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BALLOON DILATATION ANGIOPLASTY OF A STENOTIC BLALOCK - TAUSSIG ANASTOMOSIS*

A Case Report

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SUMMARY: Saltık İL, Güler-Eroğlu A, Sarıoğlu A, Batmaz G. (Pediatric Cardiology Unit, İstanbul University Institute of Cardiology, İstanbul, Turkey). Balloon dilatation angioplasty of a stenotic Blalock-Taussig anastomosis. Turk J Pediatr 1996; 38: 515-519.

A 12-year-old boy with tetralogy of Fallot was evaluated for increasing cyanosis and exercise intolerance. The patient had a right Blalock-Taussig shunt operation 11 years previously and a left modified Blalock-Taussig shunt operation one year previously. After demonstration of hypoplastic pulmonary arteries, the stenosed right Blalock-Taussig shunt and the totally occluded, left modified Blalock-Taussig shunt were successfully dilatated with a 7-mm-diameter angioplasty balloon resulting in a 5-mm-diameter patent shunt. We believe that, when possible, balloon dilatation angioplasty of stenosed Blalock-Taussig shunts is a reasonable and safe alternative to surgery.
Key words: balloon dilatation, Blalock-Taussig shunt.

Blalock-Taussig shunts are standard palliative treatment for various cyanotic, congenital heart defects associated with pulmonary blood flow. Early or late occlusion of Blalock-Taussig shunts occurs in approximately 10 percent of cases[1]. Recently, balloon dilatation angioplasty of stenotic Blalock-Taussig shunts has been done successfully in pediatric patients who were not amenable to total surgical correction in order to avoid the mortality and morbidity of a new systemic-pulmonary anastomosis[2-8]. We report the successful dilatation of a severely stenosed Blalock-Taussig shunt in a child with tetralogy of Fallot.

Case Report

A 12-year-old boy with tetralogy of Fallot was evaluated for his increasing cyanosis and exercise intolerance. The patient had a classical right Blalock-Taussig shunt operation 11 years previously and a left modified Blalock-Taussig shunt operation one year previously at another center. On admission he had severe cyanosis, clubbing and normal pluses in all extremities with the exception of an absent

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right brachial pulse. There was a grade 1/6° systolic murmur at the left sternal border, but a continuous murmur was not heard. Chest x-ray showed decreased pulmonary vascular marking. Right axis and right ventricular hypertrophy was noted on electrocardiogram. His hemoglobin was 17 g/dl with a hematocrit of 54 percent. Echocardiographic examination revealed tetralogy of Fallot, severe obstruction of right ventricular outflow, hypoplastic pulmonary arteries and aorto-pulmonary collaterals. Color doppler echocardiography demonstrated minimal turbulent flow in the right pulmonary artery, and there was no shunt flow in the left pulmonary artery.

Right heart catheterization was performed to determine the diagnosis and demonstrate pulmonary blood sources under general anesthesia. After percutaneous entry via the right femoral vein, 50 units/kg of intravenous heparin was administered A 7 French NH catheter was advanced into the aorta by the femoral venous route via the right ventricle and ventricular septal defect. After pressure and saturation measurements, a right innominate artery angiogram was performed. There was severe stenosis at the anastomotic site of the right Blalock-Taussig shunt with a tinny "jet" of contrast medium passing through the shunt into the right pulmonary artery (Fig. 1a). There was no evidence of a left modified Blalock-Taussig shunt in repeated angiograms. After demonstrating hypoplastic pulmonary arteries, the decision was made to perform balloon dilatation angioplasty of the stenosed Blalock-Taussig shunt. A Cordis Judkins 5 French right coronary artery catheter with a 4 cm curve was inserted in to the right femoral vein and advanced with floppy guide-wire manipulation across the Blalock-Taussig shunt into the right pulmonary artery by the transvenous route. A 260 cm 0.032 inch exchange guide-wire was advanced through the catheter and positioned distally within the left pulmonary artery. The catheter was removed and a 7 French balloon dilatation (Meditech) catheter with a balloon diameter of 5 mm was then inserted over the exchange wire and advanced into the right pulmonary artery through the Blalock-Taussig shunt so that the midsection of the balloon was at the point of stenosis. The balloon was dilatated to a maximum of 10 atmospheres pressure for three to four minutes (Fig. 1b). Because of inefficient dilatation, the procedure was repeated with a balloon diameter of 7 mm until the balloon waist disappeared. The balloon catheter was then removed and repeated angiography performed. The angiogram documented improved pulmonary flow to pulmonary arteries through the shunt, the diameter of the anastomotic site increased to 5 mm (Fig. 1c), and systemic arterial oxygen saturation increased from 72 percent to 80 percent. Immediately after the procedure a loud continuous murmur was easily heard. The child was discharged on the following day.

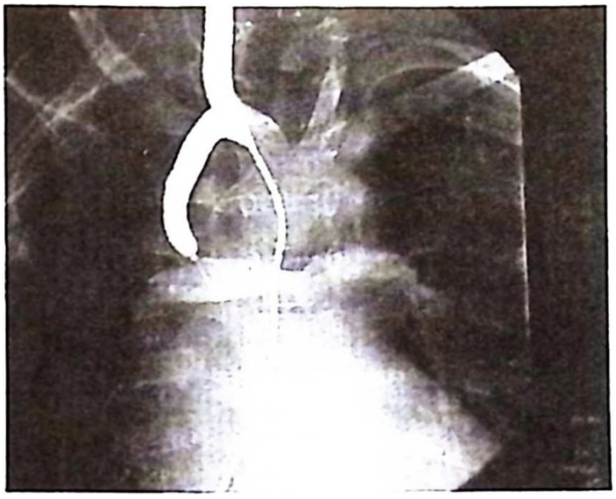

Fig. 1a: Angiographic injection into the right innominate artery before balloon dilatation demonstrates marked narrowing of the anastomotic site of the Blalock-Taussig Shunt.

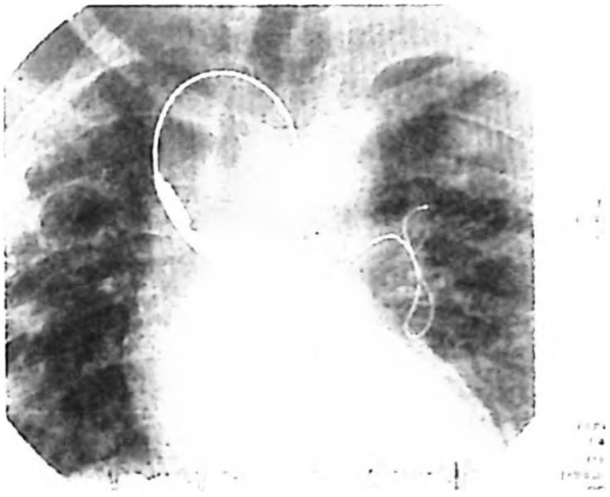

Fig. 1b: Position of 5 mm balloon dilatation catheter during inflation. Note waist of balloon.

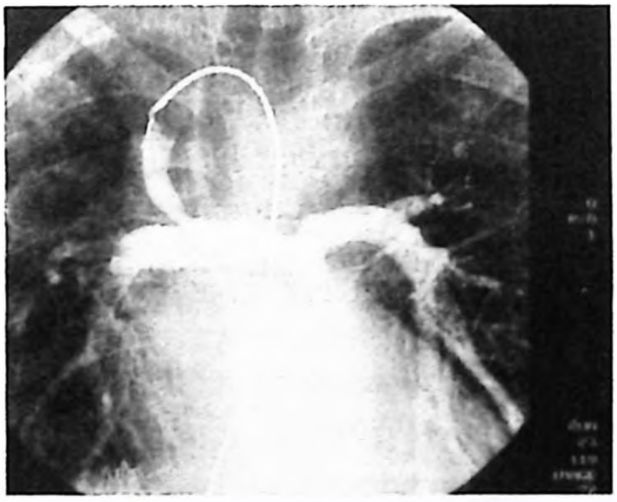

Fig. 1c: Angiographic injection into right Blalock-Taussig shunt after balloon dilatation shows relief of stenosis at the anastomotic site and improvement in pulmonary flow.

Discussion

When a Blalock-Taussig shunt becomes stenosed in the case of a cyanotic congenital heart defect with reduced pulmonary blood flow, therapeutic options include the creation of another systemic-pulmonary shunt or, if suitable, correction of the underlying cardiac malformation earlier than planned. Transcatheter balloon dilatation of stenosed shunts has been proposed as an alternative to a new systemic-pulmonary anastomosis[2-7]. Our patient had hypoplastic pulmonary arteries and was not amenable to total surgical correction. He also had a right Blalock-Taussig and totally occluded left modified Blalock-Taussig shunt; thus,

creating a new systemic to pulmonary shunt was too difficult. Therefore, balloon dilatation angioplasty of the stenotic Blalock-Taussig shunt was the ideal treatment for him.

Transcatheter balloon dilatation of a stenotic Blalock-Taussig shunt has achieved adequate palliation, but the results have depended on the size of the balloon in relation to the size of the shunt[3, 4, 9]. Oversized balloons, nonetheless, may cause increased pulmonary blood flow leading to congestive heart failure in the short term and pulmonary hypertension in the long term[9]. In order to avoid complications, we completed the procedure when the diameter of the anastomotic site increased to 5 mm.

A major limitation in the application of this technique for occluded systemic to pulmonary artery shunts in children is that patients in whom the shunt was the major (or singular) source of pulmonary blood flow often have severe hypoxia and metabolic acidosis at presentation. When other sources of pulmonary blood flow in the form of aorta-pulmonary collateral arteries or a stenosed pulmonary valve are present, however, the patient is often in a stable hemodynamic state despite shunt occlusion[1, 3, 5, 9]. Our patient had the advantage of having aorta-pulmonary collateral arteries, and hemodynamic disturbance was prevented during the procedure.

In most published reports, transcatheter balloon dilatation of stenosed shunts has been accomplished by the arterial route (retrograde). We used the transvenous route (antegrade) in this patient with tetralogy of Fallot. When possible, use of the transvenous route prevents femoral artery injury and permits safe advancement of larger balloons. However, there is a potential risk of arrhythmia with this technique, because the catheter passes through the heart. Our patient did not have any arrhythmia.

We believe that balloon dilatation angioplasty of stenosed Blalock-Taussig shunts is a reasonable and safe alternative to reoperation in patients who are unsuitable for surgical correction and in those for whom the correction needs to be delayed. Fundamental questions remain regarding the magnitude of dilatation, determination of which shunts will respond to dilatation and evaluation of both short-and long-term results.

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