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## Recanalisation of Totally Occluded Modified Blalock Taussig Shunt by Balloon Angioplasty 48 Hours after its Construction

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### Abstract

An 18 months old boy with TOF benefited from a BTS. Deep cyanosis reappeared 48 hours later and continuous flow profile of the shunt could not be identified by Doppler echocardiography. At catheterization, angiogram confirmed complete shunt occlusion. The shunt was recanalized using a coronary guide wire and a 4mm diameter balloon. The SpO<sub>2</sub> improved and repeated Doppler echocardiography showed the patency of the shunt during follow-up. Four days later, he developed a severe febrile pneumopathy due to RSV and died 2 days later. The shunt patency was documented 2 hours before death.

**Keywords:** Fallot; Catheter canalisation; Blalock–taussig shunt; Shunt occlusion; Respiratory syncytial virus

**Abbreviations:** TOF: Tetralogy of Fallot; BTS: Blalock Taussig Shunt; RSV: Respiratory Syncytial Virus; LAD: Left Anterior Descending Coronary; VSD: Ventricular Septal Defect; WBC: White Blood Cell; CRP: C Reactive Protein; ACT: Activated Clotting Time

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### Case Report

An 18 months old boy with TOF and deep cyanosis was admitted for a palliative surgery. The cardiac catheterization had shown a hypoplastic pulmonary tree and an abnormal LAD crossing the infundibulum. He was well vaccinated but no Palivizumab injection was performed.

The laboratory tests showed minor thalassemia and iron deficiency. No hemostasis disorder was documented. A 4 mm Gore-Tex tube was inserted between the arterial brachiocephalic trunk (ABCT) and the proximal right pulmonary artery. Immediate heparin therapy (500 UI/Kg/day) was initiated as well as oral Aspirin (5 mg/Kg/day). An Adequate ACT level (64 seconds) was rapidly achieved and the shunt patency was documented by echocardiography and color Doppler 24 hours later. At 36 hours after surgery, the SpO<sub>2</sub> suddenly dropped from 83 to 60%. Continuous flow profile of the shunt could not be identified by Doppler echocardiography. At catheterization, a 5F femoral arterial short introducer was inserted. A selective angiogram in the ABCT, using a 5F mammary catheter (Cordis), confirmed complete shunt occlusion at 5mm of the aortic connection (**Figure 1**). Using a 0.014" "Cross It" guide wire (Abott), the shunt

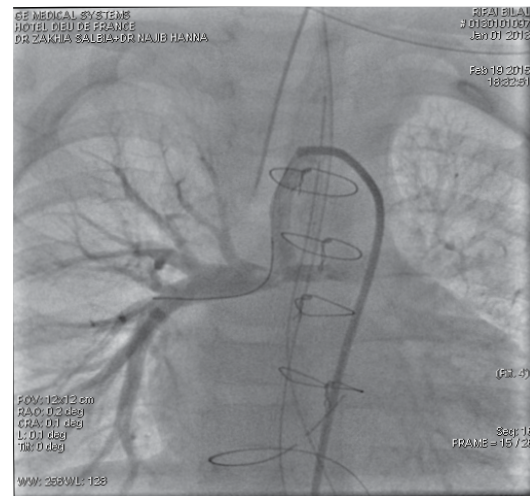
was crossed to place the wire (**Figure 1-3**) distally in the right pulmonary branch. A 4F Right Judkins catheter (Cordis special) was used to cross the shunt over the 0.014" wire and then, a 0.035" exchange wire was used to introduce a multipurpose 5F guiding catheter in the right pulmonary artery. After that, the 0.014" was replaced in the guiding catheter and using a 4 mm × 20 mm coronary TREK balloon (Abott) multiple hand inflations in the shunt were repeated to reestablish the shunt patency (**Figure 2**). At the final angiogram, aortic and pulmonary shunt's ends were free of narrowing or kinking (**Figure 3**). The SpO<sub>2</sub> increased to 85% and heparin therapy with oral Aspirin was continued and oral Clopidogrel (1 mg/Kg/d) was added. He was extubated the next day and fed normally. Repeated Doppler echocardiography showed the patency of the shunt. Three days later, high grade fever and cough appeared. The nasopharyngeal secretions tests showed the presence of RSV. The Chest X-ray showed bilateral infiltrates (**Figure 4**) and WBC count was 3500 (N36%; L69%), CRP 26 mg/dL. The dyspnea exacerbated and tracheal bleeding followed by anuria occurred. Although no bacterial super infection was documented, a large spectrum anti-biotherapy was started. High frequency ventilation was used but despite all therapeutic measures the hypoxia and hypercapnia worsened and the child died on the 8<sup>th</sup> day after the surgery. Cardiac ultrasound

performed 2 hours before death showed the patency of the shunt (Figure 4).

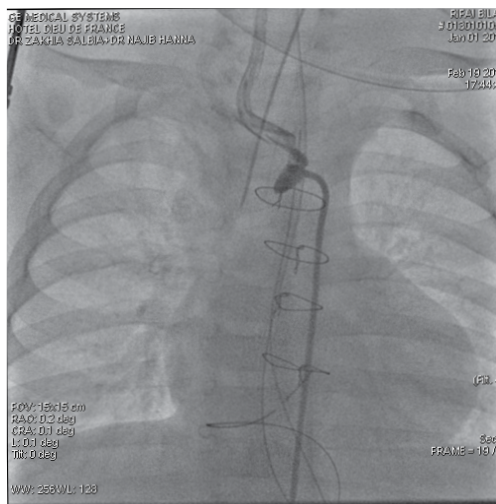
## Discussion

Surgery is the only curative treatment for TOF and should be electively performed in infancy. However, in some instances, e.g. low weight, severe pulmonary branches hypoplasia, abnormal coronary arteries and multiple VSD, a palliative surgery should be undertaken.

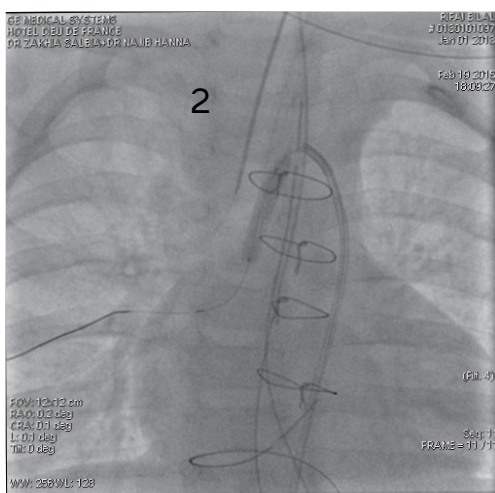
The classic BTS, first performed in 1944 [1] is nowadays replaced by a gore-tex tube between the aorta and the pulmonary branch. Despite early anticoagulation and anti-aggregant therapy, the early or late shunt occlusion rate is still high [2]. The usual cause of shunt obstruction is a thrombus formation closing the narrow lumen of the graft, which in a majority of cases is additionally narrowed by coexisting distal stenosis present at the junction of the BT graft and the narrow pulmonary artery branch. Total occlusion in the early postoperative period is not a contraindication



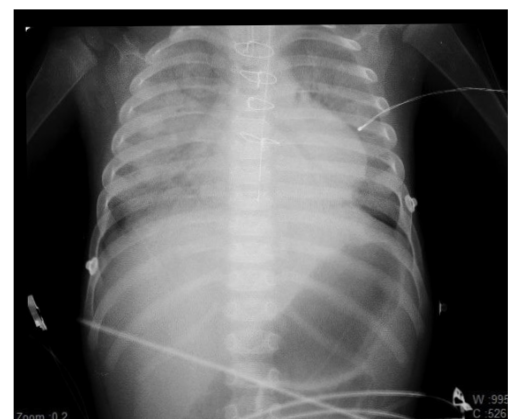
**Figure 3** Aortic and pulmonary shunt's ends were free of narrowing or kinking.



**Figure 1** Complete shunt occlusion at 5 mm of the aortic connection.



**Figure 2** Re-establishment of shunt patency.



**Figure 4** Chest X-ray showing bilateral infiltrates.

to catheter treatment. The freshly constituted thrombus can be crossed using some special wires and maneuvers. The mammary catheter is adapted to the right angled aorto-shunt connection. After that, the "off label" use of a **0.014"** wire, conceived for coronary occlusions, permits a shunt recanalisation. Then, progressive or one step ballooning, depending on balloon tractability, may restore the shunt patency. Additionally, some advocate the use of local or systematic thrombolytic therapy combined with a successful balloon angioplasty procedure [3-7]. Stenting may be needed particularly in distant from surgery interventions and residual narrowing.

Transcatheter balloon dilatation of stenosed shunts has been proposed as an alternative to surgical revision. Most have been performed for stenosed classical BTS, where direct end-to-side anastomosis of the subclavian artery to the pulmonary artery has been performed [2].

In our case, we performed only a balloon angioplasty with total recanalisation of the modified shunt, without thrombolytic therapy.

Even with the success of the procedure, the child died most likely of his RSV pneumopathy. Palivizumab has reduced the incidence of respiratory syncytial virus hospitalization in infants and children with congenital heart disease by 45%. Although the mortality

rate of children with congenital heart disease hospitalized with respiratory syncytial virus infection has declined from 37% to approximately 3% over the past 3 decades and there are recommendations for providing palivizumab up to age 24 months in children with congenital heart disease [8]. Ribavirin therapy, not available in our country, would have been an indication in this case.

## Conclusion

Percutaneous emergency recanalisation of occluded BTS is a safe and effective method and can avoid redo risky surgery.

Palivizumab prophylaxis may help preventing severe pneumopathy in these patients and thus improving the outcome.

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