CASE REPORT

Transcatheter treatment of partial anomalous pulmonary venous connection to left subclavian vein

Sol subklavyen vene olan anormal pulmoner venöz bağlantının perkütan tedavisi

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Summary– Reports of transcatheter treatment for dual drainage of an abnormal pulmonary venous connection are rare. Presently described is the case of a 27-year-old female with exertional dyspnea and a partial anomalous pulmonary venous connection of the left upper pulmonary vein with dual drainage to a vertical vein (VV) and the left atrium. The patient was evaluated with a balloon occlusion test to determine whether closing the anomalous VV connection would increase pulmonary pressure. The results of this test are an important guide to treatment decisions. A 12x9 mm Amplatzer Vascular Plug II device was successfully used to occlude the anomalous pulmonary venous connection using a transcatheter technique. This is a less invasive option than surgical repair and can be an appropriate choice in suitable cases.

Özet– Nadiren çift drenaj anormal pulmoner venöz bağlantı ve transkateter tedavisi bildirilmiştir. Bu yazıda, sol üst pulmoner vende dikey vene ve sol atriyuma drene olan çift drenajlı anormal pulmoner venöz bağlantısı olan ve egzersiz ile nefes darlığı olan 27 yaşında kadın hasta sunuldu. Hastada, balon oklüzyon testi ile anormal dikey ven bağlantısının kapatılmasının akciğer basıncını artırıp artırmadığı değerlendirildi. Bu testin sonuçları, tedavi kararları için önemli bir kılavuzdur. Testten sonra, anormal venöz bağlantı Amplatzer Vascular Plug II 12x9 mm vasküler plak ile kapatıldı. Perkütan tedavi cerrahi tedaviye kıyasla daha az invazif bir tedavi yöntemidir ve uygun hastalarda tercih edilebilir.

A partial anomalous pulmonary venous connection (PAPVC) is a rare congenital cardiac condition in which some pulmonary veins connect to the right atrium (RA) or other vessels rather than returning blood to the left atrium (LA). The estimated incidence is 0.4% to 0.7%.[1] PAPVC is more common on the right side of the heart; only 10% involve the left side, with a reported prevalence of 0.05%.[2,3] Total anomalous pulmonary venous connections of the left side can drain to the innominate vein, the coronary sinus, or the inferior vena cava. PAPVC usually occurs in association with other cardiac anomalies, most commonly an atrial septal defect. Anatomical forms featuring both vertical vein (VV) and scimtar vein connections have been identified.[4] Reports of dual drainage of pulmonary venous blood are uncommon. In the present case, a transcatheter technique was used to successfully treat a case of VV-type dual drainage PAPVC.

Abbreviations:

CT	*Computed tomography*
LA	*Left atrium*
PAPVC	*Partial anomalous pulmonary venous connection*
RA	*Right atrium*
VV	*Vertical vein*

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A 27-year-old female was referred to the cardiology clinic for exertional dyspnea. A transthoracic contrast echocardiography examination was performed with the contrast injected via the left antecubital vein and it was observed that the contrast was visible in both the LA and the RA (Fig. 1a, Video 1*). The interatrial septum was intact (Fig. 1a). Multislice computed tomography (CT) revealed a VV anomalous pulmonary

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venous connection to the left subclavian vein (Fig. 1c-e). Cardiac catheterization confirmed the anomalous pulmonary venous connection (Video 2*, Fig. 2c). Hemodynamic and blood gas analyses were conducted (Fig. 1b). The Qp/Qs ratio was 1.2. The hospital cardiology committee decision was to perform percutaneous closure of the partial abnormal venous return due to the risk of paradoxical embolism.

Procedure

A 7F introducer was inserted into each femoral vein. One Swan-Ganz catheter was inserted into the pulmonary artery, and a second was inserted into the VV. Balloon occlusion was performed in the VV with the catheter and the pulmonary artery and vein pressures were evaluated for 10 minutes (Video 3, Fig. 2d). No significant change was observed. Before balloon occlusion, the pulmonary artery pressure was 24/13/9 mmHg, the pulmonary vein pressure was 10/7/3 mmHg, and the SaO_2 reading was 98%. After balloon occlusion, the pulmonary artery pressure was 24/13/8 mmHg, the pulmonary vein pressure was 10/7/3 mmHg, and the SaO_2 level was 99% (Fig. 2c, d, Video 3*). A 7F right guiding catheter was inserted into the VV and used to send a 12x9 mm Amplatzer Vascular Plug II (AVP II) device (St. Jude Medical Inc., St. Paul, MN, USA) to achieve occlusion of the vein (Fig. 2e, Video 4*). The patient was discharged the following day and was asymptomatic in follow-up.

DISCUSSION

Estimating the incidence of dual drainage PAPVC is difficult. Most patients are asymptomatic; however, the increase in multislice CT and echocardiographic examinations has led to more diagnoses. Treatment of asymptomatic cases without a hemodynamically significant left-to-right shunt is a matter of debate. Nonetheless, complications related to the left-to-right shunt or a paradoxical embolism can occur as a result of these anomalies.[5,6]

There are few reports of transcatheter treatment for PAPVC with dual drainage in the literature.[4] Surgical ligation is another treatment strategy, but transcatheter treatment is less invasive. Interventional therapy allows for an occlusion test during the procedure to guide treatment. An absolute increase of 10

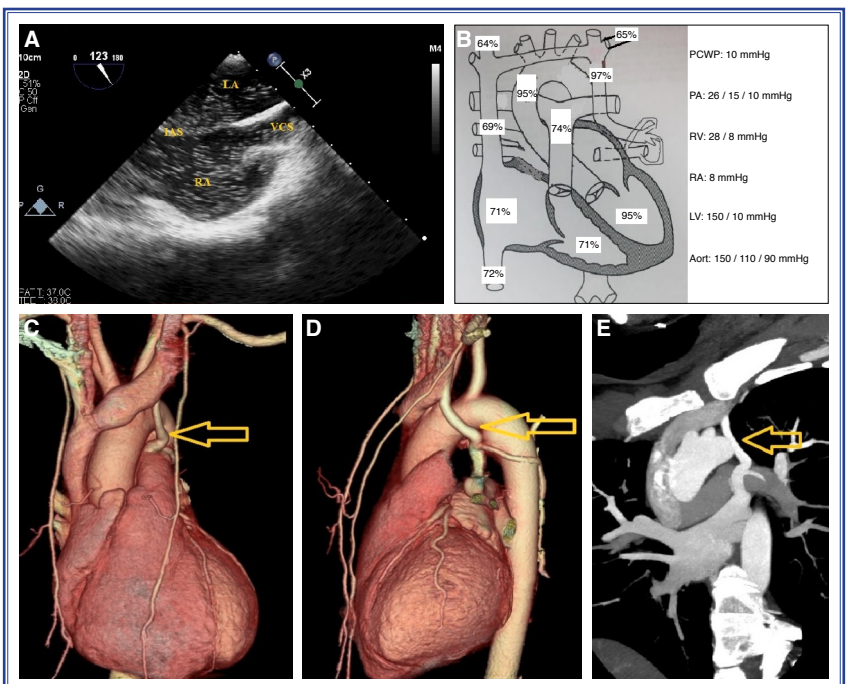

Figure 1. **(A)** Contrast visible in both the left and right atrium; **(B)** Right and left heart catheterization; **(C-E)** Computed tomography images of the partial anomalous pulmonary venous connection. Arrow: vertical vein. Aort: Aorta; IAS: Interatrial septum; LA: left atrium; LV: Left ventricle; PA: Pulmonary artery; PCWP: Pulmonary capillary wedge pressure; RA: Right atrium; RV: Right ventricle; VCS: Vena cava superior.

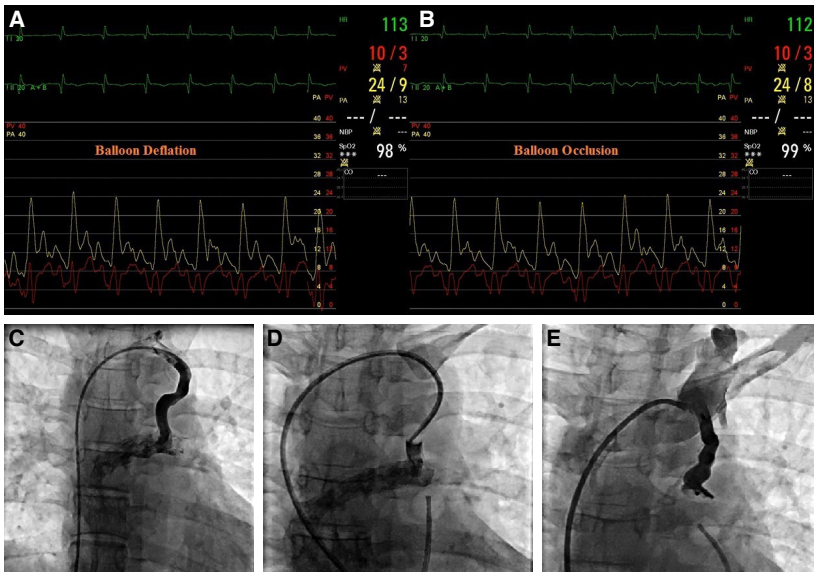

Figure 2. (A) Balloon occlusion test (balloon deflection time); **(B)** Balloon occlusion test (balloon occlusion time); **(C)** Fluoroscopic image of pulmonary venous connection; **(D)** Fluoroscopic image of balloon occlusion test; **(E)** Fluoroscopic image of percutaneous vertical vein occlusion.

mmHg in pulmonary venous pressure during balloon occlusion indicates risks associated with pulmonary venous hypertension.[7]

Various devices (duct occluder, vascular plug, atrial septal defect occluder, ventricular septal defect occluder) have been used to close an abnormal pulmonary venous connection.[4,5] The type of closure device used is determined by the anatomical size and shape of the abnormal venous connection. The AVP II is cylindrical in shape with 3 lobes, and can provide full and fast occlusion. The device diameter selected is 30% to 50% larger than the measured diameter of the abnormal connection.[8]

We used a 12 mm device because the connection diameter was 9 mm. Amplatzer trial septal defect occluder, ventricular septal defect occluder, and duct occluder devices have wings on one or both sides that are larger than the waist. Wide wings increase device fixation and can increase the risk of occlusion and erosion in the pulmonary venous bed and other venous structures. The AVP II is suitable for closing oblong connections; however, using this device in short abnormal connections can cause erosion and device embolization. An Amplatzer duct occluder, ventricular septal defect occluder, or atrial septal defect occluder device can be used with short abnormal connections if they are anatomically compatable.[4,5] Gupta et al.[9] treated a dual drainage pulmonary venous connection case using an Amplatzer duct occluder device. As in our case, Al Qbandi et al.[10] and Gangadhara et al.[5] treated patients with a dual drainage pulmonary venous connection using the AVP II device.

Conclusion

Dual drainage of the left pulmonary veins to both a VV and the LA is rare. In appropriate cases, this form of PAPVC can be treated using a transcatheter method.

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

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