

Off-pump atrial septostomy with thoracoscopic scissors under transesophageal echocardiography guidance

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ABSTRACT

Selected children with congenital heart defects undergoing palliative closed heart procedures require a cardiopulmonary bypass (CPB) run only for the purpose of creating an inter-atrial communication. We report a simple technique of atrial septostomy using thoracoscopy scissors under transesophageal echocardiography guidance without the need for CPB.

Keywords: Atrial septostomy, off-pump technique, pulmonary artery band, single ventricle

INTRODUCTION

Selected palliative closed heart operations such as a pulmonary artery (PA) band and Blalock-Taussig (BT) shunt sometimes require a cardiopulmonary bypass (CPB) run, only to facilitate creation of an inter-atrial communication. This is often needed when the patent foramen ovale is restrictive or absent and one of the atrioventricular (AV) valves is stenotic or atretic. Alternatively, these patients require creation of an atrial opening in the cardiac catheterization laboratory. Catheter-based techniques tend to be relatively unreliable unless a stent is used.^[1] Stenting of the atrial septum is risky and technically challenging, especially in very young patients.^[2]

We report an off-pump technique to perform atrial septostomy under transesophageal echocardiography (TEE) guidance using thoracoscopic scissors. Our technique is possibly a simpler way to perform septostomy without CPB and its adverse effects.

CASE REPORT

An 8-month-old female child with single ventricle physiology (double-inlet left ventricle) with hypoplastic

mitral valve (9 mm, Z score = -2.44) and intact atrial septum and unobstructed pulmonary blood flow needed PA banding and creation of an inter-atrial communication.

After detailed evaluation of the child and taking informed consent from her parents, the child was prepared under anesthesia as for open-heart surgery and the procedure was carried out through a median sternotomy. The patient was heparinized. A purse-string suture was made on the right atrial (RA) appendage. A stab was made within the purse string, and through this, thoracoscopy scissors [Figure 1] was introduced in the RA. Under TEE guidance, the closed tip of the instrument was used to tent the fossa ovalis below the limbus [Figure 2a] and a small perforation was created. It was then dilated

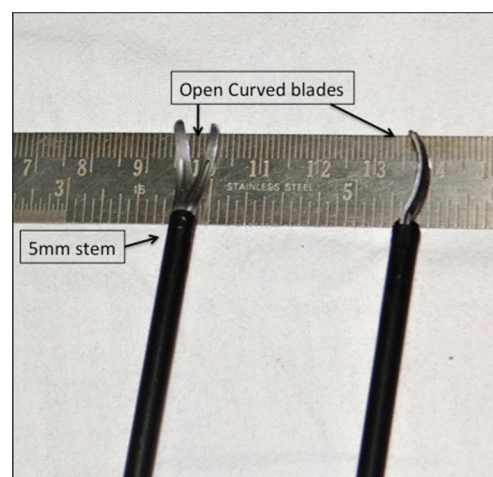


Figure 1: Photograph of the thoracoscopic scissors in the open position (left) and in the closed position

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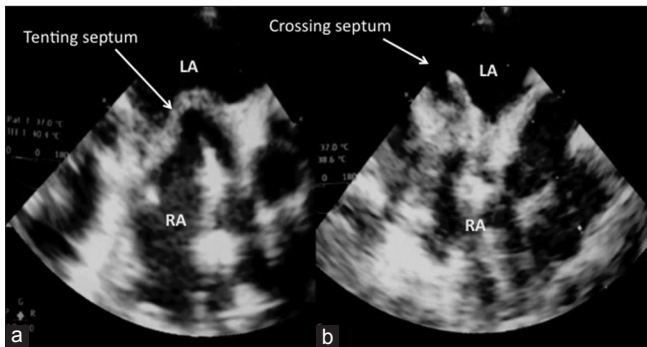


Figure 2: Intraoperative transesophageal echocardiography of the procedure: The tips of the scissors are shown tenting the inter-atrial septum (a) and subsequently passing into the left atrium (LA) through the atrial septum (b)

by stretching with the opening of the blades of the scissors [Figure 2b]. The orifice was assessed and found to be restrictive with a peak gradient of 4 mmHg and a mean gradient of 2 mmHg.

The scissors was then rotated to face inferiorly with one blade on either side of the inter-atrial septum, and two cuts were made in the inferior and lateral directions, away from the AV valves and conduction tissue, creating an orifice of maximum size 9 mm with free laminar flow across the resulting defect [Figure 3]. PA banding was done as per Trussler's formula to 27mm.

The child recovered uneventfully and was discharged from the hospital on the 6th postoperative day. The PA band gradient on the pre-discharge echo was 60 mm Hg. At 1 month follow-up, the child was well and symptom free with an oxygen saturation of 92%. The child had gained 0.5 kg in the 1 month following discharge. The follow-up echo at 1 month showed a band gradient of 50 mm Hg. The atrial septal opening measured 9 mm with laminar flows across the defect. A bidirectional Glenn shunt is planned in the subsequent 3-6 months.

DISCUSSION

Surgical procedures like PA banding, bidirectional Glenn shunt, or BT shunt sometimes need an atrial septostomy to enable good mixing or decompression of the left atrium. Traditionally, this is performed through a brief CPB run. The additional use of CPB is inherently associated with specific risks from exposure to non-endothelialized tubing with resultant systemic inflammatory response. Additionally, there is an unavoidable exposure to donor blood. Further, it is a source of considerable expense in a limited resource environment.

While it is possible to use catheter-based techniques such as atrial septostomy, blade septostomy, static balloon dilation, and atrial septal stenting to create an atrial septal communication, this necessitates an additional

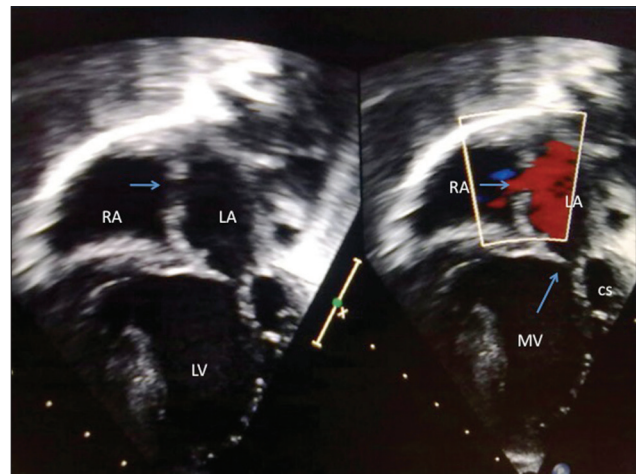


Figure 3: Pre-discharge transthoracic echocardiogram shows the atrial septal opening. Color Doppler (right frame) shows a laminar flow across the atrial septum

procedure. Success with balloon atrial septostomy is limited to neonates. In older children with thick septum, blade atrial septostomy is possible but seldom performed because of its inherent risks. Static balloon dilation is unlikely to create a reliable atrial septal defect. Atrial septal stenting can potentially provide a reliable opening^[1] but is technically very challenging and associated with risks.^[2]

Closed-heart methods of creation of atrial septal defect have been previously described.^[3-5] The first technique described was the Blalock Hanlon septectomy.^[3] This involves snaring of right pulmonary veins and right pulmonary artery and has been associated with complications such as arrhythmias, pulmonary hemorrhage, and neurological insult. More recent techniques include the use of a Brock punch under TEE guidance^[4] and a specially designed atriotomy knife through a thoracotomy.^[5]

Our technique of atrial septostomy using thoracoscopic scissors under transesophageal echocardiography guidance is relatively simple and has the following advantages:

1. The narrow body of the instrument requires only a small stab incision on the RA. The manipulation of this slender instrument was well tolerated and there was no arrhythmia or bleeding with minimal risk.
2. It is well controlled and visible on TEE.
3. Avoidance of CPB is possible, with a low chance of injury to the neighboring structures.

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