A small PDA allows only a small left to right shunt, and is often clinically silent. Conversely, several complications including pulmonary hypertension, heart failure, aneurysm, atrial fibrillation, infectious endocarditis, pulmonary artery and aortic dissection, may be associated with a large PDA. The clinical manifestations of PDA vary greatly according to the size of ductus, the pressure across the ductus, patient's age, and the presence or absence of pulmonary hypertension (5). In the patient in our study, there was a relatively long tube of PDA and focal tiny lumen on pulmonary artery side, which offers substantial resistance to blood flow. Such PDA allows a small left to right shunt and restricts the transmission of aortic pressure to pulmonary artery. Therefore, this patient tolerated PDA without obvious symptoms for several years. Due to the existence of left to right shunt, significant thoracic descending aortic atherosclerosis had occurred surrounding PDA.

In conclusion, to our knowledge this is the first report of PDA coexistent with type B IMH secondary to atherosclerotic ulcer and ulcerative protrusion in an adult patient. Multiple aortic pathologies can be simultaneously delineated by CTA, which helps clinicians determine therapeutic strategy. However, appropriate management for this complex disease entity has not been fully documented yet. Endovascular repair of thoracic aortic disease is widely used mainly because of its invasiveness. In our patient, endovascular treatment demonstrated a less invasive option with promising results, which was verified by postoperative follow-up CTA.

Conflicts of interest: The authors declare that they have no conflict of interest.

Informed consent: Informed consent was obtained from the patient in the study.

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An unusual cause of pulmonary hypertension; partial anomalous pulmonary venous return to coronary sinus detected on transesophageal echocardiography

An asymptomatic male patient aged 25 years was admitted to the cardiology polyclinic with two transesophageal echocardiography (TEE) reports from separate hospitals indicating no abnormalities. Transthoracic echocardiography revealed mild tricuspid valve regurgitation and mild right chamber dilation. Mean pulmonary arterial pressure measured on pulmonary valve was 37 mm Hg. Coronary sinus (CS) was dilated with an abnormal flow (Fig. 1a, 1b). TEE was performed to detect the etiology of pulmonary hypertension (PHT); it showed that the left upper pulmonary vein was separated from the left atrium by a septum (Video 1) and the

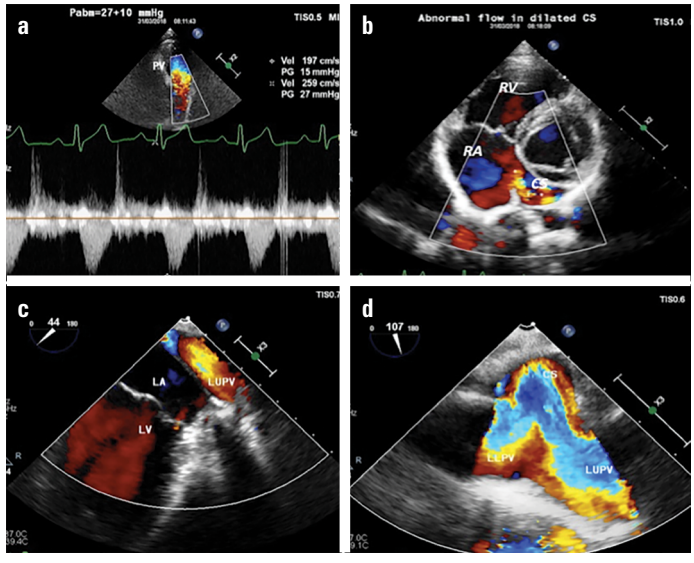

Figure 1. (a) Mean pulmonary arterial pressure measured on pulmonary valve was 27+10: 37 mm Hg. (b) Coronary sinus (CS) was dilated with an abnormal flow. (c) Transesophageal echocardiography showed that the left superior pulmonary vein was separated from the left atrium by a septum and was draining into CS. (d) The left upper and lower pulmonary veins were both draining into the CS.
PABm - mean pulmonary arterial pressure, PV - pulmonary valve, RA - right atrium, RV - right ventricle, LA - left atrium, LV - left ventricle, LUPV - left upper pulmonary vein, LLPV - left lower pulmonary vein

left upper and lower pulmonary veins were both draining to the CS (Fig. 1c, 1d, Video 2). Computed tomography showed partial anomalous pulmonary venous return (PAPVR) that involved left pulmonary veins draining into CS, as seen on TEE (Fig. 2). The patient was referred for right cardiac catheterization and subsequent surgical correction, although the procedure has not yet been performed.

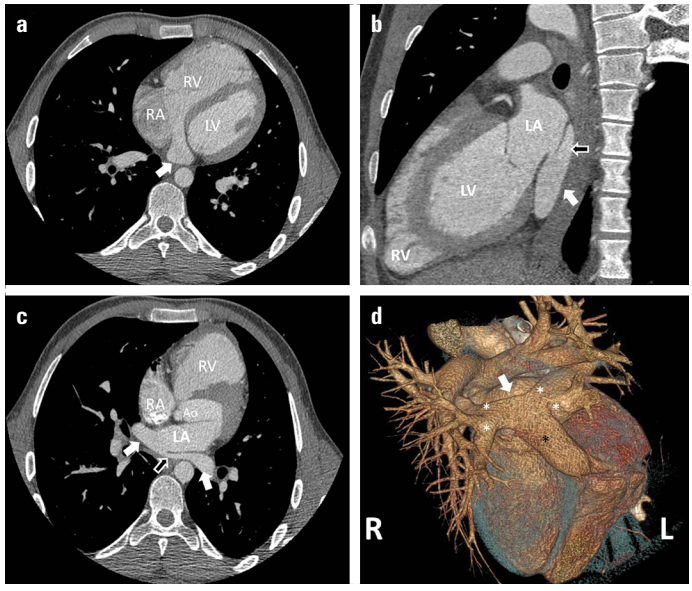

Figure 2. (a) The coronary sinus (CS) diameter (arrow) is approximately 22 mm, and CS is markedly dilated. (b) The sagittal section shows that left pulmonary veins (LPVs) (black arrow) are draining into CS (white arrow). (c) The section passing through LA (left atrium) shows that right pulmonary veins (RPVs) (white arrow) are draining into LA and LPVs (white arrow) are connected to CS. LPVs also have a small connection (black arrow) with LA. (d) The Volume Rendering Technique (VRT) image, passing through the posterior part of the heart, shows that LPVs (white asterisk) are linked by a common root to CS (black asterisk). Although RPVs (white asterisks) appear to be connected with CS on the VRT image, it is evident on the axial views that they are draining into LA (white arrow). Thus, VRT images can be misleading, and axial images must be carefully examined.
LV - left ventricle, RA - right atrium, RV - right ventricle, Ao - aorta

The drainage of the pulmonary veins to CS is an uncommon finding and is a very rare cause of PHT. We have reported a case of isolated PAPVR to CS, detected on TEE, leading to PHT. The presented patient had undergone multiple TEE examinations; however, a review of the previous reports indicated no anomalies of the pulmonary vein. Given the widespread use of TEE, cardiologists should be aware of the possibility of anomalous pulmonary venous return (APVR) and be vigilant in tracing the path of pulmonary veins to identify APVR in patients evaluated for unexplained PHT.

Informed consent: Patient informed consent was obtained for publication.

Video 1. Transesophageal Echocardiography. The left upper pulmonary vein was separated from the left atrium by a septum and was draining into the coronary sinus
LA - left atrium, LV - left ventricle, LUPV - left upper pulmonary vein

Video 2. Transesophageal Echocardiography. The left upper and lower pulmonary veins were both draining into the coronary sinus
CS - coronary sinus, LLPV - left lower pulmonary vein, LUPV - left upper pulmonary vein

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