

# Repair of Recurrent Patent Ductus Arteriosus in an Adult with Cardiopulmonary Bypass

Harun Arbatli, M.D.,\* Uğur Özbek, M.D.,\*\* Ergun Demirsoy, M.D.,\*  
Mehmet Ünal, M.D.,\* Naci Yağan, M.D.,\* and Bingür Sönmez, M.D.\*

\*Department of Cardiovascular Surgery, Memorial Hospital, İstanbul, Türkiye

\*\*Department of Anesthesiology, Kadir Has University, Florence Nightingale Hospital, İstanbul, Türkiye

**ABSTRACT** Recurrence of ductal patency is a rarely encountered complication in surgical repair of patent ductus arteriosus (PDA). An adult patient with ductal recurrency underwent closure of ductus by using cardiopulmonary bypass via transpulmonary approach. She had significant improvement of symptoms and no residual shunt or pseudoneurysm seven months after surgery. (*J Card Surg* 2003;18:17-19)

## INTRODUCTION

Ligation of patent ductus arteriosus (PDA) became an available method for PDA treatment when the technical modification of multiple transfixion suture ligation was suggested by Blalock in 1946.<sup>1</sup> Currently, the incidence of recurrent or persisting ductal patency is rarely observed when division or appropriate ligation techniques are used.<sup>2</sup> Residual shunt after ductal interruption is usually trivial and does not lead to hemodynamic compromise. However, it carries the risk of endocarditis.<sup>2</sup>

A 43-year-old female was admitted to the hospital with symptoms of breathlessness and palpitation. She had been operated for PDA 17 years ago, and ligation of the ductus had been carried out via left posterolateral thoracotomy. Electron beam tomography revealed a recurrent ductus

with 6 mm transverse diameter and slightly dilated ascending aorta (Fig. 1). Coronary angiography was normal. The ratio of pulmonary blood flow to systemic flow ( $Q_p/Q_s$ ) was 2.2.

## OPERATIVE TECHNIQUE

Transesophageal echocardiography (TEE) was done with a multiplane probe and colorflow doppler echocardiography for ductal visualization (Fig. 2). Midline sternotomy was performed and cardiopulmonary bypass (CPB) was established with aortic and bicaval cannulation. External digital compression was applied to occlude the ductus and prevent pulmonary overflow while the temperature was reduced to 20°C. Caval snares were tightened, total CPB was achieved, and pulmonary artery was opened longitudinally. A 6F embolectomy catheter was inserted through the ductus and inflated to prevent ductal backflow (Figs. 3a and 3b). Pledged 4/0 polypropylene sutures were used to occlude the orifice. Pump flow was transiently lowered to half-flow and care was taken to avoid damage to the balloon during suture placement. Balloon was removed, pulmonary

Address for Correspondence: Dr. Harun Arbatli, İstanbul Memorial Hastanesi, Erişkin KVC, A Blok AT Kati, Piyale Paşa Bulvarı 80270, Okmeydanı Şişli, İSTANBUL. Tel: 0090 212 2208910, Fax: 0090 212 2107143; e-mail: harbatli@hotmail.com



**Figure 1.** Ductal patency detected by electron beam tomography.

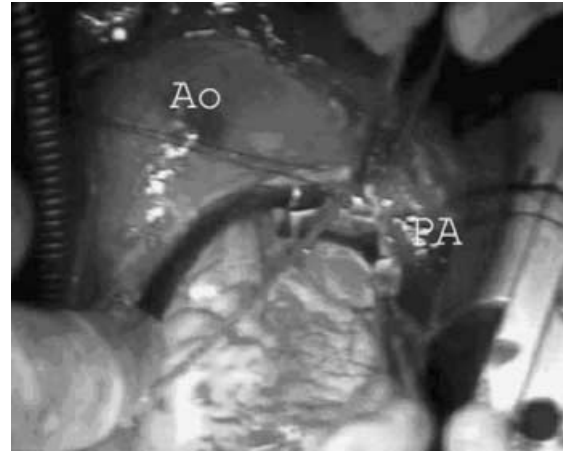
arteriotomy was closed and the patient weaned from bypass. TEE confirmed no residual shunt before chest closure (Fig. 4).

#### POSTOPERATIVE COURSE

The patient had a short episode of atrial fibrillation controlled with IV diltiazem infusion on the third postoperative day. She was discharged on the eighth postoperative day. At seven months postsurgery she is in NYHA class I and no residual shunt or pseudoneurysm has been detected by echocardiography.



**Figure 2.** PDA visualized by intraoperative TEE.



**Figure 3a.** An embolectomy catheter was inserted through the ductus via pulmonary arteriotomy to stop ductal backflow. Ao-aorta; PA-Pulmonary artery.

#### COMMENT

Ligation is a simple and safe method for the treatment of PDA in the pediatric age group.<sup>3</sup> By using the proper technique, the incidence of recanalization is extremely low.<sup>3,4</sup> Stark and De Leval reported 4 cases in their series including 936 patients (0.43%) and they presumed the recurrence of PDA to be the result of incomplete ligation rather than recanalization.<sup>2</sup>

Our patient was operated on in adult age and the inadequate ligation of the wide and short ductus was the most probable cause of recurrence. We preferred to reoperate on the patient via



**Figure 3b.** TEE image of inflated balloon occluding the ductus.



**Figure 4.** TEE confirmed complete ductal closure intraoperatively.

median sternotomy with the aid of CPB. There were two major reasons for this preference. First, the ductus is usually calcified and friable in adult patients; second, the recurrent laryngeal nerve is susceptible to injury in reoperations. On the other hand, the pulmonary artery wall at the end of the short ductus is resistant to holding the sutures well.

We used the balloon occlusion technique in an adult patient reported previously by Bhati to occlude the ductus in children with concomitant congenital cardiac lesions.<sup>5</sup> Moderate hypothermia was used and the pledged sutures were placed in short periods of low-flow state without cross-clamping the aorta.

Although profound hypothermia and circulatory arrest or low-flow perfusion was the preferred method for some authors,<sup>6,7</sup> the balloon occlusion technique on the CPB was the easiest way to control the ejecting blood through the defect while placing the sutures.<sup>8</sup> Balloon catheter breakage was the probable complication during suture placement and may cause air embolization if it is inflated without removing the whole air bubbles. On the other hand, reducing the pump flow

and pushing the catheter slightly inwards exposes the ductal ostium for placing the safe sutures. TEE was also used to confirm the adequacy of the repair before weaning from bypass.

We report the successful repair of a recurrent PDA in an adult with CPB without cross-clamping the aorta in this article. The balloon-occlusion method facilitated the procedure and obviated the need for deep hypothermia and circulatory arrest. This approach provided an easy and reliable repair in a rarely encountered late complication of PDA ligation procedure.

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