Direct Reimplantation as an Alternative Approach for Treatment of Anomalous Aortic Origin of the Right Coronary Artery

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Anomalous aortic origin of the coronary artery (AAOCA) is a rare cardiac anomaly associated with myocardial ischemia, infarction, and even sudden death. We report 2 patients presenting with AAOCA of the right coronary artery originating from the left coronary sinus with an initial intramural course. In both patients, we performed uncomplicated direct reimplantation of the right coronary artery into the right coronary sinus. For this purpose, the right coronary artery was dissected from the transmural emersion point out of the aortic wall, subsequently as proximal as possible transected and directly reimplanted into the right coronary sinus. In both cases, the postoperative course was uneventful, and cardiac computed tomography confirmed excellent postoperative results after 1 year of follow-up. This technique is a convenient and easily performable approach, characterized by short cross-clamp times and avoidance of aortotomy, and thus is an excellent alternative strategy.


Anomalous aortic origin of the coronary artery (AAOCA) is a rare cardiac anomaly that is associated with myocardial ischemia and sudden death—especially among the young and athletes [1]. Several surgical techniques have been described for treatment of AAOCA including coronary artery bypass graft surgery (CABG), “unroofing” technique, reimplantation of the coronary ostium, and translocation of the pulmonary artery [2–8]. In particular, reimplantation of the coronary ostia restores normal anatomic conditions and thus may be the solution for every potential morphologic concern. Nonetheless, reimplantation of the coronary ostium is technically challenging, and only a few reports exist describing successful performance of this technique [2, 3].

With the present 2 cases, we describe an alternative approach, easy and quick to perform, without need for aortotomy. Until now, no reports have described a comparable approach avoiding aortotomy, only being performed from the outer side of the aorta for treatment of AAOCA of the right coronary artery (RCA).

Technique

The first patient, a 22-year-old man, presented after prior cardiopulmonary resuscitation due to ventricular fibrillation, occurring during his marathon participation. This athletic male reported neither prior episodes of chest pain nor syncope or dyspnea on exertion. Emergency coronary angiography demonstrated an absence of coronary stenosis, but revealed the RCA originating from the left coronary sinus. Magnetic resonance imaging confirmed these findings and impressively revealed the anomalous RCA originating from the left coronary sinus with an intramural course between the aorta and the pulmonary artery (Fig. 1). The second patient was a 49-year-old woman with stable angina. Elective coronary angiography demonstrated the same AAOCA of the RCA. Likewise, the RCA originated from the left coronary sinus, taking an intramural course between aorta and pulmonary artery.

Both procedures were performed by median sternotomy on normothermic cardiopulmonary arrest. After cross-clamping of the aorta, cold crystalloid cardioplegia was administered into the aortic root. Venting was performed in a typical manner, using standard needle vent in the aortic root. After careful examination of the topical coronary anatomy, the RCA was attentively dissected from the emersion point from the aortic to the crux cordis. Subsequently, the RCA was transected directly distal to the emersion point and the stub closed by sewing over with the aortic wall using 6-0 polypropylene suture. For preparation of the central anastomosis, a 5-mm hole was punched into the right coronary sinus. After sufficient mobilization, the RCA was directly reimplanted in a standard end-to-side fashion, using a continuous 7-0 polypropylene suture (Fig. 2). After sufficient deairing using the needle vent, the clamped aorta was deblocked, and subsequent weaning from extracorporeal circulation was smoothly performed. In both cases, the reimplanted RCA had sufficient length...
without kinking or strain. Flow measurement by ultrasonography revealed excellent coronary flow. Procedure times were 85 and 110 minutes, respectively; aortic cross-clamp time was 25 minutes in both cases. The postoperative course was uneventful for both patients.

Comment

Anomalous aortic origin of coronary arteries is a rare cardiac disorder. Corresponding incidences are assumed to be between 0.1% and 0.3% [4]. Pathophysiologic theories explaining sudden death include compression of the RCA during its intramural course between aorta and pulmonary artery, presence of slitlike ostia, marked artery angulation, stretching of the RCA during distention of aortic and pulmonary artery, arterial spasm, and malignant arrhythmias induced by minor myocardial ischemia. Affected patients are usually alleged healthy, with minor symptoms. Several surgical techniques have been described in insular reports for the treatment of anomalous right coronary artery [2, 3, 5–8].

Within this variety of reported techniques, CABG and unroofing are the most commonly used procedures. But it has to be considered that CABG using the internal mammary artery or the saphenous vein, especially without proximal ligation of the native coronary artery, can lead to an unsatisfactory result because of competitive flow [7]. Although CABG may be an acceptable therapy for an elderly patient with coexistent coronary artery disease, it seems imprudent for a young patient.

On the contrary, the unroofing technique can be relatively easily performed and generally provides good results. Nonetheless, some reports describe relevant aortic regurgitation due to detachment of the intercoronary aortic commissure, subsequently requiring aortic valve replacement or the Ross procedure [5, 6]. Mumtaz and colleagues [6] modified the unroofing technique by maintaining the intercoronary commissure, minimizing the risk of aortic regurgitation. A further technique, pulmonary artery translocation, was described by Gulati and colleagues [8] in 4 patients for the treatment of a single coronary ostium. Alternatively, the reimplantation of the coronary ostium with a surrounding aortic button into the appropriate sinus was described by Erez and coworkers [3]. Although this technique creates a normal coronary anatomy, this sophisticated technique is only described in insular reports—probably owing to its technically challenging aspects [2, 3].

The present case reports describe a different and much more easy approach. As represented by a short procedure and cross-clamp times, this technique is less invasive, easy, and convenient to perform. As far as we know, there exist no reports describing a comparable approach for treating AAOCA of the RCA with a single ostium and an initial intramural course between aorta and pulmonary artery. One advantage of our technique is that it can be performed without touching the aortic valve, eliminating the potential risk of aortic regurgitation. Another merit lies in the sparing of the right internal mammary artery as a conduit in a young adult in whom coronary artery
disease may develop later. The most important aspect of performing our technique is to estimate the correct length of the RCA. For those purposes, adequate transection of the RCA and sufficient mobilization of the distal segment is essential to avoid kinking.

In conclusion, our reported technique represents a feasible and convenient approach and thus a serious alternative for treating AAOCA of the RCA originating from the left coronary sinus with a proximal intramural course. Likewise, when the anomalous RCA is outside the wall of the aorta as it travels between the aorta and the pulmonary artery, application of our technique is supposable. The main thing is the sufficient mobilization of the RCA, so that the anastomosis can be performed like a common aortic anastomosis in CABG surgery.

References


