How-to-do-it

Complete autologous reconstruction of the aorta and the pulmonary bifurcation in truncus arteriosus communis

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Abstract

Truncus arteriosus communis is a congenital heart malformation, which is usually repaired in the neonatal period or early infancy. Although results of repair are good, there is long-term morbidity caused by reoperations mainly owing to right ventricle to pulmonary artery conduit exchange or stenosis at the pulmonary artery bifurcation as recently reported for Contegra™ conduits. We present a new technique for complete autologous reconstruction of the aorta and the pulmonary bifurcation in truncus arteriosus type I and II.

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1. Introduction

Truncus arteriosus communis (TAC) accounts for 1% of all congenital heart malformations. Repair is performed in the first months of life [1] with excellent long-term results [2]. Dearani et al. [3] reported that younger age at operation was associated with improved late survival. Delayed repair can lead to pulmonary hypertensive vascular disease caused by systemic pulmonary artery (PA) pressure. Repair consists of VSD closure, separation of the pulmonary artery bifurcation from the aorta and connection to the right ventricle (RV) with a conduit. Frequently, the aorta and the PA bifurcation are reconstructed with patch material or additional conduit material, respectively. Particularly in TAC-type-II, the pulmonary bifurcation needs patch augmentation preferably with autologous tissue. In some cases, severe malformation of the truncus valve requires replacement by homograft or prostheses.

We describe a new technique for the reconstruction of the aorta and the pulmonary bifurcation in truncus arteriosus communis with enlargement of the pulmonary bifurcation with native growing tissue in a complete autologous way without the use of patch material.

2. Technique and case report

We performed this procedure for the first time in a 4-week-old neonate, weight 3.3 kg, with truncus arteriosus communis type II.

Under cardiopulmonary bypass and cardioplegic cardiac arrest, the ascending aorta was transected just above the commissures of the truncus valve after the coronary arteries have been carefully identified. A second transection was performed distal to the orifice of the pulmonary arteries thus excising a circular segment of the ascending aorta. The resulting aortic ring, which includes the pulmonary arteries, was closed distally by suturing the ventral edge of the ring to the dorsal rim thus roofing the pulmonary bifurcation. Proximally, the valved conduit (Contegra™) for the right outflow tract was anastomosed to this aortic ring (Figs. 1 and 2). The conduit anastomosis is separated from the PA bifurcation ventrally by the aortic ring. The ascending aorta was anastomosed primarily end-to-end without the use of patch material.

After the convincing results two further neonates underwent the identical procedure for TAC-type-II. All three patients survived with an uneventful postoperative course.

3. Comments

In repair of truncus arteriosus, the pulmonary arteries are resected from the aorta; right ventricle to pulmonary artery continuity is established with an allograft or xenograft valved conduit or with a prosthesis [4].
A major cause of morbidity in the long-term of truncus arteriosus patients is the reconstructed RVOT, as the valved conduits do not grow and degenerate leading to stenosis [5]. Clearly, in the growing child several reoperations seem inevitable to adjust the graft size [5]. The benefit of a repair of the arterial trunk without a valved conduit is also possible but remains controversial.

In addition, the reconstructed pulmonary bifurcation is one of the crucial areas. Just recently, stenoses of the distal anastomosis and the PA bifurcation were reported for Contegra® jugular vein conduits [5,6]. Obviously, these conduits can induce neointimal proliferation at the level of the pulmonary anastomosis, which is particularly hazardous.
for the PA bifurcation. Therefore, it is likely to be advantageous to have additional native tissue between the conduit and the pulmonary arteries, as achieved in the technique demonstrated in this report: The autologous roofing of the PA bifurcation separates the PA bifurcation from the conduit and additionally eases the replacement of the conduit in reoperations. This is especially important in TAC-type-II and may prevent from the complications of intimal proliferation and supravalvar stenosis in bovine jugular vein conduits (Contegra®, Medtronic, Minneapolis, USA) reported by Meyns et al. and Goeber et al. [5,6].

As already pointed out the exchange of the RVOT-conduit is likely to be technically easier with our technique.

A potential disadvantage of removing a circumferential segment from the ascending aorta might be the consequences of a shortened aorta. This might lead to a traction of the aorta with a compression of the mediastinum and surrounding structures or even a compression of the right pulmonary artery by the shortened ascending aorta. However, we have not seen these theoretical phenomena in our series of three consecutive cases.

Completely autologous reconstruction of the aorta and the pulmonary bifurcation in TAC without the use of patches carries the highest potential of growth in this crucial area with lowest risk of stenosis. This can be achieved with the demonstrated technique and seems particularly advantageous in TAC-type-II.

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References