# Acute aortic insufficiency and its surgical treatment early after arterial switch operation: a report of two cases

## *Arteryel switch ameliyatı sonrasında erken dönemde gelişen akut aort yetersizliği ve cerrahi tedavisi: İki olgu sunumu*

**Ersin Erek, Yusuf Kenan Yalçınbaş, Tayyar Sarıoğlu**

Department of Cardiovascular Surgery, Acıbadem Bakırköy Hospital, İstanbul

Arterial switch operation is preferable in the presence of resectable subpulmonic stenosis in patients with transposition of the great arteries. We present two patients, aged 6 and 4 years, respectively, who developed acute aortic insufficiency and pulmonary edema early after arterial switch operation with subpulmonic resection. Neoaortic valve replacement with posterior annular enlargement was performed in the early postoperative period. The patients were in NYHA functional class I and II after postoperative 24 and 16 months, respectively. Possible causes of acute aortic insufficiency following arterial switch operation and treatment alternatives are discussed.

*Key words:* Aortic valve/surgery; child; heart septal defects, ventricular/surgery; postoperative complications; transposition of great vessels/surgery; ventricular outflow obstruction/surgery.

Arteryel *switch* ameliyatı, rezektabl subpulmonik darlık varlığında, büyük arterlerin transpozisyonu bulunan hastalarda tercih edilen bir yaklaşımdır. Bu yazıda, subpulmonik rezeksiyon ile birlikte arteryel *switch* ameliyatından sonra erken dönemde akut aort yetersizliği ve akciğer ödemi gelişen iki hasta (yaş 6 ve 4) sunuldu. Hastalara acil olarak posterior annulus genişletmesi ile birlikte neoaortik kapak replasmanı uygulandı. Ameliyattan 24 ve 16 ay sonra hastaların NYHA fonksiyonel durumu sırasıyla sınıf I ve II idi. Yazıda, arteryel *switch* ameliyatı sonrasında akut aort yetersizliğinin olası nedenleri ve tedavi seçenekleri tartışıldı.

*Anahtar sözcükler:* Aort kapağı/cerrahi; çocuk; kalp septal defekti, ventriküler/cerrahi; ameliyat sonrası komplikasyon; büyük arterlerin transpozisyonu/cerrahi; ventrikül çıkış yolu tıkanıklığı/cerrahi.

Arterial switch operation is a preferable procedure in the presence of mild or resectable left ventricular outflow tract anomalies in patients with transposition of the great arteries.[1] Although satisfactory mid- to long-term results have been documented after arterial switch with bicuspid, nonobstructive neoaortic valve, or resected left ventricle outflow tract obstruction,[2] the fate of the neoaortic valve is not well known.

We presented two cases with transposition of the great arteries and subpulmonic stenosis, in which acute aortic insufficiency and pulmonary edema developed in the early postoperative period after successful arterial switch and subpulmonic resection. Both patients were successfully treated with aortic valve replacement with posterior aortoplasty.

## CASE REPORT

***Case 1–*** A six-year-old girl who had transposition, subpulmonic stenosis, and restrictive remote ventricular septal defect underwent arterial switch operation with ventricular septal defect closure and subpulmonic resection. A usual coronary pattern and trileaflet neoaortic valve were observed during the operation. Operative and early postoperative course was uneventful except for complete heart block and the patient was extubated at 36 hours. During the postoperative period, the patient required intensive diuretic therapy and continuous mild-to-moderate inotropic support due to recurrent pulmonary congestion. Permanent pacemaker implantation was performed on postoperative day 12. Echocardiographic examination showed mild-to-moderate aortic valve insufficiency, moderate mitral valve insufficiency, and good left ventricular function. The patient underwent reoperation on postoperative day 23 for the correction of aortic and mitral valve insufficiency.

During reoperation a competent neoaortic valve could not be obtained by repair and the valve was resected. Posterior annular enlargement was performed

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Correspondence: Dr. Ersin Erek. Halit Ziya Uşaklıgil Cad., No: 1, 34140 Bakırköy, İstanbul., Turkey.
Tel: +90 212 - 414 44 08 e-mail: eerek@asg.com.tr

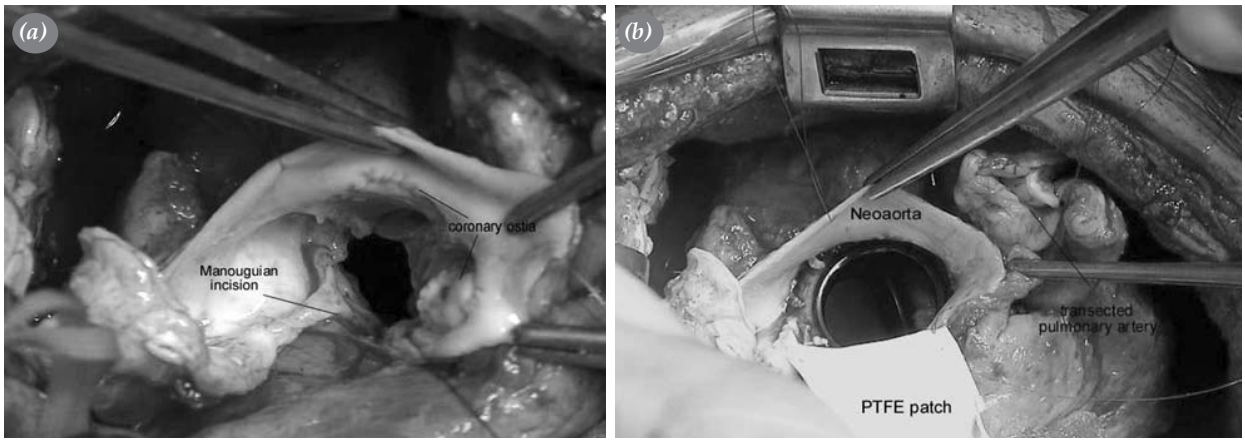


**Fig. 1. (a)** Manouguian-like incision in the neoaorta. **(b)** Mechanical valve was implanted after reconstruction of the posterior aortotomy incision with PTFE patch material (Case 1).

with the Manouguian procedure to be able to implant a mechanical aortic valve of the smallest size available. Aortotomy incision was advanced across the neoaortic annulus towards the anterior leaflet of the mitral valve, slightly to the left of the commissure between the non-facing sinus and the right-facing sinus (Fig. 1a). This incision was reconstructed with a polytetrafluoroethylene patch and a 17-mm HP St. Jude mechanical valve was implanted by using interrupted matress sutures (Fig. 1b). Then, the mitral valve was exposed via a transseptal approach. A cleft in the anterior leaflet was detected and repaired with interrupted sutures. The postoperative course was uneventful. The patient was discharged on day 7 after reoperation. She was followed-up for 24 months and her functional capacity was class I.

***Case 2–*** A four-year-old boy with transposition and subpulmonic stenosis underwent arterial switch and subpulmonic resection. The right-facing sinus leaflet of the pulmonary artery (neoaorta) was slightly hypoplastic, but coaptation of the leaflets was almost normal. The sinotubular junction was enlarged due to poststenotic dilatation (Fig. 2). The fibromuscular ring causing subpulmonic stenosis was resected and a standard arterial switch operation was performed with the usual coronary pattern. The patient was weaned from cardiopulmonary bypass with the standard-dose inotropic support. Intraoperative transesophageal echocardiography showed mild aortic insufficiency and good left ventricular function with widely open left ventricular outflow tract.

Hemodynamic performance of the patient was satisfactory with standard inotropic support. Six hours after the operation, acute pulmonary edema and hypotension developed. Echocardiographic examination showed aortic insufficiency as the possible cause of deterioration. An emergency reoperation was performed and the aortic valve was replaced with a 17-mm HP St. Jude valve. As in the first case, posterior annular enlargement was also needed to enlarge the neoaortic annulus. Because of the difficulty in weaning from cardiopulmonary bypass, left ventricle assist circulation was conducted for 48 hours with a roller pump from the left ventricle apex to the ascending aorta. Tracheotomy and ventilatory support were necessary for 20 days postoperatively due to pulmonary infection. The patient was discharged on postoperative day 35 and was followed-up for 16 months, at which time his functional capacity was class II.

## DISCUSSION

The presence of left ventricular outflow tract obstruction has significant impacts on the timing and technique of transposition repair. The anatomic features of the obstruction may be more important than the left ventricular outflow tract gradient.[3] Although there are some reports presenting favorable results with arterial switch and left ventricular outflow tract obstruction resection, the fate of the neoaortic valve is not well

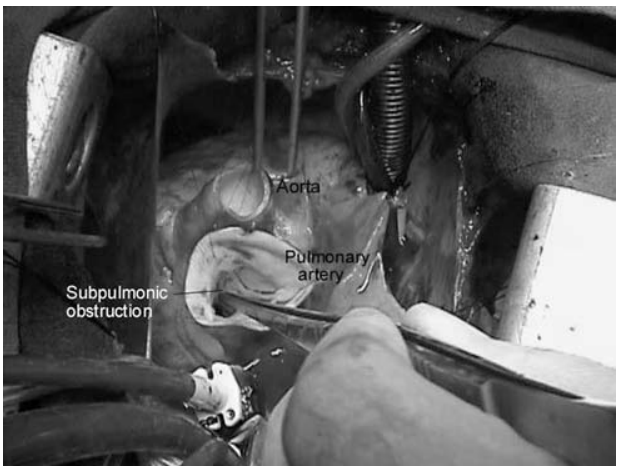


**Fig. 2.** Prominent sinotubular junction dilatation and mild aortic valvular anomaly (Case 2).

known. This condition may have some potential risks as in our two cases. Aortic insufficiency is poorly tolerated in these patients, because left ventricular hypertrophy and diastolic dysfunction might have developed due to pressure overload over time preoperatively. Poststenotic dilatation of the pulmonary artery (neoaorta) due to systolic jet into the pulmonary artery may develop with increasing age in some patients with transposition and subpulmonic obstruction and this may cause abnormalities in the neoaortic valve morphology and geometry such as dilatation of the sinus of Valsalva and sinotubular junction. From the recent experiences with the Ross operations, we already know that sinotubular junction dilatation may cause aortic insufficiency particularly when the valve functions against the systemic pressure. [4] This may be especially true for children of older ages like our cases who were referred late from rural areas of the country.

No case of Manouguian-like posterior annular enlargement for transposition has been reported in the literature. The most important lesson we have learned from our two cases is that neoaortic valve replacement with posterior annular enlargement is feasible in transposition thanks to pulmonary-mitral continuity that prevails in most of the transposed hearts.

Homograft implantation may be another option. However, the scarcity of homografts restricts their use, and accelerated degeneration and calcification of homografts in pediatric patients pose another potential problem.[5] The "switch-back" procedure described by Hazekamp et al.[6] would be another option. They used the pulmonary valve (original aortic valve) to replace the aortic valve in a patient with aortic insufficiency that developed late after arterial switch operation.

del Nido et al.[7] suggested aortic root autograft with arterial switch (Switch-Ross-Konno) procedure as a primary procedure in patients with transposition and left ventricular outflow tract anomalies. It involves aortic root translocation with coronary transfer for reconstruction of the left ventricular outflow tract and right ventricle outflow tract reconstruction with a homograft or heterograft. More recently, Morell et al.[8] reported excellent results in 13 patients treated with this technique. Although technically demanding, this procedure seems to be appropriate and we think that it should be considered in the management of patients with transposition of the great arteries, ventricular septal defect, and left ventricle outflow tract obstruction, especially in the presence of neoaortic valve abnormality and the possibility of neoaortic valve insufficiency.

In conclusion, acute aortic insufficiency may develop early after arterial switch operation in patients with transposition, subpulmonic pulmonary stenosis, and poststenotic dilatation of the pulmonary artery. Neoaortic valve replacement with posterior annular enlargement is feasible and may be life saving in these patients. On the other hand, the Switch-Ross-Konno procedure should be considered as another primary alternative surgical option in patients with transposition and left ventricular outflow tract anomalies.

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