

# Stentless Aortic Root Bioprosthesis Implantation and Coronary Artery Bypass Grafting in a Patient with Single Right Coronary Artery

Shinji Kanemitsu, MD, Keizo Tanaka, MD, Hitoshi Suzuki, MD, Toshiya Tokui, MD, and Toshihiko Kinoshita, MD

Coronary arteries with anomalous origin from the aorta can be a risk factor during aortic root procedures. We report on the successful management of aortic root surgery in a 76-year-old man with a single coronary ostium. Preoperative computed tomography and angiography revealed an anomalous course of the left main coronary artery from the right sinus of Valsalva. A stentless aortic root bioprosthesis (Prima Plus) was implanted using a modified subcoronary technique. The origin of the left main coronary artery was approximately 2 mm beyond the ostium of the common trunk. Attention to the anatomic relationship of the anomalous coronary arteries to the aorta by clarifying the anatomy of coronary arteries in advance allowed us to safely perform aortic root surgery in a patient with an anomalous origin of the coronary arteries. (*Ann Thorac Cardiovasc Surg* 2007; 13: 128–31)

**Key words:** anomalous coronary artery, stentless aortic root bioprosthesis, aortic root surgery

## Introduction

Anomalous origin of a coronary artery from the aorta is usually an incidental finding; however, if not recognized it can lead to serious complications during cardiac operations. In particular there is the risk of damage to an anomalous coronary artery during an aortic or mitral valve operation.<sup>1,2)</sup> We report on the successful surgical treatment of a patient with anatomically abnormal positioning of the coronary ostia associated with aortic valve disease and coronary artery disease. A stentless aortic root bioprosthesis (Prima Plus) was implanted using a modified subcoronary technique. We also discuss the significance of coronary artery anomalies during aortic root operations.

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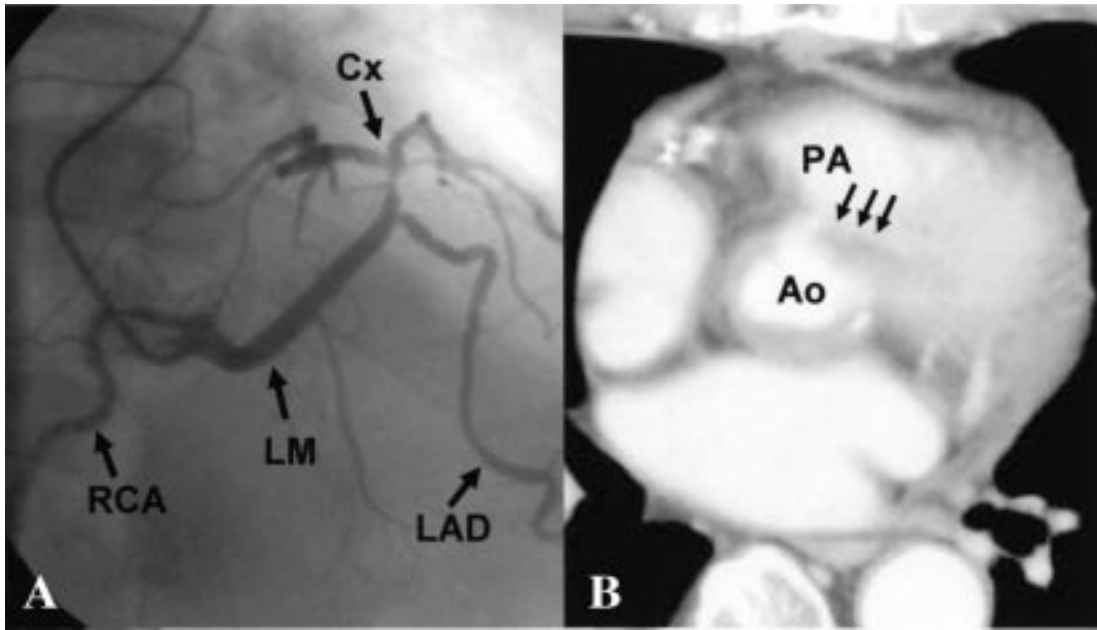
*From Department of Thoracic and Cardiovascular Surgery, Anjo Kosei Hospital, Anjo, Japan*

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Address reprint requests to Shinji Kanemitsu, MD: Department of Thoracic and Cardiovascular Surgery, Anjo Kosei Hospital, 28 Higashihiroko, Anjo-cho, Anjo, Aichi 446–8602, Japan.

## Case Report

A 76-year-old man had been followed for 9 years after percutaneous coronary intervention. He presented with complaints of increasing shortness of breath and he was classified as Stage 4 according to the New York Heart Association (NYHA) classification. Coronary angiography revealed a dominant right coronary artery (RCA) with anomalous circumflex (Cx) and a left anterior descending coronary artery (LAD) (Fig. 1A). He was found to have two vessel coronary artery disease involving a 75% proximal stenosis of the RCA and 75% stenosis of the Cx. Aortic valve stenosis was demonstrated with a pressure gradient of 64 mmHg. Computed tomography (CT) and angiography revealed an anomalous course of left main coronary artery (LM) from the right sinus of Valsalva (Fig. 1B). The course of the anomalous LM was between the aorta and the pulmonary trunk. The anomalous Cx coursed lateral then posterior to the aorta to enter the atrioventricular groove and supply the lateral wall. The LAD appeared to travel in the basal septum to reach the anterior wall. Serial echocardiography (ECG) revealed reduced ventricular function with an ejection fraction of 51%.



**Fig. 1.**

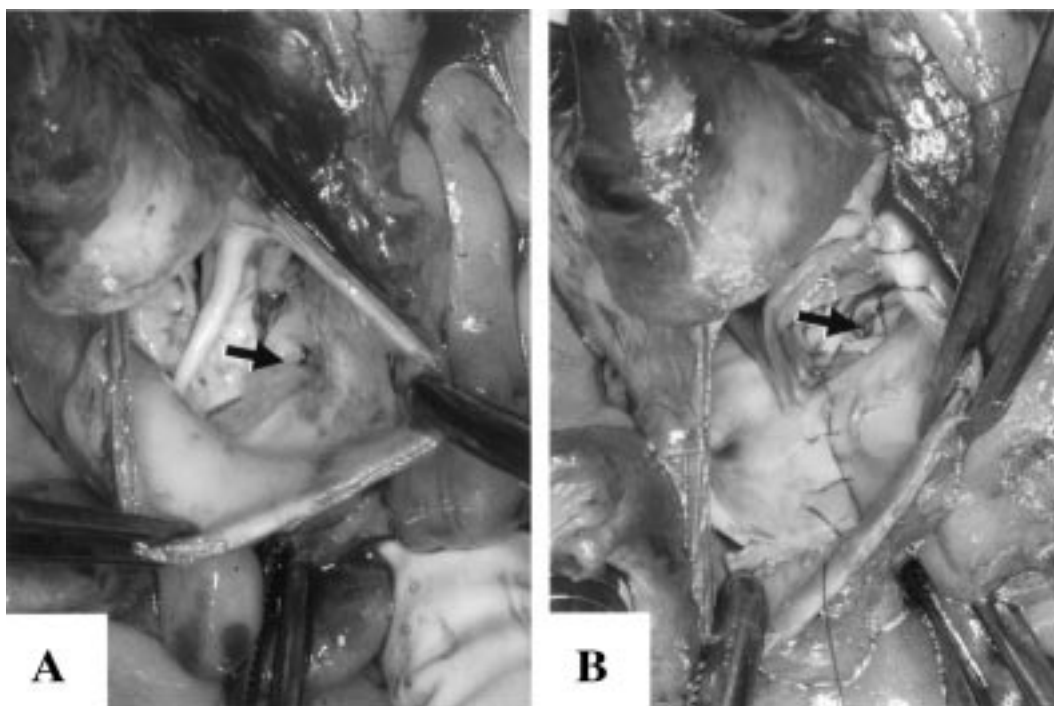
- A:** Angiogram demonstrating the origin of the left main coronary artery (LM) from the proximal right coronary artery (RCA). LAD, left anterior descending coronary artery; Cx, circumflex.
- B:** Computed tomography of the chest shows the internal course of the left main coronary artery. Arrows indicate the left main coronary artery coursing between the ascending aorta and the pulmonary trunk. Ao, ascending aorta; PA, pulmonary artery.

Aortic root implantation and coronary artery bypass grafting were performed through a median sternotomy with the aid of cardiopulmonary bypass and moderate hypothermia to 28°C. A transverse aortotomy revealed a single anterior located in the coronary ostium. The origin of the LM was visible approximately 2 mm beyond the ostium of the common trunk (Fig. 2A). The heart was arrested with antegrade cold blood cardioplegia delivered by respective direct cannulation of the RCA and the LM. A heavily calcified trileaflet aortic valve was excised. A 23 mm Prima Plus aortic root bioprosthesis (Edwards Lifesciences, Irvine, CA) was sutured to the aortic annulus while paying particular attention to the abnormal coronary arteries. We excised only the left coronary sinus of the bioprosthesis and rotated it 120 degree using a modified subcoronary implantation technique. We implanted the bioprosthesis so that the left coronary sinus of the bioprosthesis valve was in the patient's right coronary sinus. The outflow suture line was done with a running technique. Subcoronary anastomosis was undertaken around the ostium of the common trunk in the right coronary sinus (Fig. 2B). We transected the remaining tissue of the bioprosthesis to the height of the native aorta. The two sutures at the right-left and right-non commissure

were continued in a running fashion and then tied together. The distal anastomosis of the bioprosthesis to the aorta was completed, and the aortotomy closed. Coronary artery bypass grafting was then done; one saphenous vein graft was anastomosed to the RCA and another saphenous vein graft to the Cx. Both saphenous veins were anastomosed to the native ascending aorta, and the heart was carefully de-aired. The patient was smoothly weaned from cardiopulmonary bypass in a sinus rhythm. Postoperative electrocardiography was unchanged from before the operation and echocardiography performed before discharge revealed a normally functioning bioprosthesis, a reduced pressure gradient of 19 mmHg and no segmental wall motion abnormalities.

## Discussion

The incidence of anomalous origin of a coronary artery from the aorta is 0.62–0.83%.<sup>3,4)</sup> The most common anomaly is with the origin of the Cx from the RCA or the right sinus of valsalva with a course lateral then posterior to the aortic root. An anomalous Cx encircling the aortic root can be injured by deeply placed sutures or compressed by a prosthetic ring during aortic and mitral valve proce-



**Fig. 2.**  
**A:** Intraoperative photograph of the aortic root demonstrating the origin of the common trunk (arrow).  
**B:** Intraoperative photograph of the aortic root implantation. Subcoronary anastomosis was undertaken around the ostium of the common trunk (arrow) in the right coronary sinus.

dures.<sup>1,2)</sup> Ropers et al. presented the identification of the four common variations by electron beam tomography.<sup>5)</sup> Depending on the anatomic relationship of the anomalous vessel to the aorta and the pulmonary trunk, the anomaly can be classified into four common courses: posterior, interarterial, anterior, and septal courses.<sup>4)</sup> In our patient, preoperative CT and angiography revealed that the anomalous LM was long and followed an interarterial course (Fig. 1). The anomalous Cx did not encircle the aortic root, with intraoperative findings showing that the Cx coursed apart from the aortic root. Therefore, we could anastomose the bioprosthesis to the aortic annulus without a dissection of the Cx from the aortic root. If the anomalous Cx in our case had been identified immediately adjacent to the aorta under the visceral pericardium, it would have been necessary to dissect from the aortic wall along its entire course lateral and then posterior to the aorta at the level of the annulus. O'Blenes and Feindel suggested that to prevent injury, an anomalous artery should be carefully dissected away from the aortic wall, especially utilizing a full root technique.<sup>6)</sup>

An origin of all three coronary arteries from a single trunk allows implantation using a modified subcoronary

technique such as trimming of the single left aortic sinus. Coronary artery anomalies have been described as a risk factor for coronary complications after aortic root replacement.<sup>7)</sup> We suggest that it is important to clarify the anatomy of coronary arteries in advance in order to safely perform aortic root operations in patients with anomalous coronary arteries. Coronary artery anomalies appear to be more common in patients with aortic valve pathology; thus a liberal criteria for preoperative angiography may be justified.<sup>3,4)</sup> The use of various tomographic imaging techniques for diagnosis and evaluation of coronary anomalies has been described.<sup>8)</sup> Aris et al. reported an anomalous finding by multidetector row computed tomography (MDCT) before aortic valve replacement.<sup>9)</sup> We believe that if the angiographic anatomy is unclear, MDCT is useful to clearly and non-invasively show the spatial relationship of coronary arteries to the aortic root.

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