The Turkish Journal of Pediatrics 1996; 38: 107-111

TRANSCATHETER EMBOLIZATION OF A PULMONARY COLLATERAL VESSEL IN A CHILD WITH TRICUSPID ATRESIA*

Case Report

*Sevim Karaaslan MD***, *Alpay Çeliker MD***, *Nazlıhan Günal MD****

SUMMARY: Karaaslan S, Çeliker A, Günal N. (Cardiology Unit, Department of Pediatrics, Hacettepe University Faculty of Medicine, Ankara, Turkey). Transcatheter embolization of an aortopulmonary collateral vessel in a child with tricuspid atresia: case report. Turk J Pediatr 1986; 38: 107-111.

When a significant systemic-pulmonary arterial collateral connection occurs in children with cyanotic congenital heart disease, they may present surgical difficulties making operative management undesirable. Transcatheter vessel occlusion can be a life-saving procedure or an important adjunct in reducing blood loss during surgery.

This report describes the selective obliteration of a large systemic pulmonary arterial collateral vessel in a child with tricuspid atresia before Fontan operation. A transcatheter wire coil embolus technique was used, and no complications or errors in placement of the coils occurred. *Key words: tricuspid atresia, aortopulmonary collateral vessel, coil embolization.*

Transcatheter vascular occlusion utilizing the stainless steel coil has found applications in the control of hemorrhage, the management of neoplasm and complex aneurysms of the vertebrobasilar circulation, the closure of the small patent ductus arteriosus, and the nonsurgical treatment of arteriovenous fistulas and aortopulmonary collateral vessels in patients with congenital heart disease[1-9].

This report describes a steel coil embolization of a collateral vessel in a child with tricuspid atresia.

Case Report

A five-month-old girl was referred to the Pediatric Cardiology Unit of Hacettepe University in June 1989 for cyanosis which had first been noted when she was three months old. She was cyanotic, and auscultation of the heart revealed a grade III/VI ejection systolic murmur on the left sternal border. The electrocardiogram revealed tall P waves, left axis deviation and left ventricular hypertrophy. The chest radiogram showed oligemic lung fields and cardiomegaly. The echocardiographic examination revealed tricuspid atresia.

* From the Cardiology Unit, Department of Pediatrics, Hacettepe University Faculty of Medicine, Ankara.

** Associate Professor of Pediatrics and Pediatric Cardiologist, Hacettepe University Faculty of Medicine.

*** Pediatrician and Fellow in Cardiology, Hacettepe University Faculty of Medicine.

In view of the patient's worsening condition and increasing cyanosis, cardiac catheterization was performed at age two years. Normally related great arteries, a restrictive ventricular septal defect and pulmonary stenosis were demonstrated, and a left Blalock-Taussig shunt was contemplated.

When the patient was five years old, cardiac catheterization was performed again in order to measure the pulmonary artery pressure before Fontan operation. The left Blalock-Taussig shunt was present, and the pressure was 100/4 mm Hg in the left ventricle and 16/4 mm Hg (mean: 12 mm Hg) in the pulmonary artery. The antero-posterior and lateral angiograms of the descending aorta demonstrated an aortopulmonary collateral vessel that could not be achieved via median sternotomy, so the day before the operation this aortopulmonary collateral vessel was occluded with coil (Fig. 1).

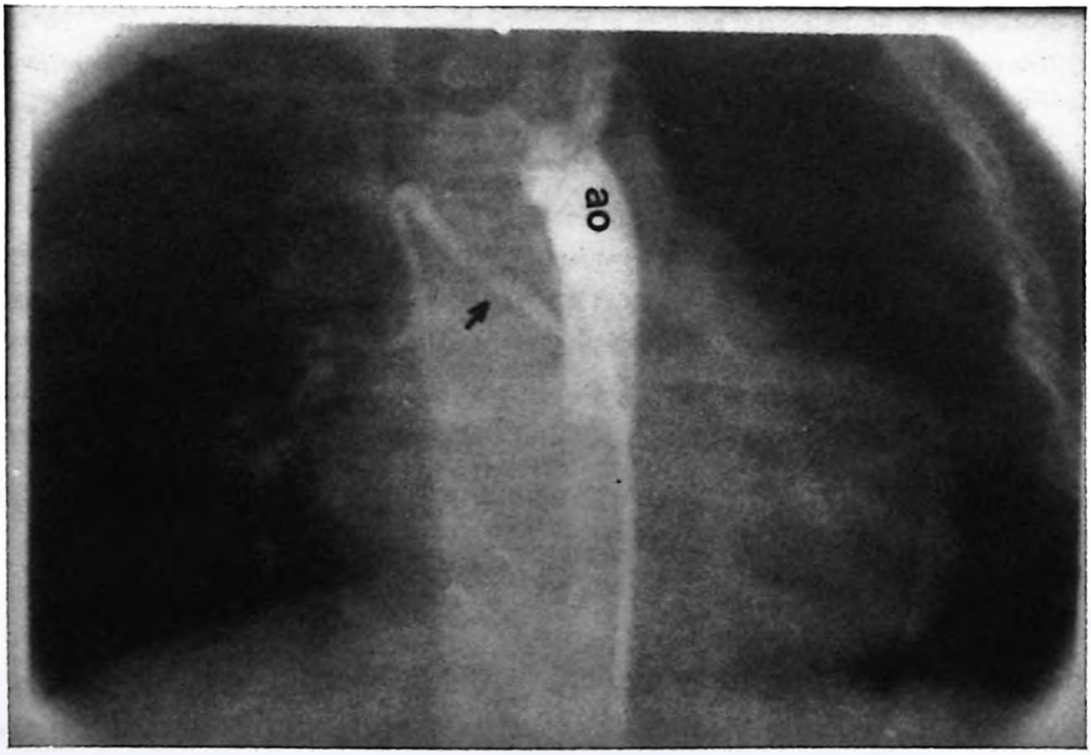

Fig. 1: Aortogram before embolization. Arrow shows collateral vessel. ao = descending aorta.

The patient received antibiotic prophylaxis with cefazolin before and for 24 hours after coil embolization. Routine precatheterization sedation with pethidine HCl, chlorphenoxamine and chlorpromazine combination was used, followed by diazepam during the procedure. Intravenous heparin was given when vascular access had been obtained.

The collateral vessel was precisely localized by hand injection of contrast material into the collateral. Embolization was performed by transarterial approach, and a number six French end-hole catheter was sufficient for coil placement. A 0.035-

inch guide wire was used to push the coil from the catheter into the vessel. Three coils, two measuring 4 cm x 3 mm and one 3 cm x 5 mm. (occluding spring coil, Cook Inc.), were extruded through the catheter.

Fifteen minutes after the last spring coil placement, a descending aortic angiogram revealed no blood flow into the collateral vessel (Fig. 2). The procedure was terminated with no complications, and the patient underwent a Fontan operation in the Cardiac and Thoracic Surgery Department of Hacettepe University.

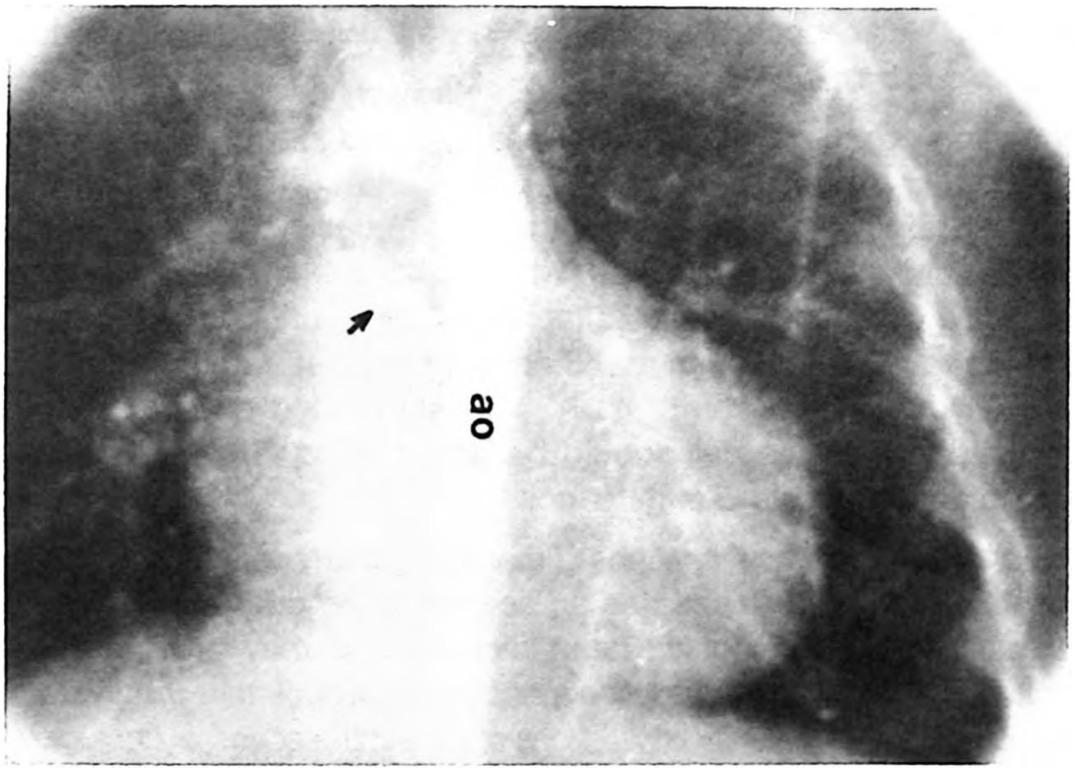

Fig. 2: Aortogram after embolization demonstrates occluded collateral vessel (arrow: spring coils) ao = descending aorta.

Discussion

The association of large systemic-pulmonary collateral blood vessels in cyanotic congenital heart disease is well known. If major collateral vessels are left unattended, maintenance of adequate perfusion pressure is difficult and achieving optimal surgical exposure without circulatory arrest is at times impossible because of voluminous cardiac return of blood which leads to flooding of the operative field.

Objective assessment of the hemodynamic significance of collateral vessels in patients who have already undergone corrective surgery is difficult[7]. According to Wernovsky et al.[10], the presence of cardiomegaly, continuous murmur, elevated left ventricular end-diastolic pressure, pulmonary artery hypertension or prompt visualization of pulmonary veins and the left atrium after injection of contrast

medium into the aorta or left ventricle may indicate significant flow into the pulmonary vascular bed; in such cases, embolization of these vessels is indicated. Thus careful preoperative angiographic assessment of the size and location of the collateral vessels is essential to determine which of these vessels might best be approached surgically and which might best be occluded by the catheter technique.

In our case, angiographic examination of the descending aorta demonstrated significant flow into the pulmonary vascular bed via a collateral vessel; thus this collateral vessel was chosen to occlude with coil before Fontan operation because of its anatomic localization.

The length and shape of the coil when embolized depend on a number of factors, including the ratio of coil to vessel diameter, the distensibility of the vessel and the diameter of the wire in the coil. In our case a 4 cm long, 3 mm diameter "occluding spring embolus" was implanted into the collateral vessel but it remained patent 10 minutes after the placement, and an additional two coils were placed (4 cm x 3 mm and 3 cm x 5 mm) depending on the anatomy of the vessel and the position of the previously placed coil or coils. Perry et al.[7] demonstrated that the coil should be about 10 to 40 percent larger than the vessel diameter, as in our third coil.

Coil embolization is an attractive means of managing many difficult clinical problems. The procedure may be performed as an adjunct to the operative management of children with complex congenital heart disease and may provide a practical, cost-effective alternative to the operative managemenat of certain congenital thoracic vascular anomalies[8]. However, complications of transcatheter vessel occlusion include reflux and occlusion of nontarget vessels, tissue ischemia with pain, tissue necrosis, altered organ function, fever, sepsis and miscellaneous mechanical complications[11]. Nonetheless, considerable clinical experience has demonstrated that coil embolization is a safe and effective procedure, as in our case[7,8].

In summary, this report described a succesful coil embolization of a collateral vessel in a child with tricuspid atresia before Fontan operation, and this was the third application of coil into a collateral vessel at our institute.

REFERENCES

1. Olson RR, Athanasoulis CA. Hemoptysis: treatment with transcatheter embolization of the bronchial arteries. In: Lock JE, Keane JF, Fellows KE (eds). Diagnostic and Interventional Catheterization in Congenital Heart Disease (2nd ed). Boston: Martinus Nijhoff Co; 1988: 196-202.
2. Numaguchi Y, Pevsner PH, Rigamonti D, Ragheb J. Platinum coil treatment of complex aneurysms of the vertebrobasilar circulation. Neuroradiology 1992; 34: 252-255.
3. Anderson JH, Wallace S, Gianturco C, Gerson LP. "Mini" Gianturco stainless stell coils for transcatheter vascular occlusion. Diag Radiol 1979; 132: 301-303.

4. Cambier PA, Kirby WC, Wortham DC, Moore JW. Percutaneous closure of the small (< 2.5 mm) patent ductus arteriosus using coil embolization. Am J Cardiol 1992; 69: 815-816.
5. Castaneda-Zuniga W, Epstein M, Zollikofer C, et al. Embolization of multiple pulmonary artery fistulas. Diag Radiol 1980; 134: 309-310.
6. Bilgiç A. Çeliker A. Coil embolization in pulmonary arteriovenous fistula. A case report. Çocuk Sağlığı ve Hastalıkları Dergisi 1989; 32: 287-291.
7. Perry SB, Radtke W, Fellows KE, Keane JF, Lock JE. Coil embolization to occlude aortopulmonary collateral vessels and shunts in patients with congenital heart disease J Am Cell Cardiol 1989; 13: 100-108.
8. Fuhrman BP, Bass JL, Castaneda-Zuniga W, Amplatz K, Lock JE. Coil embolization of congenital thoracic vascular anomalies in infants and children. Circulation 1984; 70: 285-289.
9. Szarnicki R, Krebber HJ, Wack J. Wire coil embolization of systemic-pulmonary artery collaterals following surgical correction of pulmonary atresia. J Thorac Cardiovasc Surg 1981; 81: 124-126.
10. Wernovsky G, Bridges ND, Mandell VS, Castaneda AR, Perry SB. Enlarged bronchial arteries after early repair of transposition of the great arteries. J Am Coll Cardiol 1993; 21: 465-470.
11. Greenfield AJ. Transcatheter vessel occlusion: methods and materials. In: Lock JE, Keane JF, Fellows KE (eds). Diagnostic and Interventional Catheterization in Congenital Heart Disease (2nd ed). Boston: Martinus Nijhoff Co; 1988: 40-53.