Anomalous right coronary artery arising from the left main coronary artery causing myocardial infarction

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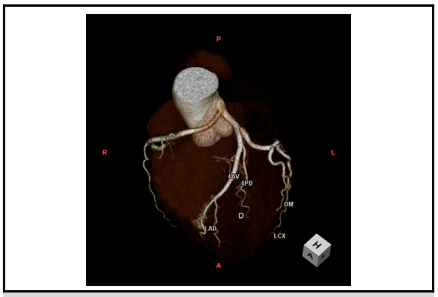

Anomalous origin of the right coronary artery arising from the left main coronary artery.

Anomalous coronary artery origin is a rare but important cause of cardiac ischemia and sudden cardiac death in relatively young patients. Herein, we report the case of a 49-year-old woman who presented with myocardial infarction caused by an anomalous right coronary artery (RCA) arising from the left main coronary artery (LMCA). The patient underwent surgical reconstruction with a successful outcome. Ethics review is not required for case report implementation at our institution, and written patient's informed consent was obtained from the patient for publication of the study data.

CENTRAL MESSAGE

We report the successful surgical repair of an anomalous right coronary artery arising from the left main coronary artery causing myocardial infarction.

CASE REPORT

A 49-year-old woman with no significant medical history of hypertension, hyperlipidemia, or diabetes presented to our hospital with acute myocardial infarction. Electrocardiogram showed ST-segment elevation in the II, III, and aVf leads. Emergency coronary angiography and subsequent coronary computed tomography angiography (CCTA) revealed a balanced coronary artery dominance and an anomalous RCA arising from the LMCA that coursed between the ascending aorta and the main pulmonary artery (interarterial type) (Figure 1, *A*, and Figure 2, *A-C*). The anomalous RCA was observed to be eccentric between the great vessels in intravascular ultrasound (IVUS) and CCTA (Figure 1, *B*, and Figure 2, *B*). The serum creatine kinase level decreased from the peak level of 1107 ng/mL. Transthoracic echocardiography revealed a left ventricular ejection fraction of 65% with normal wall motion, whereas cardiac magnetic resonance imaging (MRI) showed localized akinesis of the inferior wall with a positive late gadolinium enhancement (Figure 1, *C-F*). After discussion with our heart team, we planned an elective surgical intervention.

We initiated cardiopulmonary bypass through a median sternotomy with ascending aortic cannulation and bicaval venous drainage. Upon dissecting the aortic root around the sinuses, we found the anomalous RCA to be running between the ascending aorta and the main pulmonary artery (Figure 2, *D*). We transected the RCA, ligated the proximal segment with 2-0 silk, and closed it with 5-0 polypropylene suture along the aortic wall. We opened a small hole distal to the right coronary sinus using a 3.5-mm diameter aortic puncher and anastomosed the RCA in an end-to-side fashion with 7-0 polypropylene suture.

The patient had an uneventful postoperative course, and postoperative CCTA showed favorable results without any stenosis, flexion, or torsion of the reconstructed RCA (Figure 2, *E*). The patient was discharged 10 days after the surgery.

DISCUSSION

Anomalous origin of the coronary artery is a rare anatomical variant that has been reported to be present in 0.2% to 0.5% of the general population.[1] Of these, 1.8% of RCAs are estimated to arise from the left coronary artery, and

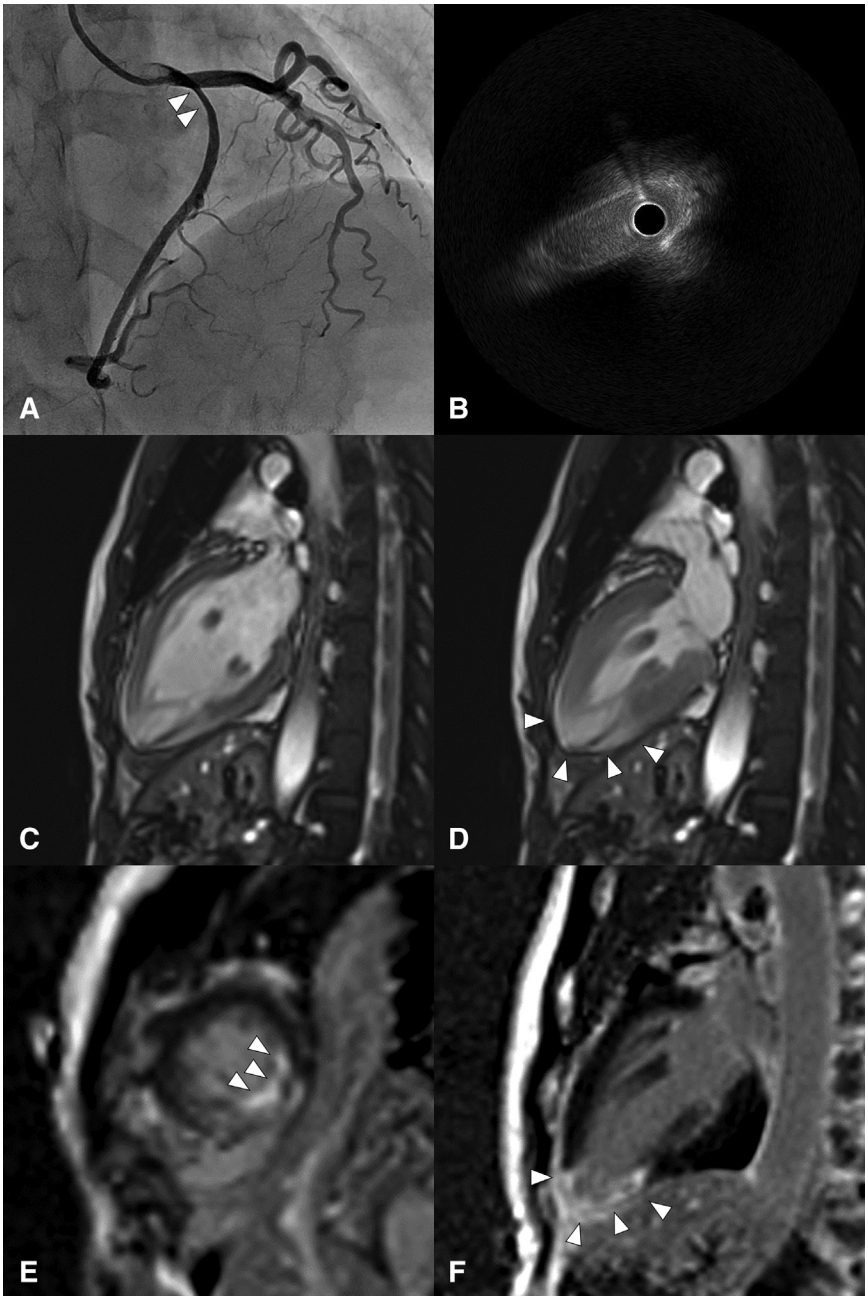

FIGURE 1. Preoperative imaging of the coronary arteries. A, Coronary angiography demonstrating luminal narrowing in the proximal lesion of the anomalous RCA arising from LMCA (*arrowheads*). B, IVUS revealing the compressed coronary artery lumen. According to the measurements, the reference lumen area was 9.1 mm^2 (3.5 × 3.3 mm), whereas the minimal lumen area was 3.7 mm^2 (3.3 × 1.4 mm), with a percentage area stenosis of 40.7%. C and D, Magnetic resonance imaging at the dilated and systolic phases revealing localized akinesis in the inferoapical region (*arrowheads*). E and F, Late gadolinium enhancement images illustrating the presence of scar tissue in the inferoapical region. *RCA*, Right coronary artery; *LMCA*, left main coronary artery; *IVUS*, intravascular ultrasound.

only a few surgical reports have been published previously.[2,3] In particular, the interarterial type of this anomaly is reportedly associated with an increased risk of cardiac ischemia and sudden cardiac death, making it an indication for surgical intervention.[4] However, it should be noted that many anomalous RCAs have no evidence of ischemia.[5] In our case, IVUS and CCTA images revealed anomalous RCA narrowing, and cardiac MRI showed localized akinesis of the inferior wall in the RCA territory, showing myocardial damage. Although it is not significant as an area stenosis, it is eccentric and may have been narrower when blood pressure was elevated.

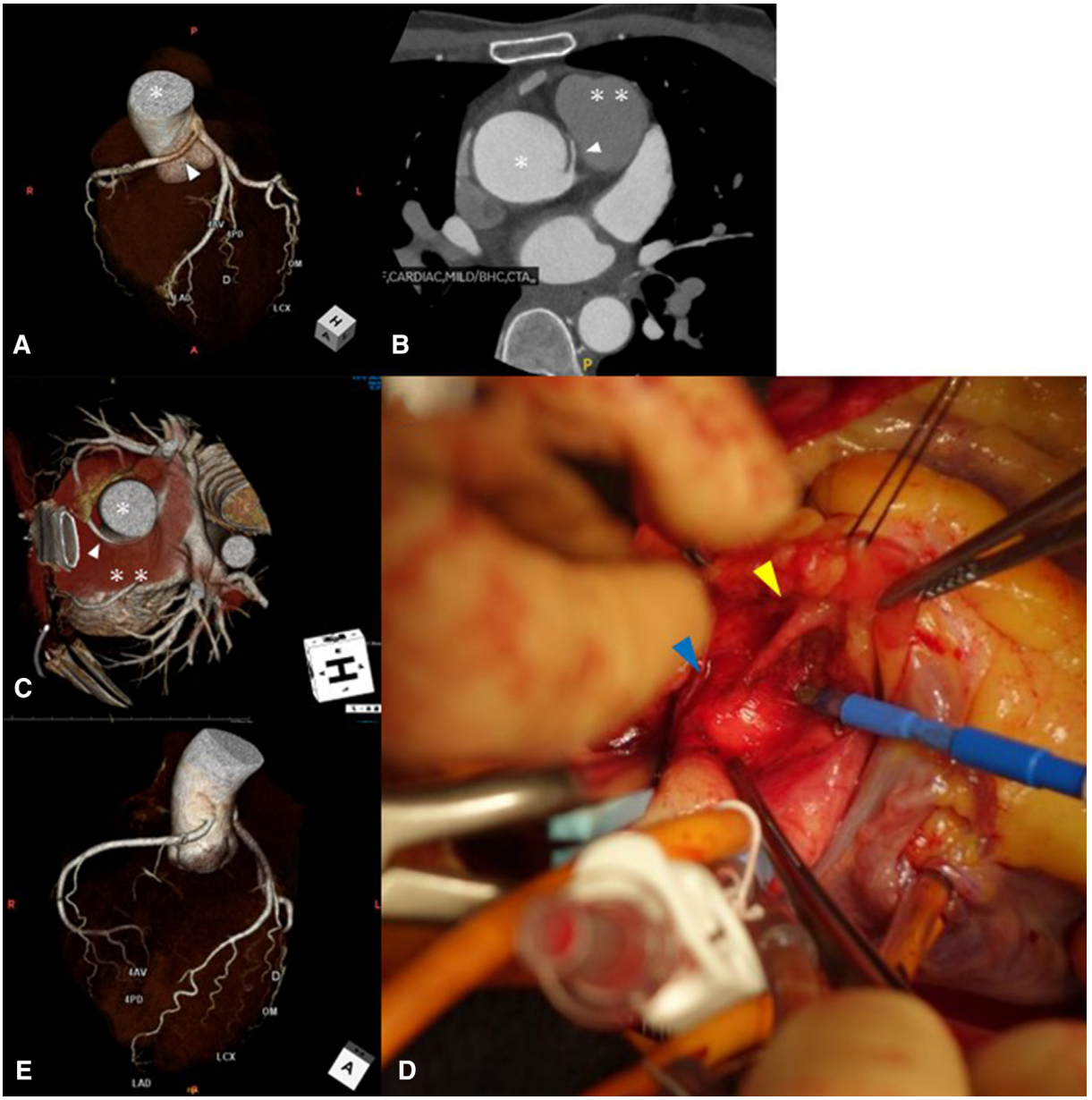

FIGURE 2. CCTA images and surgical view. A-C, Preoperative CCTA revealed luminal narrowing in the proximal lesion of the anomalous RCA arising from the LMCA (*arrowhead*). A and C, volume-rendered images; B, axial view, *ascending aorta, **main pulmonary artery. D, Surgical view after dissection around the coronary sinuses showed that the right coronary artery firmly adhered to the aortic wall (*blue arrowhead*). The distal side of the right coronary artery was minimally dissected for anastomosis (*yellow arrowhead*). E, Postoperative image showing successful transposition of the RCA to the anterior aortic wall. The ligated anomalous RCA no longer contrasted immediately after LMCA bifurcation. *CCTA*, Coronary computed tomography angiography; *RCA*, right coronary artery; *LMCA*, left main coronary artery.

Surgical treatments include coronary artery bypass grafting, reimplantation, and unroofing.[4] In our case, we opted for reimplantation because of the position, size, and angle of the anastomotic orifice, which were suitable for this procedure, as in a previous report.[3] Unroofing may be considered for the intramural type of the anomaly but is a more invasive procedure that requires aortotomy. The anomalous RCA could have been an intramural type because it firmly adhered to the aortic wall; however, we did not go so far as to confirm that it was. Coronary artery bypass grafts should be avoided in relatively young patients because of concerns about long-term patency. Surgical treatment should be carefully selected for each patient on the basis of anatomical characteristics and the patient's age and medical history. Percutaneous coronary intervention is a possible option for the interarterial type, but there are no

data on the long-term durability of the metallic coronary artery stents for mechanical compression between the great vessels. Our report highlights an effective treatment for a very rare cardiac condition of an anomalous RCA arising from LMCA. CCTA, IVUS, and contrast-enhanced MRI were useful tools for diagnosing the condition and determining the best surgical option. Further research is needed to better understand the pathophysiology and optimal treatment strategies for this rare anatomical variant.

Conflict of Interest Statement

The authors reported no conflicts of interest.

The *Journal* policy requires editors and reviewers to disclose conflicts of interest and to decline handling or reviewing manuscripts for which they may have a conflict of interest. The editors and reviewers of this article have no conflicts of interest.

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