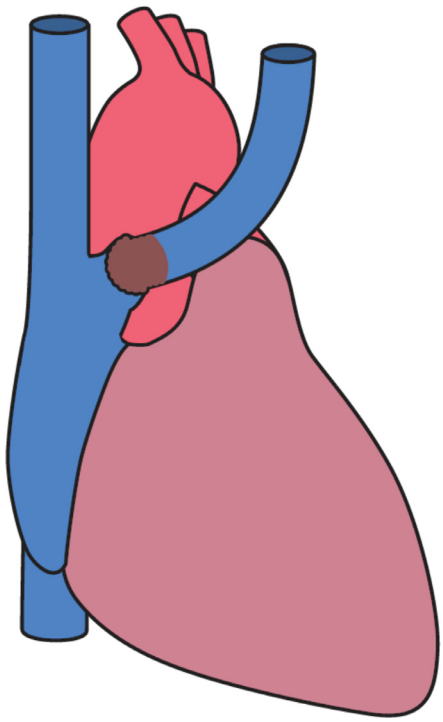
Extracardiac Rerouting of Left Superior Vena Cava to Right Atrium

Siddartha C. Rudrappa, MCh, Neeraj Aggarwal, MD, Reena Joshi, MD, and Raja Joshi, MCh

Rerouting of persistent left superior vena cava is necessary in correction of certain congenital cardiac conditions. Techniques previously described involve either an "intracardiac" baffle or an "extracardiac" connection between the left superior vena cava and the right atrium or its appendage or the right superior vena cava. We present a modification of the extracardiac technique, utilizing flaps of right and left atrial appendages in construction of the extra-anatomic tube. Using this technique in 7 patients, we obtained a tension-free, oblique anastomosis with vascular tissue circumferentially and potentially preserving growth.

Semin Thoracic Surg 31:571–572

Keywords: Left superior vena cava, Dilated coronary sinus



Extracardiac rerouting of the left superior vena cava to the right atrial appendage.

Central Message

A technique of extracardiac rerouting of left superior vena cava to the right atrium using autologous vascular tissue and preserving growth potential.

INTRODUCTION

Persistent left superior vena cava (LSVC) usually drains to the right atrium (RA) via an intact coronary sinus, which dilates to accommodate the left brachiocephalic systemic venous return. Occasionally, the dilated coronary sinus overhangs the mitral valve significantly enough to cause left ventricle (LV) inflow obstruction.[1] LSVC in association with unroofed coronary sinus requires routing to the systemic atrium during repair of various cardiac lesions. We describe a reproducible method, which was employed in 7 children with LSVC and absent innominate vein. Five of them had an unroofed coronary sinus, while the rest had the coronary sinus dilated, causing LV inflow obstruction.

TECHNIQUE

After a median sternotomy and thymectomy, LSVC was dissected up to the subclavian vein. The hemizygous vein and other mediastinal tributaries were divided, while the left phrenic nerve was safeguarded. Cardiopulmonary bypass was established with standard techniques of cannulation. LSVC was cannulated in its extrapericardial portion. After correction of the primary pathology under myocardial arrest, LSVC was disconnected from the roof of left atrium (LA) along with left atrial appendage (LAA) in continuity (Fig. 1A). The defect in the LA was closed directly and the aortic cross clamp was released. A wide flap was obtained by filleting open the LAA (Fig. 1B and C) and another 2 cm wide flap was raised from the base of the anterior wall of right atrial appendage (RAA; Fig. 2A). Thick obstructive pectinate muscles in both the appendages were excised. An anastomosis was made between LSVC and RA using the flap from LAA as its anterior wall and flap from RAA as its posterior wall, taking precautions to prevent distortion and axial rotation (Fig. 2B). CPB was weaned thereafter.

In patients with LV inflow obstruction, the dilated coronary sinus was unroofed transatrially and later LSVC was divided and procedure completed as described above.

All patients were followed up for a median duration of 14 months (range 10–24 months) without any anticoagulation.

Department of Pediatric Cardiac Sciences, Sir Ganga Ram Hospital, New Delhi, India

Funding: There are no financial disclosures to be made.

Conflicts of Interest: There are no conflicts of interest among the authors.

Address reprint requests to C.R. Siddartha, MCh, Department of Pediatric Cardiac Sciences, Sir Ganga Ram Hospital, Old Rajendar Nagar, New Delhi 110060, India. E-mail: siddartha.cr@gmail.com

https://doi.org/10.1053/j.semtcvs.2019.04.009

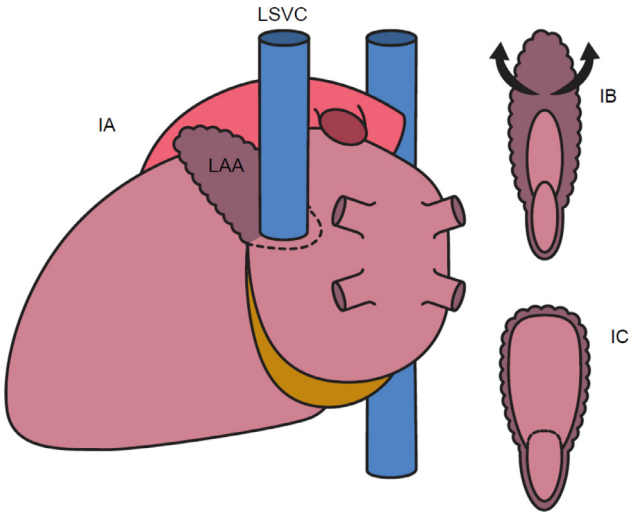


Figure 1. (A) The LAA is harvested in continuity with LSVC while safeguarding the left superior pulmonary vein and the circumflex artery. (B and C) Flap is created from the LAA after filleting open and excising the obstructive pectinate muscles. LAA, left atrial appendage; LSVC, left superior vena cava.

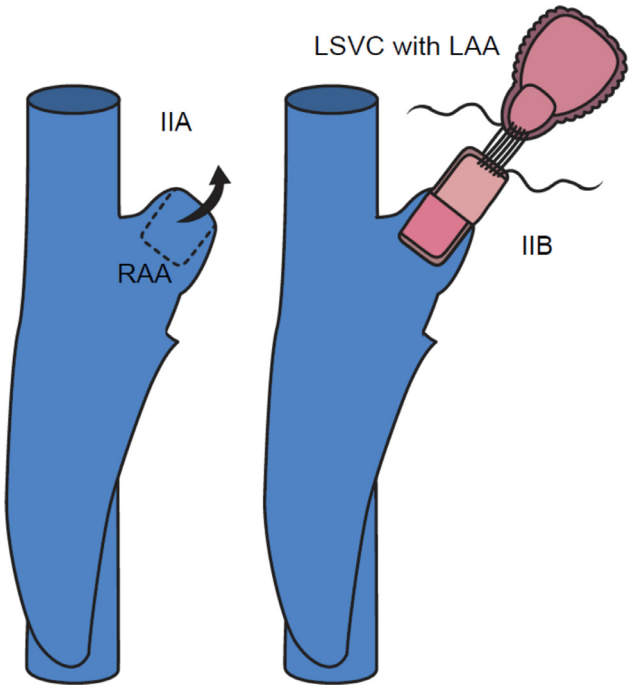


Figure 2. (A) A wide-based right atrial appendage flap is raised to form the posterior wall of the anastomosis. (B) Anastomosis of the right atrial appendage to the left superior vena cava and left atrial appendage flap. LAA, left atrial appendage; LSVC, left superior vena cava; RAA, right atrial appendage.

All had patent anastomosis with no evidence of flow acceleration on echocardiography.

COMMENT

Various techniques have been described for routing of the LSVC to the right atrium. The intracardiac techniques involve creation of tunnel and reconstruction of atrial septum in different planar axis. These require 3-dimensional planning and the procedure to be done under myocardial arrest and run a risk of obstruction or occlusion of the long term.

In contrast, the extracardiac routing of LSVC to RAA can be performed with the heart beating. Reddy et al in their report preferred to route the LSVC behind the aorta, akin to a retroaortic innominate vein.[2] This becomes difficult in the presence of dilated aorta or pulmonary artery. Ugaki et al alternatively described the LSVC to be taken superior to aorta for anastomosis.[3] Even though, they have good patency on follow-up, redirecting a larger LSVC blood flow through a smaller right SVC may cause some degree of cerebral venous congestion in the postoperative period. Moreover, the length of the LSVC is not always adequate to perform a tension-free anastomosis.

In order to obtain a tension-free routing of LSVC to RAA, due to the inconsistency of the length of the latter, a RA flap is created posteriorly and augmentation of the anterior surface is done with a pericardial patch.[4] In order to avoid a pericardial patch, the use of a cuff of LA wall in continuity with the LSVC increases the length enabling to perform a direct RAA anastomosis.[5] We feel the proximity of the left superior pulmonary vein may not allow a large cuff of LA to be excised, and a circumferential cuff does not add to the length of LSVC significantly. However, these techniques would result in a retrosternal venous structure anterior to the aorta, which might be at risk during sternal re-entry.

Harvesting the LAA in continuity with LSVC provides great flexibility to adjust the length of the conduit. We aligned the LSVC in the direction of RAA and the gap in between guided the length of the RAA flap to be raised to perform the anastomosis. This manoeuver ensured us that we always had the length required and at times we had to cut short a fragment on the LAA while performing the anastomosis. The resulting conduit lay on a gentle curve without any axial torsion which ensured the good patency on follow-up. Although, our technique has the same pitfall of having a retrosternal venous channel, the advantage of fashioning the endothelium lined native vascular tissue conduit with the appendages provides flexibility to create a wide and tension-free anastomosis consistently, which retains its growth potential and not require any anticoagulation.

REFERENCES

1. Di Bardino D, Fraser C, Dickerson H, et al: Left ventricular inflow obstruction associated with persistent left superior vena cava and dilated coronary sinus. J Thorac Cardiovasc Surg 127:959–962, 2004
2. Reddy V, McElhinney D, Hanley F: Correction of left superior vena cava draining to the left atrium using extracardiac techniques. Ann Thorac Surg 63:1800–1802, 1997
3. Ugaki S, Kasahara S, Fujii Y, et al: Anatomical repair of a persistent left superior vena cava into the left atrium. Interact Cardiovasc Thorac Surg 11:199–201, 2010
4. Erek E, Aydin S, Suzan D: Right atrial flap repair for left superior vena cava draining into left atrium. Thorac Cardiovasc Surg 64:059–061, 2016
5. Vargas F, Rozembaum J, Lopez R, et al: Surgical approach to left ventricular inflow obstruction due to dilated coronary sinus. Ann Thorac Surg 82:191–196, 2006