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CREATION OF RIGHT VENTRICLE - PULMONARY ARTERY CONTINUITY WITHOUT CARDIOPULMONARY BYPASS*

*İlhan Paşaoğlu MD***, *Rıza Doğan MD****, *Süheyla Özkutlu MD*****

SUMMARY: Paşaoğlu İ, Doğan R, Özkutlu S. (Departments of Thoracic and Cardiovascular Surgery, and Pediatric Cardiology, Hacettepe University Faculty of Medicine, Ankara, Turkey). Creation of right ventricle - pulmonary artery continuity without cardiopulmonary bypass. Turk J Pediatr 33: 173-179, 1991.

A closed technique was applied successfully in a patient with Fallot's tetralogy in whom total correction had been previously performed, for creation of continuity between the right ventricle and left pulmonary artery without the use of cardiopulmonary bypass. A surgical approach was achieved by an anterolateral thoracotomy incision in the left third intercostal space. A Dacron non - valved tubular graft, 10 mm. in diameter, was anastomosed to the proximal end of the left pulmonary artery. The proximal end of the graft was anastomosed to the pericardial outflow tract patch with a running technique using a monofilament suture. The peripheral arterial oxygen saturation increased postoperatively, and the patient's condition improved dramatically. *Key words: tetralogy of fallot, pulmonary artery stenosis.*

Intracardiac correction of tetralogy of Fallot (TOF), first described by Lillehei[1] in 1955, has become the treatment of choice for almost all variations of this anomaly. Parallel to the improvement of surgical techniques, anesthesia, extra-corporeal circulation, and postoperative intensive care units, the weight and age of patients no longer constitute an obstacle to correction. However, hypoplastic pulmonary arteries are still an impediment to one stage correction in infants with TOF. In such patients, several palliative surgical methods have been used to improve the pulmonary blood flow before correction. One of these procedures is conduit implantation (with or without valve) between the right ventricle and pulmonary artery.

This report describes establishment of right ventricle - pulmonary artery continuity with a conduit to increase pulmonary blood flow, without the use of cardiopulmonary bypass, In a patient with TOF in whom total correction had been previously performed.

* From the Departments of Thoracic and Cardiovascular Surgery, and Pediatric Cardiology, Hacettepe University Faculty of Medicine, Ankara.

** Professor of Thoracic and Cardiovascular Surgery, Hacettepe University Faculty of Medicine.

*** Assistant Professor of Thoracic and Cardiovascular Surgery, Hacettepe University Faculty of Medicine.

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

Case Report

A six-year-old female developed cyanosis at the age of one month and a cardiac murmur was noted. The electrocardiogram revealed a normal sinus rhythm, right axis deviation and right ventricular hypertrophy. An anteroposterior telecardiogram showed diminutive pulmonary vessels and an elevated rounded apex consistent with right ventricular dominance, giving the heart a "coeur en sabot" appearance. Two - dimensional echocardiography revealed TOF. Propranolol was given orally to relieve the hypoxemia. Cardiac catheterization was performed at five years of age. The infundibulum of the pulmonary artery was extremely narrow, and a left ventricular angiogram revealed a normal - sized ventricle. The combination of a large ventricular septal defect (VSD) and overriding of the aorta, which resulted in equalization of pressure in both ventricles, verified the diagnosis of TOF.

When the patient was six years of age, total correction was performed which consisted of closure of the VSD with a Dacron patch using a continuous suture. Since the diameter of the pulmonary annulus was less than the confidence limit for the patient's age, the transannular incision was closed with a pericardial patch extending up to the bifurcation of the pulmonary arteries. Both pulmonary artery orifices were observed to have normal diameters. The next day, low cardiac output developed and the oxygen tension and saturation decreased (PO_2 44 mm Hg and 72 percent). The patient's general condition did not improve. A chest roentgenogram showed decreased vascularity on the left side. Repeat cardiac catheterization and angiography demonstrated proximal occulsion of the left pulmonary artery resulting from stenosis and kinking. The left pulmonary artery was not demonstrated with contrast material (Fig. 1). Since the patient was in

Fig. 1: Anteroposterior view of a right ventricular angiogram, left pulmonary artery was not demonstrated.

poor general condition, it was decided that in order to increase pulmonary blood flow, a closed technique should be applied immediately which would allow establishment of right ventricule pulmonary artery continuity. After a few days passed correct diagnosis was made by catheterization and angiocardiography and a second operation was performed. The chest was incised through the left third intercostal space. The pericardium was opened longitudinally, anterior to the phrenic nerve, and extending up to the pericardial reflection. After the pulmonary bifurcation was dissected from the aorta, it was observed that the left pulmonary artery showed severe narrowing and kinking, 1.5 - 2 cm from the bifurcation (Fig. 2a). There was no blood flow within the left pulmonary artery. The left pulmonary

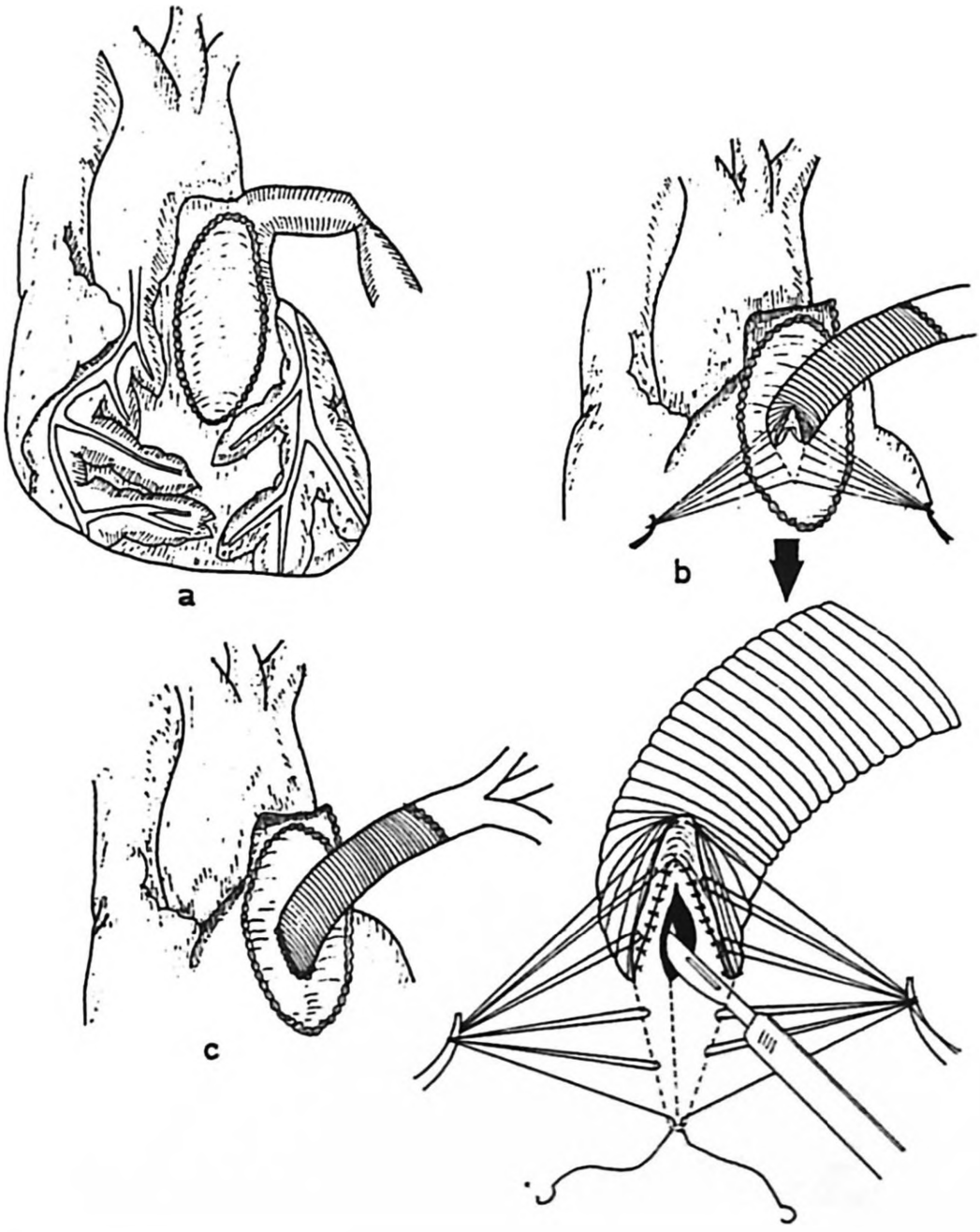

Fig. 2: Schematic presentation of surgical technique.

artery was severed from the bifurcation and the proximal end was closed using a running suture. A vascular clamp was applied to the left pulmonary artery and the narrowed segment was resected. A Dacron non - valved tubular conduit, 10 mm in diameter, was preclotted and end-to-end anastomosis was performed on the left pulmonary artery with a 5/o monofilament continuous suture. The proximal end of the conduit was trimmed to an adequate length and was sutured to the pericardial outflow patch in an elliptical shape using the running suture technique with a 4/o monofilament suture (Fig. 2b). The posterior and lateral suture line was completed, but the last four stitches were allowed to remain loose and retracted. A scalpel was then inserted between these stitches and entered the right ventricular cavity. A pericardial patch was opened along the extent of the anastomosis. To minimize blood loss after the scalpel was removed, the ends of the suture were tied off (Fig. 3). The conduit was stretched and flattened. No pressure gradient was noted between the conduit and the left pulmonary artery.

Fig. 3: Operative view of the implanted Dacron tubular graft between the left pulmonary artery and pericardial right ventricular outflow patch.

Postoperatively, the arterial oxygen saturation increased dramatically (94 %). The next day, scintigraphy demonstrated left lung perfusion to be nearly within normal limits (Fig. 4). The postoperative course was uneventful and the patient was

Fig. 4: Patient's postoperative lung perfusion scintigraphy.

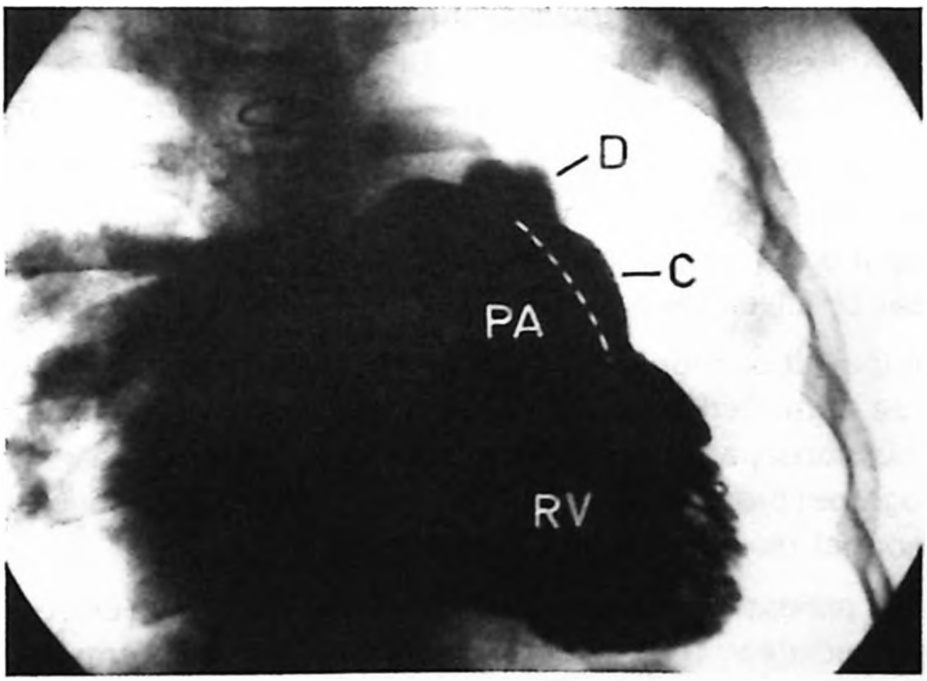

Fig. 5: Right ventricular angiogram, conduit was open but left pulmonary artery was slightly dilated just distal to the anastomosis (C: Conduit, PA: Pulmonary artery, D: Pulmonary artery dilatation).

discharged on the 12th postoperative day. The patient had no complaints and was followed up at six month intervals. At her last follow-up (December 1989), cardiac catheterization was performed which revealed an 8 mm Hg gradient between the left pulmonary artery and the right ventricle (LPA 32/12 mm Hg mean 17, Rt ventricle 40/0-5 mm Hg). An angiogram revealed that the conduit was open, but that the left pulmonary artery was slightly dilated just distal to the conduit.

Discussion

It is possible to reach the ultimate stage of treatment with total correction of TOF. But, in order to avoid right ventricular failure, the use of palliative techniques is preferred in patients with diminutive pulmonary arteries and pulmonary vascular bed as well as in those with a small left ventricular cavity.

However, in infants with severe cyanosis, anoxic spells, high hematocrit levels and low birth weights palliative techniques might be preferred as an immediate measure, until total surgical correction can be performed, because it carries a low mortality. Reconstruction of the right ventricular outflow tract is one of the palliative operations.

Establishment of right ventricle - hypoplastic pulmonary artery continuity without cardiopulmonary bypass was first performed by Puga and colleagues[2] in 1982 on six patients with VSD, hypoplastic pulmonary arteries and total or near total atresia of the pulmonary valve with zero mortality. In the same year, Diaz et al[3] reported using a similar technique which they applied to 11 patients for partial reconstruction of the right ventricular outflow tract without the use of cardiopulmonary bypass. In both studies it was stressed that the oxygen saturation had increased and that good clinical improvement had been observed postoperatively.

In 1985 Maeta and co-workers[4] reported a new technique in which a wire-guided knife was used. The technique had been applied in two patients with TOF and in one with coarctation of the aorta, and neither flow occlusion nor extracorporeal circulation was used.

If stenosis of the left pulmonary artery is recognized preoperatively or intraoperatively, it can be corrected by a patch angioplasty and/or reimplantation into the native main pulmonary artery. However, in our case left pulmonary artery stenosis was not recognized preoperatively, and the pulmonary artery orifice was observed to have a normal diameter intraoperatively.

Because of our patient's poor condition, it was decided that a closed technique be performed immediately. The case presented shows that for creation of continuity between the right ventricle and left pulmonary artery without the use of cardiopulmonary bypass, the closed technique can be applied to a patient with

TOF in whom total correction had been previously performed. We decided to present this case because, as far as we know, this is the first time that such a technique has been used.

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