How to do it

Repair of anomalous connection of the left coronary artery to the pulmonary artery using native aortic and pulmonary tissue flaps

Jacques A.M. van Son *, Friedrich W. Mohr

Department of Cardiovascular Surgery, Herzzentrum, University of Leipzig, Russenstrasse 19, D-04289 Leipzig, Germany

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Abstract

A modified repair technique in anomalous connection of the left coronary artery to the main pulmonary artery is reported in which transfer of the origin of the vessel into the aortic root is facilitated by augmentation with native aortic and pulmonary tissue flaps. This modification reduces tension on the anastomosis and may enhance the likelihood of successful transfer of the left coronary artery into the aortic root. © 1997 Elsevier Science B.V.

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1. Introduction

In anomalous connection of the left coronary artery (LCA) to the pulmonary artery, the whole of the LCA or only the left anterior descending or circumflex branch connects anomalously to the proximal main pulmonary artery, most commonly to the left (posterior) sinus of Valsalva [1]. Concomitant with the postnatal decrease in pulmonary artery pressure the flow in the anomalous LCA becomes reversed, rendering the oxygenation of the left ventricular myocardium dependent on the adequacy of collateral circulation from the right coronary artery. Consequently, secondary to congestive heart failure (often associated with mitral valve incompetence), the natural history of this malformation is unfavorable with a reported mortality rate of 65% during the first year of life [2].

Although several surgical procedures have been utilized for treatment of anomalous connection of the LCA to the pulmonary artery, there is now general agreement that a two-coronary artery system should be constructed with immediate restoration of LCA perfusion [3–8]. Transfer of the origin of the LCA into the aortic root appears to be the most direct and therefore advisable procedure. However, there may be situations in which a long distance between the origin of the LCA and the anticipated implantation site in the aortic root may complicate this procedure. In such circumstance, tubular augmentation of the LCA with native aortic and pulmonary tissue flaps may be a useful adjunct technique.

2. Operative technique

A 2-year-old boy with angiographically proven anomalous connection of the LCA to the pulmonary artery was referred with a history of failure to thrive and mild congestive heart failure. The left ventricular shortening fraction was 24%. The mitral valve was mildly regurgitant. Operative treatment was performed without delay.
The ascending aorta and the main pulmonary artery and its branches were widely mobilized and the ligamentum arteriosum was divided. The LCA was found to arise from the left (posterior) sinus of Valsalva of the pulmonary artery. The distance between the origin of the LCA and the anticipated implantation site in the aortic root (which was marked with a fine suture) was 16 mm. Under cardiopulmonary bypass cardioplegic solution was administered into the aortic root and into the main pulmonary artery after both had been cross-clamped. The main pulmonary artery was opened anteriorly and the LCA ostium was excised with nearly the entire sinus wall from which it arose with extension of the tissue flap up to the pulmonary bifurcation (Fig. 1A). The LCA was carefully mobilized up to its bifurcation. Subsequently, a large posteriorly hinged trap-door incision was made at the left sinotubular junction of the aorta to balance against the pulmonary artery flap on the LCA. A preliminary aortotomy aided in avoiding aortic valve leaflet damage. The proximal LCA with its adherent tissue flap was slightly rotated in a clockwise fashion and was anastomosed to the aorta with a continuous 7-0 polyglyconate suture (Maxon, Davis and Geck, Danbury, CT, USA) with the aortic and main pulmonary artery tissue flaps forming the respective posterior and anterior walls of the proximal LCA (Fig. 1B). The thus constructed tubular augmentation of the LCA resulted in a widely patent neo-coronary ostium and a tension-free anastomosis between LCA and aorta. The posterior segment of the transected main pulmonary artery was augmented with an untreated autologous pericardial patch to fill the tissue defect and to avoid pressure on the posteriorly coursing LCA.

The postoperative course was uncomplicated; notably, there was electrocardiographic and enzymatic absence of myocardial ischemia. At 9-month follow-up, the patient was in excellent clinical condition, the left ventricular shortening fraction had increased to 35%, and angiography demonstrated a widely patent LCA (Fig. 2). The mitral valve regurgitation had resolved.

3. Discussion

Augmentation of the proximal LCA with native aortic and pulmonary arterial tissue flaps is a useful adjunct in the transfer of the anomalously connected LCA in the circumstance where a long distance between the origin of the LCA from the pulmonary artery and the anticipated implantation site in the aortic root may preclude such procedure. In analogy to the experience in the arterial switch operation and repair techniques using arterial flaps in various congenital cardiac anomalies, we believe that the proposed technique is also feasible in the neonate and young infant. It is important to implant the LCA as posterior as possible to minimize compression of the LCA by the main pulmonary artery. We prefer the use of native aortic and pulmonary tissue flaps as opposed to the use of a native pulmonary tissue flap only, because using the latter technique a less wide neo-coronary ostium is created with a circumferential suture line with the potentially increased risk of thrombus formation [6]. In the technique that we propose, half of the circumferential suture line is interrupted and the aortic and pulmonary arterial flaps are sutured together to form the proximal extension of the LCA (Fig. 1B). The main pulmonary artery is reconstructed end-to-end with augmentation of its posterior segment with pericardial patch.
ence of the neo-coronary ostium is devoid of a suture line. Slight rotation of the LCA tissue flap has not posed a problem in our experience. Immediate proximity of the anomalous LCA ostium to a commissure of the pulmonary valve, which is a frequent finding [1], may necessitate temporary detachment of the commissure to allow excision of part of the sinus wall supporting the commissure to obtain sufficient cuff lateral to the coronary ostium. In the less common case of anomalous connection of the LCA to the left anterior aspect of the main pulmonary artery, the LCA may be routed anterior to the main pulmonary artery [4]. These modifications may render transfer of the anomalous LCA almost always possible, thus reducing the necessity of applying less optimal techniques of establishing a two-coronary artery system, such as a tunnel operation according to Takeuchi et al. [5], end-to-end anastomosis of the LCA to the left or right subclavian artery [7], or bypass grafting of the LCA [3]. These procedures have reported disadvantages of supravalvar pulmonary stenosis, baffle obstruction, and aortic valve damage, kinking of the subclavian artery and occlusion of the subclavian-coronary anastomosis, and occlusion of the coronary bypass graft, respectively [3,7].

References