

Successful percutaneous transluminal balloon angioplasty and thrombolysis of a thrombosed bovine mesenteric venous graft after a modified Blalock-Taussig shunt

Modifiye Blalock-Taussig şantı sonrası tromboz gelişen sığır mezenterik venöz greftin transkütan yolla başarılı balon anjiyoplastisi ve trombolizi

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For the palliation of a five-month-old male baby who had a duct-dependent cyanotic congenital heart disease, a modified Blalock-Taussig shunt was made using a 4 mm bovine mesenteric venous graft. The shunt occluded on the seventh postoperative day and was surgically revised. However, rethrombosis of the graft was detected six days after the second operation. Percutaneous balloon angioplasty and thrombolysis were performed to shunt material successfully.

Key words: Acute Blalock-Taussig shunt occlusion; balloon angioplasty; bovine mesenteric venous graft; thrombolysis.

The modified Blalock-Taussig (m-BT) shunt is a well known palliative treatment in patients with cyanotic congenital heart diseases. The incidence of acute and subacute thrombosis of a m-BT shunt is reported to be around 3%. Young age, lower body weight, smaller size of the pulmonary arteries and grafts, and thrombophilic predisposition were predictors of early and intermediate shunt failure. Recently, percutaneous balloon angioplasty and/or transluminal stent implantation have become successful alternatives to fibrinolytic therapy or operative shunt revision in an emergency situation in a severely hypoxic child.^[1-7] Herein, a five-month-old baby with early postoperative thrombosis of the m-BT shunt is presented. The patient was treated successfully with transluminal balloon angioplasty and thrombolysis.

CASE REPORT

A five-month-old 5.5 kg male baby with double outlet right ventricle, pulmonary atresia and hypoplastic pulmonary arteries was referred to our institution with increasing cyanosis and recurrent hypoxic spells. Low levels of

Duktus bağımlı siyanotik doğuştan kalp hastalığı olan beş aylık erkek bebeğe 4 mm'lik sığır mezenterik ven grefti ile palyasyon amaçlı modifiye Blalock-Taussig şant ameliyatı uygulandı. Ameliyat sonrası yedinci günde tekrar tıkanan şant cerrahi olarak revize edildi. Ancak, ikinci ameliyattan altı gün sonra greftte tekrar retromboz tespit edildi. Şant materyaline perkütan yolla başarılı bir şekilde balon anjiyoplastisi ve tromboliz yapıldı.

Anahtar sözcükler: Akut Blalock-Taussig şant oklüzyonu; balon anjiyoplastisi; sığır mezenterik ven grefti; tromboliz.

Antithrombin III activity, high levels of Factor VIII and von-Willebrand Factor and protein C and S deficiency were recorded in his thrombophilic panel. Because the patient had a high thrombophilic panel, it was decided to use bovine mesenteric venous graft (BMVG) as a biologic vascular conduit. The infant underwent left m-BT shunt using 4 mm BMVG, and was extubated one day after the surgery. Transthoracic echocardiography (TTE) with color flow imaging three days after extubation revealed a functioning left m-BT shunt with an adequate shunt flow seen in the pulmonary arteries. The child was clinically stable with oxygen saturation of 85% and was continued on aspirin 3 mg/kg/day. On the 7th day, the child had a sudden episode of desaturation (O₂ saturation of 35% on 2L/min O₂) with tachypnea. Transthoracic echocardiography with color flow imaging confirmed a thrombosed m-BT shunt. The patient underwent shunt revision immediately. The shunt was blocked at the pulmonary artery anastomosis, and there was a slight angulation of the graft material. The graft was removed from the distal end and the thrombus

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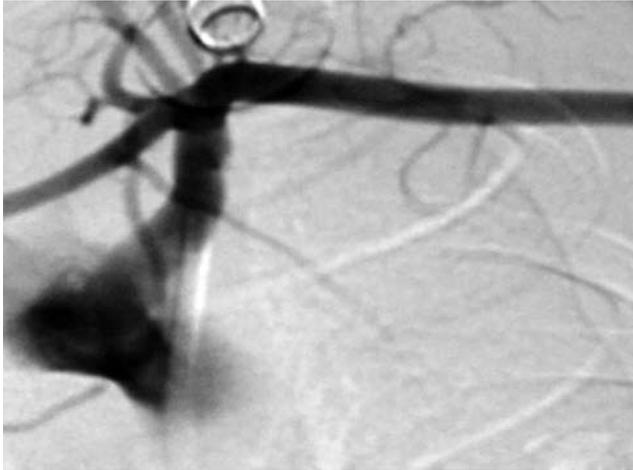


Fig. 1. Left subclavian angiogram revealing a totally occluded left modified Blalock-Taussig shunt at the aortic end.

was totally removed from the graft and the pulmonary artery. The graft was shortened for obtaining suitable length and the distal anastomosis was repeated using the same graft. Unfortunately, six days after the second operation, the child had another abrupt onset of intense cyanosis. Transthoracic echocardiography confirmed a blocked m-BT shunt. A transcatheter balloon angioplasty was planned. Left subclavian angiography revealed an occluded left m-BT shunt (Figure 1). The shunt was probed with a 4Fr Cobra I catheter (Radifocus Glidecath, Terumo Corporation, Tokyo, Japan) and a 0.035 inch angled glide-wire (Radifocus Guide Wire, Terumo Corporation, Tokyo, Japan; Figure 2a). A diagnostic catheter was advanced into the proximal stump of the shunt and then into the left pulmonary artery, and a 0.014 inch microwire (Choice Extra Support, Boston Scientific Corporation, Miami, FL, USA) was advanced across the shunt with its tip positioned in the distal LPA (Figure 2b). A 4x20 mm monorail balloon

(Rx Musso, Terumo Corporation, Tokyo, Japan) was positioned across the occluded shunt and inflated along the thrombosed shunt with 1st inflation at 6 atm and 2nd and 3rd inflations distally at 4 atm (Figure 3). Control angiography revealed flow through the recanalized shunt (Figure 4). A repeat echocardiography in m-BT shunt revealed good antegrade flow across the left m-BT shunt, and there was no evidence of a thrombus in the distal shunt extending into the pulmonary artery. In view of the remaining thrombus of the shunt, local thrombolysis and heparin was administered after the procedure. Tissue plasminogen activator (2 mg/kg/day) was administered locally, over 10 minutes; and continued as a systemic infusion at 4400 units/kg/hour for the next 24 hours. Post-procedure, systemic oxygen saturation rose to 75-85%. A control echocardiography after thrombolysis showed a patent m-BT shunt with a good flow into the LPA. Heparin infusion at 10 units/kg/hour replaced with t-PA after 24 hours and was continued for 72 hours, with activated partial thromboplastin time (aPTT) monitoring. The child was also simultaneously started on warfarin 0.1 mg/kg/day. He was clinically stable with O₂ saturations >70% at room air. At six month follow-up, TTE with color flow imaging showed a well functioning left m-BT shunt. Intracardiac repair with a valved conduit from right ventricle to pulmonary artery is planned.

DISCUSSION

Recent studies have shown that thrombophilic factor positivity in cyanotic cases is the main factor of early synthetic graft (polytetrafluoroethylene graft) failure after mBT shunt. Therefore, since 2004, we have used the BMVG as a biologic shunt conduit, in our cyanotic cases with high thrombophilic factors. In this report, we presented a successful transcatheter balloon angioplasty and subsequent thrombolysis in a

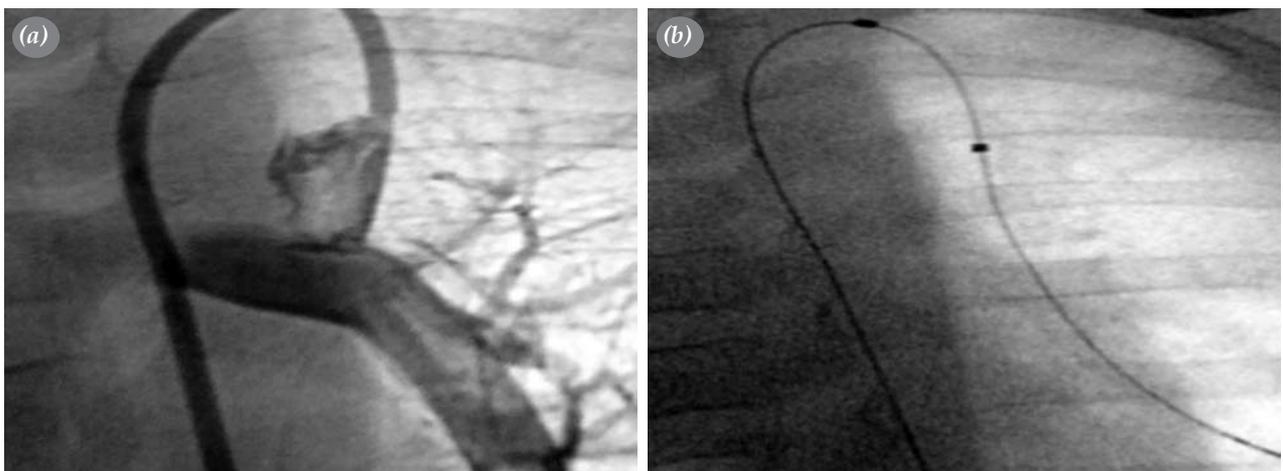


Fig. 2. (a, b) Angiogram demonstrates that shunt is probed with a 4Fr Cobra I catheter and a 0.035 inch angled glide-wire across to the left pulmonary artery before balloon dilatation of left m-BT shunt.

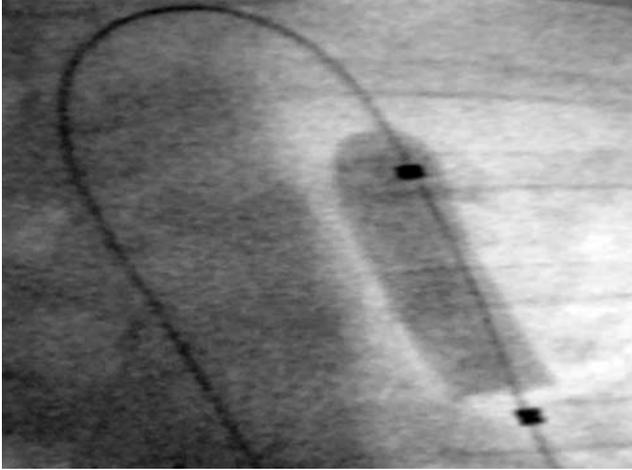


Fig. 3. A 4 x 20 mm monorail balloon across to the occluded shunt and inflating along the shunt with 1st inflation at 6 atm., and 2nd and 3rd inflations distally at 4 atm.

patient with an acutely thrombosed mBT shunt, which created a 4 mm BMVG and short and mid-term as a result.

Transcatheter recanalization of a stenotic systemic to pulmonary artery shunt provides an effective means to restore or increase the pulmonary blood flow. Percutaneous approach for acutely obstructed mBT shunt is increasingly being used by number of clinics. MacMillan et al.^[1] and Sivakumar et al.^[2] have reported the successful balloon dilatation of an obstructed BT shunt in five cases. Wang et al.^[3] have also reported the successful balloon dilatation in 46 cases in whom acute shunt failure was diagnosed postoperatively.

Marks et al.^[4] and Marx et al.^[5] demonstrated a series of m-BT shunt dilatations with suboptimal or optimal results, and clear success obtained in their patients. In 1994, Ries et al.^[6] reported thrombolysis with recombinant tissue plasminogen activator in m-BT shunt in a 10-day-old infant, four days after surgery for complete shunt thrombosis.

Balloon dilatation along with thrombolysis of an occluded shunt results in mechanical thrombus disruption and an increase in the surface area of thrombus susceptible to pharmacological thrombolysis, thus increasing the efficacy of the thrombolytics administered as an infusion over the next 48-72 hours.^[6] There is always an issue as to how early the thrombolysis can be administered in case of occlusion of m-BT shunt immediately after surgery. According to the standard guidelines, thrombolytic agents can be administered safely after 10 days of any surgical procedure.^[7]

The management of thrombosed systemic to pulmonary artery shunts with balloon dilatation and thrombolysis is preferred, as it avoids a repeat surgical procedure

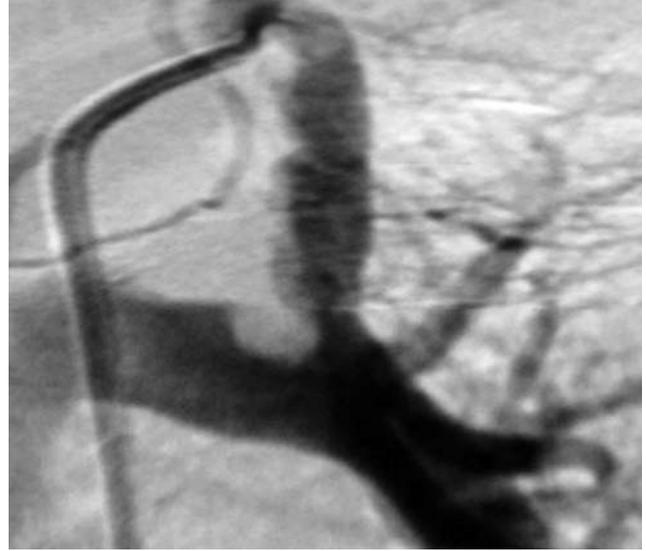


Fig. 4. Postdilatation angiogram of the subclavian artery revealing flow in the left m-BT shunt with a significant thrombus extending through the length of the shunt.

with its inherent morbidity and mortality. Complications associated with thrombolytic therapy for thrombosed BT shunts in early postoperative period include serious bleeding requiring transfusion and also possibility of excessive bleeding during reoperation if thrombolytic therapy fails.

In our case, following administration of t-PA infusion for 24 hours, the thrombus was significantly reduced which was confirmed on echocardiography. As the flow observed in m-BT subsequent to balloon angioplasty and thrombolysis was satisfactory, stent deployment was not considered in our case. In addition, stent implantation is accepted as an attractive alternative therapy for prevent mBT shunt stenosis or occlusion by many authors, particularly in the immediate postoperative period when fibrinolytic therapy may be hazardous. Indeed, many reports of stent placement have been reported in thrombosed m-BT shunt for restoration of patency. Lee et al.^[8] reported a series of 13 cases who underwent successful stent implantation for restoration of aortopulmonary shunt.

It was concluded that transcatheter recanalisation (with or without the use of stent placement) of an acutely thrombosed mBT shunt is an attractive alternative to redo surgery. We believe that thrombolysis and/or stent deployment can be decided and carefully performed with adequately sized balloons.

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