

Brief Report

Modification of the arterial switch procedure in the presence of a rare coronary arterial pattern

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Abstract Numerous techniques have been described for translocation of the coronary arteries in the setting of the arterial switch procedure. In the case we describe, the close alignment to the aortic and the pulmonary wall of the main stem supplying the left anterior descending and circumflex arteries, and dual origin of this vessel and the right coronary artery from sinus #2, required an individual approach. After taking down the main stem feeding the left anterior descending and circumflex arteries in the usual manner, we opted for a connection maintaining the artery in its existing site, and punched a hole into the neo-aorta just in front of the coronary orifice. We then used a piece of glutaraldehyde-preserved pericardium as a hood, anastomosing the right coronary artery to the new aorta by means of the usual trap door technique.

Keywords: Transposition; complex coronary anatomy; intramural coronary artery

COMPLEX CORONARY ARTERIAL ANATOMY IS STILL considered the major risk factor for the arterial switch operation. Technical expertise has progressed over the years to the point that, in many centres, the operative mortality in patients without associated major defects is now well under 5 percent.^{1,2} In patients with abnormal patterns of the coronary arteries, a higher immediate risk is well-recognized.^{3,4} We describe the individualised approach we adopted in the rare situation in which both the main stem feeding the left anterior descending and circumflex arteries and the right coronary artery arose from the left-hand sinus, known as sinus #2, with close alignment of the main stem to the walls of both the aorta and the pulmonary trunk.

Technique

A male newborn, weighing 3800 grams, with concordant atrioventricular and discordant ventriculoarterial

connections, underwent surgical correction at the age of 7 days. Balloon septostomy had been carried out at the age of 1 day. After dissection of the arterial trunks, we suspected an abnormal and complex pattern of the coronary arteries. Cardiopulmonary bypass was subsequently instituted using bicaval cannulation, and cooling to 26 degree Celsius commenced. After division of the pulmonary trunk, the heart was arrested using crystalloid solution, and a vent was placed through the wide intraatrial communication. After division of the aorta, we noted that both the right coronary artery, and the main stem feeding the left anterior descending and circumflex arteries, arose from sinus #2 (Fig. 1). Since the orifices of the 2 arterial stems were separated by about 2 to 3 millimetres from each other, we were able to dissect out the right coronary artery along with a button of aortic wall. Then, we took down carefully the attachment of the zone of apposition between the aortic valvar leaflets to the sinutubular junction, and divided the remainder of the aortic wall adjacent to orifice of the main stem feeding the left anterior descending and circumflex arteries (Fig. 2a). At this point, we also noted that the main stem was intimately aligned to the neo-aortic wall. After splitting longitudinally the orifice of the artery, we opted to make a direct

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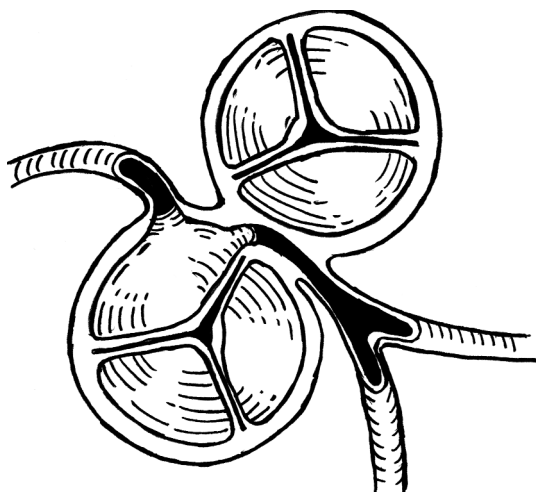


Figure 1.

Cartoon showing the dual origin of both the right coronary artery and the main stem feeding the left anterior descending and circumflex arteries from sinus #2. The main stem of the left coronary artery is intimately related to the walls of both arterial trunks.

connection to the neo-aorta, so we punched a hole of 4 millimetres diameter into the neo-aorta just in front of the orifice (Fig. 2b). We then used a piece of glutaraldehyde-preserved pericardium as a hood to complete the anastomosis (Fig. 2c). The right coronary artery was transferred to the neo-aorta using the usual trap-door technique. The defect of the neo-pulmonary trunk was also augmented with a piece of glutaraldehyde-preserved pericardium.

After an interval of 3 days the sternum was closed. The postoperative course was uneventful, without any signs of ischaemia and without any gradient over the right ventricular outflow tract, or valvar insufficiency.

Discussion

The technique we adopted permitted us to maintain the exact position and geometry of the main stem of the left coronary artery in this complex and unusual setting. A coronary which crosses the attachment of the zone of apposition between the aortic valvar leaflets to the sinutubular junction, the so-called commissure and which also shows an intimate alignment to the wall of the arterial trunks, is considered to be intramural. The particular arrangement encountered in our patient is rather rare. Massoudy et al.,⁵ in their study of 200 autopsied hearts with concordant atrioventricular and discordant ventriculoarterial connections, found the arteries arising from the same sinus in 34 specimens. Of these, only 16 revealed dual origin from the left-hand sinus #2, and only in 2 of these were the arteries arranged in the fashion discovered in our patient.

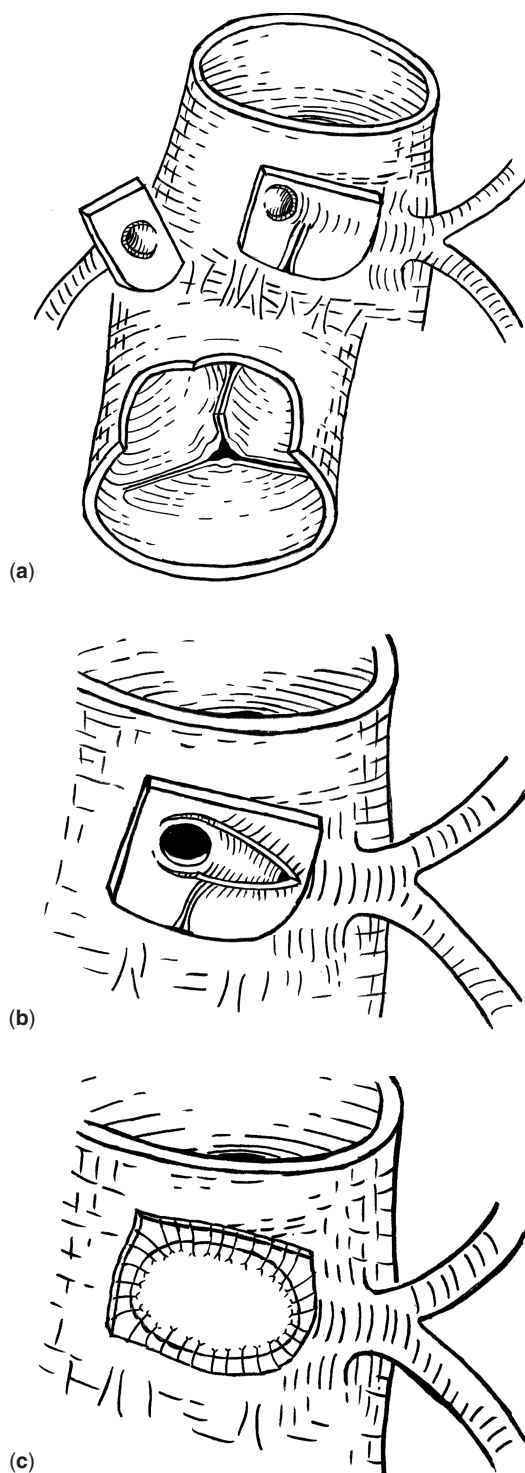


Figure 2.

We dissected out the right coronary artery along with a button of aortic wall. After taking down the attachment of the zone of apposition of the valvar leaflets to the sinutubular junction (a), we confirmed the intimate relationship of the main stem of the left coronary artery to the neo-aortic wall. After splitting the mouth of the artery longitudinally (b), we punched a 4 millimetre hole into the neo-aorta just in front of the arterial orifice (b). We then used a piece of glutaraldehyde-preserved pericardium as a hood (c) to complete the anastomosis.

Numerous techniques have been described for translocation of the coronary arteries. These include direct implantation using the so-called trap-door technique, and various modifications.^{6–8} In our case, the close alignment of the main stem feeding the left anterior descending and circumflex arteries to the walls of the arterial trunks, combined with the dual origin from sinus #2, required an individual approach. Because there was an adequate distance between the two arterial orifices, we were able to excise the right coronary artery in regular fashion. But, since we were unable to mobilise the intramural segment of the left coronary artery, we decided to leave it in place, rather than court the risk of rotating or kinking the artery during an attempted translocation. Thus, to an extent, our own technique was a modification of the approach suggested initially by Aubert et al.⁶ The pericardial hood we constructed to achieve the anastomosis to the neo-aorta also needed to be of limited size so as to ensure no compression by the newly reconstructed and bulbous pulmonary trunk. Careful follow-up will now be needed, since the results of these modified techniques may show a higher incidence of arterial obstructions when compared to the translocations that are achievable in the more usual and simple arrangements.

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