Successful neo-ostium creation using pulmonary artery tissue in a case of anomalous origin of the left coronary artery from the right sinus of Valsalva

Kazuya Kumagai, Hajime Kin*, Akio Ikai and Hitoshi Okabayashi

Department of Cardiovascular Surgery, Iwate Medical University, Memorial Heart Center, Iwate, Japan

* Corresponding author. Department of Cardiovascular Surgery, Iwate Medical University, Memorial Heart Center, 19-1 Uchimaru Moroika, Iwate 020-8505, Japan. Tel: +81-19-6515111; fax: +81-19-6248384; e-mail: hkin@iwate-med.ac.jp (H. Kin).

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Abstract

Anomalous origin of the left coronary artery (LCA) from the right sinus of Valsalva is rare and is known to cause sudden death in young patients. A 17-year old male patient experienced syncopal episodes after intense exercise. No abnormal findings were noted on brain magnetic resonance imaging, electroencephalography or Holter monitoring. Contrast-enhanced coronary computed tomography revealed the anomalous origin of the LCA from the right sinus of Valsalva. Considering the positional relationship with the aortic valve and the morphology of the left main trunk, a neo-ostium was created in the left coronary sinus, and patch angioplasty was performed using pulmonary arterial wall tissue. The postoperative course of the patient was uneventful, and the patient remains asymptomatic 2 years after surgery. Here, we describe this case and review the literature on the different surgical techniques for this anomaly. We believe that our technique would be useful in cases of anomalous origin of the LCA from the right sinus of Valsalva, regardless of morphological variations.

Keywords: Coronary artery anomaly • Ischaemic heart disease • Coronary surgery • Patch angioplasty

INTRODUCTION

The anomalous origin of a coronary artery from the opposite sinus of Valsalva is rare, with an estimated incidence of 0.15–0.39% reported in an invasive angiographic study [1]. The most concerning issue related to this condition is the association with myocardial ischaemia or sudden death. Specifically, cases in which the coronary artery has an interarterial course between the aorta and the pulmonary artery are believed to carry the highest risk.

CASE

The patient was a 17-year old boy with unremarkable family and medical histories. He experienced syncope for 1–2 min during exercise, which recovered spontaneously, several times. Brain magnetic resonance imaging, electroencephalography and Holter monitoring were performed, but these examinations did not reveal any abnormal findings. Normal left ventricular ejection fraction and no valvular diseases were noted on transthoracic echocardiography. Subsequently, contrast-enhanced coronary computed tomography (CT) was performed, which revealed that the left main trunk (LMT), originating from the right sinus of Valsalva, was present between the aorta and the pulmonary artery (Fig. 1A). This anomaly was considered to be the cause of syncope, and surgery was considered necessary to prevent sudden death.

A median sternotomy was performed, and mild hypothermic cardiopulmonary bypass (CPB) was started. After exposing the left and right coronary arteries, we found no anomaly in the origin of the right coronary artery, but the left coronary artery (LCA) originated from the right sinus of Valsalva. The main pulmonary artery was transected at its bifurcation, and the LMT did not reveal an intramural course of the aorta and also exposed. After cardiac arrest, the ascending aorta was transversely incised. The origin of the LCA was confirmed through the aortic lumen, and an oval shape was identified adjacent to the commissure of the right coronary cusp and left coronary cusp (LCC). The wall of left sinus of Valsalva on the side of the LCC commissure was incised, and the LMT was incised, involving the bifurcation between the anterior descending and circumflex branches. The incised area of the LMT was sutured with the left sinus of Valsalva using 7–0 polypropylene interrupted sutures (Prolene; Ethicon, San Angelo, TX, USA). The pulmonary arterial wall was partially resected (1 × 1 cm) and then sutured so that it covered the incised area as a patch using 7–0 polypropylene continuous and interrupted sutures (Fig. 2A–C). After the aortic wall was closed, the aortic cross-clamp was released. The pulmonary artery was also sutured for reconstruction using autologous pericardium. The durations of CPB and aortic cross-clamp were 168 and 80 min, respectively.

The patient was discharged 11 days later after an uneventful recovery. A postoperative contrast-enhanced CT scan showed the original patency and the neo-ostium of the LCA (Fig. 1B). The patient resumed playing basketball and remains asymptomatic 2 years after surgery.
DISCUSSION

Origin of the LCA from the right sinus is associated with the worst prognosis, although sudden death has been reported in all variations of a coronary artery originating from the opposite sinus of Valsalva [2]. In the present case, this anomaly was detected because the patient experienced syncope during exercise, and in some cases, sudden death is the primary outcome. Of note, there has been a recent dramatic shift in clinical care from medical observation to surgery [2].

The reported surgical techniques for this anomaly include the unroofing technique [3, 4], patch angioplasty [5], coronary artery bypass graft (CABG) [4], direct translocation (reimplantation) [4] and pulmonary artery translocation [4]. Selection of a technique depends on the anatomy, for example, the length of the coronary origin, the course of the coronary artery and the positional relationship between the orifice and the aortic valve commissure. Gulati et al. [4] selected surgical strategies based on aspects of anatomical morphology. In the present case, 320-slice CT of the coronary artery was useful in evaluating the morphology of the coronary artery and the presence or absence of the intramural course of the aorta (Fig.1A).

The unroofing technique is one of the most commonly reported procedures for origin of a coronary artery from the opposite sinus [3]. However, the unroofing technique is performed in cases of an intramural course and postoperative aortic valve replacement is required when the left coronary orifice is adjacent to the aortic valve (commissure). In the present case, preoperative CT did not reveal an intramural course of the aorta. Furthermore, the left coronary orifice was found to be adjacent to the commissure intraoperatively; therefore, the unroofing technique was not selected.

Concerning CABG, whether internal thoracic artery or saphenous vein graft (SVG) should be used must be decided on, considering competitive flow and graft failure. Young patients may be dependent on graft blood flow alone; therefore, on occlusion, the risk of myocardial infarction increases. In the present case, CABG was not selected because the patient was young.

Reimplantation was one of the procedures in this case because LMT could require extensive dissection and mobilization. However, this was not selected because of the risk of arterial stretching and kinking as well as anastomotic stenosis.

Ito et al. [5] incised the left sinus of Valsalva to form a new coronary ostium and conducted patch angioplasty of the SVG to treat this anomaly. SVG is easier to use than the autologous pericardium, and the risk of retraction at the anastomotic site is low. However, we used the pulmonary arterial tissue in the present case because we considered that, histologically, the prevention of thrombus formation with the presence of vascular endothelium would help maintain long-term patency. Pulmonary arterial tissue has been frequently used in congenital heart surgery. However, the scientific reasons for its usage have not been reported.

The technique used in the present case can be applied, regardless of morphological variations. To our knowledge, patch coronary angioplasty with pulmonary arterial tissue in adults has not been reported. However, as the long-term durability of this procedure is not established, this patient should be carefully followed up.

Figure 1: (A) Preoperative contrast-enhanced CT scan showing an anomalous left main trunk originating from the right sinus of Valsalva. (B) Postoperative contrast-enhanced CT scan showing the patency of the neo-ostium of the left coronary artery (arrow).

Figure 2: Drawings depicting (A) the performance and (B) completion of angioplasty. (C) Intraoperative photograph showing the creation of a neocoronary artery orifice using a pulmonary arterial wall patch (arrow). Ao: aorta; PA: pulmonary artery; LMT: left main trunk; RCA: right coronary artery; RCC: right coronary cusp; LCC: left coronary cusp; NCC: non-coronary cusp.
Conflict of interest: none declared.

REFERENCES


