Right-sided superior vena cava draining into the left atrium in a patient with persistent left-sided superior vena cava emptying into the right atrium diagnosed by echocardiography

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We present a patient with an isolated right-sided superior vena cava draining into the left atrium with a persistent left-sided superior vena cava emptying into the right atrium. During an agitated saline injection into the patient's right upper extremity intravenous line, the patient suffered an acute transient ischemic attack. To our knowledge, this is the only reported case of this rare anomaly incidentally uncovered during an echocardiogram with saline contrast study.

Anomalous systemic venous connection with the left atrium (LA) is an unusual congenital cause of a right-to-left shunt. It is most commonly due to a persistent left-sided superior vena cava (SVC) draining into the LA (1). Less commonly, the right-sided SVC may drain into the LA. This occurrence is rare in the absence of other cardiac abnormalities (2). Here we present a rare cardiac congenital anomaly with double SVC drainage, with a right-sided SVC emptying into the LA and a persistent left-sided SVC emptying into the right atrium (RA).

CASE PRESENTATION

A 65-year-old man presented to the emergency department with a sudden onset of speech disturbances and left arm weakness. He was known to have had hypertension, pancreatitis, migraines, hyperlipidemia, and a cerebral brain abscess drained at the age of 22, resulting in a seizure disorder. He was not cyanotic. Due to his sudden onset of stroke symptoms, a transthoracic echocardiogram with agitated saline was done. A peripheral intravenous line in the patient's right antecubital vein was used to inject agitated saline and evaluate for intracardiac shunting. During echocardiographic imaging, the agitated saline immediately entered the LA, bypassing the right side of the heart (*Figure 1*). Immediately following the injection of agitated saline, the patient had a sudden onset of left-sided weakness and speech disturbances and was ultimately diagnosed with a transient ischemic attack. In preparation for a transesophageal echocardiogram, an additional peripheral intravenous line was placed in the left antecubital vein. When the agitated saline was injected into the left arm, imaging demonstrated that it entered into the RA normally. A computed tomographic angiogram of the chest demonstrated a double SVC. The persistent left SVC

Figure 1. Echocardiographic apical four-chamber view. The agitated saline completely fills the left heart chambers after right antecubital venous injection.

coursed through the left mediastinum and around the left side of the heart, where it emptied into the coronary sinus, which was significantly enlarged. This coronary sinus then emptied into the RA. The right SVC drained the right subclavian vein and coursed along the right mediastinum and emptied into the LA, just superior to the right upper pulmonary vein, producing a large right-to-left shunt (*Figure 2*). No significant connection

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Figure 2. Chest computed tomography shows the right superior vena cava draining into the left atrium, with the persistent left-sided superior vena cava (filled with contrast) draining into the right atrium inferiorly.

or communication was noted between the persistent left SVC and the right SVC. The patient recovered fully and was discharged after 1 week of hospitalization. Surgery was declined by the patient.

DISCUSSION

Persistent left SVC occurs in about 0.3% of the general population and in about 5% of patients with congenital heart disease. It is the most common form of anomalous systemic venous return (1). A left-sided SVC forms when the left anterior cardinal vein is not obliterated during normal fetal development. The persistent left SVC passes anterior to the left hilum

and lateral to the aortic arch before rejoining the circulatory system (3). The persistent left SVC drains into the coronary sinus or RA in 92% of patients. In the remaining 8%, the persistent left SVC drains into the LA. A right-sided SVC is present in 82% to 90% of patients with a persistent left SVC; in about 30% of these patients, the left innominate vein is present (4). This usually drains into the RA. A right-sided SVC that drains into the LA is a rare congenital abnormality, and only a few cases have been reported. In our patient, due to the injection of agitated saline into the right antecubital vein, the agitated saline traveled through the right SVC and then drained directly into the LA. These saline bubbles may have acted as small air emboli, progressing to the brain, resulting in a transient ischemic attack. If the intravenous access would have been in the left arm during the echocardiogram with agitated saline, the anomaly most likely would not have been identified, and the systemic venous-arterial connection may have been missed. When an agitated saline study was performed from the left upper extremity, transesophageal imaging demonstrated normal drainage through the left SVC into the RA.

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