolization and high recanalization rates are the Achilles heel of these devices.^[2] In contrast, vascular plugs are used to occlude larger fistulas (up to 12 mm) and provide more accurate placement with less distal embolization and recanalization rates. Nevertheless, needing larger (at least 4 Fr.) and more rigid catheters to deliver vascular plugs limit their use in tortuous vessels.^[5]

Endovascular interventions are now considered the first-line treatment options for fistulas with suitable anatomical characteristics. Considering the patient's symptoms, surgical risks and anatomical features of the fistula as well as the operator's experience with transcatheter methods, they have a pivotal

role while deciding the most appropriate treatment strategy.

*Supplementary video files associated with this article can be found in the online version of the journal.

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Anahtar Kelimeler: Koroner fistül; perkütan kapama; vasküler tıkaç