Robotic-assisted two-patch repair of right partial anomalous pulmonary venous connection and sinus venosus defect

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Partial anomalous pulmonary venous connection (PAPVC) consists of an abnormal drainage of 1 or more pulmonary veins into the systemic venous system. The incidence of PAPVC has been reported to be between 0.6% and 0.7%, and it is commonly associated with a sinus venosus atrial septal defect (ASD). Initial presentation in adulthood remains uncommon.

Surgical repair can be successfully achieved via caval division and reconnection (Warden procedure), or a 2-patch technique to close the ASD while baffling the anomalous pulmonary venous return to the left atrium and expanding the cavoatrial confluence. The current case is a 2-patch repair performed robotically.

Clinical Summary

A 114-kg, 30-year-old active male laborer with a body mass index of 33 kg/m² with no previous history of congenital or adult illness presented with increasing dyspnea on exertion with New York Heart Association class 3 symptoms. Transthoracic echocardiography identified a large ASD with significant enlargement of both the right atrium and right ventricle. This was further identified by transesophageal echocardiography (TEE) and computed tomography angiography to be a right PAPVC draining both the right upper lobe and middle lobe into the posterior superior vena cava (SVC) 1.5 cm proximal to the cavoatrial junction via a sinus venosus defect. The patient was referred for correction, and he desired non-sternotomy possibilities. Fully informed consent was obtained for both sternotomy and minimally invasive options.

The patient was prepared with double-lumen endotracheal intubation, right internal jugular central line, and left upper-extremity arterial line. Cannulation was performed using Seldinger techniques and TEE guidance. The left internal jugular vein was cannulated with a 17-French cannula and positioned in the mid innominate vein. The right common femoral artery was cannulated with a 25-French multistage venous cannula and the tip positioned in the mid right atrium. The right common femoral artery was cannulated with 19-French arterial cannula. A 4-cm right thoracotomy accessed the fourth intercostal space at the level of the anterior axillary line. The
The pericardium was incised 4 cm anterior to the phrenic nerve and retracted laterally. Cardiopulmonary bypass (CPB) with vacuum-assisted drainage was instituted, and an aortic root vent was placed. A left ventricular vent was placed under TEE guidance via right inferior pulmonary vein. The DaVinci Xi robotic surgical system (Intuitive Surgical, Sunnyvale, Calif) was docked and its arms were introduced through 3 ports in the third, fifth, and seventh intercostal space. The distal ascending aorta was crossclamped and myocardial arrest was achieved and maintained with antegrade blood cardioplegia.

Under full robotic assistance, the lateral SVC was curvilinearly incised from the level of the azygous vein to the mid right atrium. The sinus venosus ASD and its confluence with the right upper lobe and right middle lobe PAPVC resulted in a defect of the posterior wall of the SVC and atrial septum measuring 3.5 × 4.5 cm (Figure 1). This area was baffled with a bovine pericardial patch using running 4-0 polypropylene suture (Figure 2). After de-airing, a second elliptical patch was used for a closure of the SVC to enlarge the cavoatrial junction (Figure 3 and Video 1). Atrial and ventricular pacing wires were robotically placed and the crossclamp removed. The patient was weaned off CPB in sinus rhythm. Crossclamp time was 141 minutes and total CPB time was 190 minutes.

The patient was extubated in the operating room and transferred to the intensive care unit. He was discharged on the fifth postoperative day in sinus rhythm. At 30-day clinical follow-up, he was in New York Heart Association class 1, normal sinus rhythm, with a normal right ventricle size and no residual defect by transthoracic echocardiography.
echocardiography, and a widely patent SVC. At 6 months, the patient is symptom free and he is working as a hard laborer without difficulty or dyspnea. Patient consent was obtained to contribute this experience.

**DISCUSSION**

Surgical repair of PAPVC and ASD using a 2-patch technique requires creating a baffle to direct anomalous pulmonary venous drainage to directly enter the left atrium and a second patch so as not obstruct the SVC or pulmonary veins.1 Robotically assisted right chest approach to intracardiac surgery has been showed to be safe, effective, and may be equivalent to sternotomy in experienced centers.4 Other attempts have been made at single-patch robotic approaches to ASD repair with or without the presence of a left sided SVC.5 6

Onan and colleagues7 performed a successful robotic single patch closure of a 1.4 × 2.0-cm secundum ASD and PAPVC defect in a 20 year old female patient. Our patient was a robust 114-kg male patient with a proximal sinus venous defect and high insertion of both the upper and middle lobe veins, in whom we felt that preserving unobstructed SVC flow was essential. Therefore, a 2-patch technique was selected and performed robotically facilitated by vacuum-assisted drainage without snaring. The patient successfully returned to work 6 weeks following his operation.

**CONCLUSIONS**

Robotically assisted right PAPVC and ASD repair with a 2-patch technique can be performed safely in the adult.

**References**

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