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Case Report Open Access

Iatrogenic diversion of superior vena cava to left atrium after surgical repair of an atrial septal defect

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ABSTRACT

Iatrogenic diversion of the superior vena cava (SVC) into the left atrium during closure surgery for an atrial septal defect (ASD) is an extremely rare complication. Herein, we describe a 34-year-old woman with cyanosis who was surgically treated for ASD accompanied by partial anomalous pulmonary venous drainage one year prior. Following re-opening of the atrial defect, iatrogenic diversion of the SVC into the left atrium was intraoperatively identified. A Gore-Tex patch was inserted to divert the flow to the correct atrium.

Keywords: Atrial septal defect; iatrogenic; cyanosis; superior vena cava.

Partial anomalous pulmonary venous connection (PAPVC) to the right side of the heart often complicates surgery for atrial septal defects (ASD).[1] Although obstruction of the pulmonary venous drainage and superior vena cava (SVC) inflow are rarely seen after repair of ASD, iatrogenic diversion of the SVC into the left atrium (LA) has not been reported in the literature. Herein, we report an unusual case of iatrogenic diversion of the SVC to the LA after closure of a sinus venosus ASD of the SVC type.

CASE REPORT

A 34-year-old female patient was admitted to our clinic one year after surgical repair of the SVC type of sinus venosus ASD with complaints of mild exertional dyspnea and cyanosis of extremities with exertion. Her medical history revealed an open heart surgery at another center one year prior. On clinical examination, the patient had central cyanosis. Her clinical vital signs were normal and her arterial oxygen saturation was 85% on room air. Auscultation revealed no abnormality. Electrocardiography showed that the patient was in sinus rhythm with left axial deviation. A chest X-ray demonstrated cardiomegaly with clear lung fields. Transthoracic echocardiography (TTE) showed no leakage in the ASD patch. The inferior vena cava (IVC) was seen draining normally into the right atrium (RA). However, the SVC flow draining to the RA was unable to be definitely documented. Contrast echocardiography of the right antecubital vein was performed. The immediate contrast enhancement was achieved in the LA and the inter-atrial septum was intact. The SVC draining to the RA was not observed (Figure 1). Computed tomography (CT) angiography revealed SVC drainage to the LA with a non-obstructed flow and intact inter-atrial septum. The right upper pulmonary veins were also seen to drain to the SVC (Figure 2).

An informed consent was obtained from the patient. Re-median sternotomy and aortic-bicaval (selective SVC) cannulation were performed, and cardiopulmonary bypass was initiated. In the inspection of the venous anatomy, the right upper pulmonary veins drained into the SVC. After aortic cross-clamping and antegrade blood cardioplegia administration, right atriotomy was performed. The SVC ostium was unable to be visualized and a small residual ASD at the right side of the SVC into the RA was observed. After enlargement of the atrial defect, the pulmonary venous and systemic venous drainage abnormalities were identified. A Gore-Tex patch (W. L. Gore & Associates, Inc., Flagstaff, AZ) was inserted to divert the flow to the correct atrium. Contrasted transesophageal echocardiography (TEE) showed no residual defect (Figure 3).

The patient's oxygen saturation improved to 98-100% after surgery. Following an uneventful

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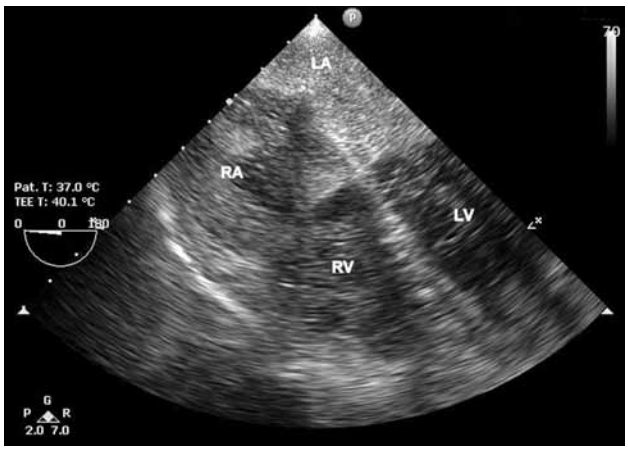

Figure 1. A preoperative transesophageal echocardiography image with contrast injected into the jugular vein. Contrast enhancement in the left atrium.

recovery, the patient was discharged on the postoperative fifth day. In the first follow-up visit at one month, she was symptom-free and in sinus rhythm and repeated electrocardiography (ECG) showed a normal right and left atrial anatomy with normal flow of SVC and pulmonary veins.

DISCUSSION

Partial anomalous pulmonary venous connection repair is a surgical procedure in which the pulmonary venous returns are separated from the systemic venous returns.[1] During this procedure, it is essential to consider the close association of the abnormal pulmonary veins with the IVC or SVC.[2] If it fails, iatrogenic systemic venous return anomalies and pulmonary venous return problems may occur. In addition, improper repair of those defects may result in significant surgical morbidity such as obstruction of the pulmonary vein orifices, SVC stenosis or obstruction, sinus node injury, and atrial bradyarrhythmias.[3]

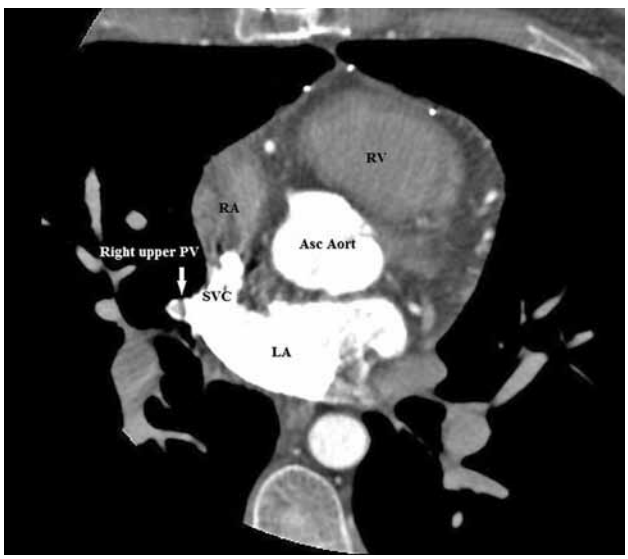

Figure 2. A computed tomography angiography image of the heart. The image showing an anomalous course of contrast from the superior vena cava to the left atrium. RV: Right ventricle; RA: Right atrium; PV: Pulmonary vein; Asc aort: Ascending aorta; SVC: Superior vena cava; LA: Left atrium.

Iatrogenic diversion of the IVC following repair of ASD is an uncommon complication of surgical repair of sinus venosus ASD with or without anomalous pulmonary venous drainage.[4] The presence of large secundum or sinus venosus type ASD or abnormal pulmonary venous return may increase the complication risk related to pulmonary or systemic venous return.[4]

Furthermore, reported cases with iatrogenic systemic venous anomaly presented primarily with cyanosis and hypoxia, which may occur immediately postoperatively or months to years after operation.[5-7] Until now, iatrogenic diversion of the SVC has not been reported in the literature. Our case presented with mild exertional dyspnea and cyanosis of extremities with exertion.

These types of serious complications can be prevented by some approaches in simple surgeries such as ASD with low morbidity and mortality rates. Therefore, it is critical to perform an effective preoperative evaluation, primarily by echocardiographic or cardiac imaging techniques.

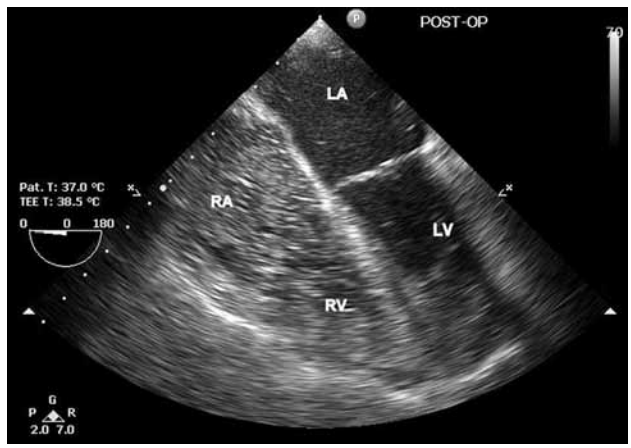

Figure 3. A postoperative transesophageal echocardiography image with contrast agent injected into the jugular vein. Contrast enhancement in the right atrium.

During ASD repair, cannulation can be selectively done above SVC or the right atrial appendix. In isolated ASD cases, there is no difference between these two cannulation strategies except surgical preference. Intra-atrial anatomy knowledge may further offer repair with both cannulation strategies. If pulmonary venous anomaly accompanies the defect, SVC should be carefully dissected and the draining pulmonary veins should be isolated. Selective cannulation above these pulmonary veins should be performed. As in selective caval cannulation in our case, it may produce pulmonary venous rerouting and provide convenience to the surgeon.

Moreover, sufficient exposure should be provided following right atriotomy in congenital cardiac defects requiring intracardiac repair. After right atriotomy, intra-atrial anatomy should be re-evaluated in detail. During the evaluation, the orifices of SVC and IVC, coronary sinus, tricuspid valve, and the margins of ASD should be identified. After the closure of ASD, the anatomical structures within the right atrium should be re-evaluated and it should be ensured that the repair is complete. After removal from cardiopulmonary bypass, intraoperative TEE should be done before decannulation. Any cyanosis identified during postoperative assessment is an indicator of a significant surgery-related complication (such as abnormal iatrogenic venous return).

In conclusion, PAPVC repair is a standard and common procedure which produces good treatment outcomes and low levels of associated morbidity. This case draws attention to this iatrogenic unusual complication secondary to surgical repair of sinus venosus ASD and anomalous pulmonary venous drainage. At each stage of the surgical procedure, cardiologists and cardiac surgeons should be aware of this extremely rare, but important complication to prevent a re-do surgery.

Declaration of conflicting interests

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REFERENCES

1. Gustafson RA, Warden HE, Murray GF, Hill RC, Rozar GE. Partial anomalous pulmonary venous connection to the right side of the heart. J Thorac Cardiovasc Surg 1989;98:861-8.
2. Alsoufi B, Cai S, Van Arsdell GS, Williams WG, Caldarone CA, Coles JG. Outcomes after surgical treatment of children with partial anomalous pulmonary venous connection. Ann Thorac Surg 2007;84:2020-6.
3. Trusler GA, Kazenelson G, Freedom RM, Williams WG, Rowe RD. Late results following repair of partial anomalous pulmonary venous connection with sinus venosus atrial septal defect. J Thorac Cardiovasc Surg 1980;79:776-81.
4. Staple TW, Ferguson TB, Parker BM. Diversion of the inferior vena cava into the left atrium following atrial septal defect closure. Am J Roentgenol Radium Ther Nucl Med 1966;98:851-8.
5. Thompson E, Moritz D, Perdue R, Cansino S. Diversion of the inferior vena cava following repair of atrial septal defect causing hypoxemia. Echocardiography 2004;21:329-32.
6. Beitzke D, Koestenberger M, Knez I, Beitzke A. Anomalous connection of the inferior vena cava to the left atrium: a surgical error in closing an atrial septal defect. Clin Res Cardiol 2008;97:191-3.
7. Desai M, Talwar S, Kothari SS, Jagia P, Airan B. Inferior vena cava to left atrium shunt presenting with polycythemia and stroke three decades following closure of atrial septal defect. Congenit Heart Dis 2013;8:102-5.