

Anomalous right coronary artery origin, arising from the high anterior wall of the right coronary artery sinus of Valsalva in a patient with acute ST-elevation myocardial infarction

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ABSTRACT

Anomalous origin of the high take-off right coronary artery (RCA) arising from the anterior wall of the right sinus of Valsalva is rare and can pose extreme challenges for the operator, especially in the setting of acute myocardial infarction (MI). Herein, we describe a patient in whom this very rare anomaly was encountered in a setting of acute anterior wall MI with the involvement of the inferior wall. Since we were aware of the RCA anomalies, as we had recently encountered a case of another RCA anomaly with the RCA ostium arising from the left coronary sinus, in a relatively elective case, we could successfully manage this case in the acute emergent setting of ST-elevation MI, minimizing contrast load and avoiding complications. Rapid recognition of this congenital anomaly and selection of an appropriate guide catheter were keys to achieving timely reperfusion and a good outcome in this case.

Key words: Anomalous right coronary artery origin, Chest pain, Complex angioplasty, Primary percutaneous coronary intervention, ST-elevation myocardial infarction

Coronary artery anomalies can be classified according to their origin, course, and termination (Fig. 1) [1]. The incidence of coronary anomalies in patients undergoing coronary angiography is rare- 0.2–1.2% [2]. Nevertheless, it is important to know these anomalies, as they impose serious challenges during intervention. When they are encountered during elective intervention, they allow the operator sufficient time to manage them. However, during emergency situations, especially ST-elevated myocardial infarction (MI), they pose additional challenges by increasing the procedure time, contrast volume, and radiation exposure. At times, the operator may need to abandon the procedure due to failure to hook the anomalous artery and/or the absence of a good guide support. This affects both the short- and long-term prognosis of these patients, [3] in whom rapid reperfusion is critical to achieving an optimal outcome [4]. Anomalous high take-off origin of the right coronary artery (RCA) arising from the anterior wall of the right coronary sinus is a rare congenital abnormality.

We present a case of a 43-year-old man, who has presented to the emergency department with acute anterior wall MI with the involvement of the inferior wall. His coronary angiography revealed an anomalous origin of the high take-off RCA arising

from the anterior wall of the right coronary sinus. Using an appropriate guide catheter and skillful technique during the intervention, we were able to perform the successful percutaneous coronary intervention (PCI) in this patient, with stenting of the anomalous RCA and restoring of thrombolysis in myocardial infarction (TIMI) 3 flow.

CASE REPORT

A 43-year-old male presented to the Emergency Department with a complaint of severe left-sided retrosternal chest pain for the past 4 h. He was transferred to our hospital from a regional medical center. He is a known case of Essential HTN and dyslipidemia, since the last 5 years, not on medication. The patient is also a known case of newly-discovered pre-diabetes.

His vital signs on arrival revealed: Temperature 36.5°C, pulse rate 88 beats/min, blood pressure 170/100 mmHg, respiratory rate 20 cycles/min, and oxygen saturation 98%. The pain score was 3/10. Chest was bilateral and there was normal vesicular breathing. No rhonchi were heard. Cardiovascular system examination revealed audible S1, and S2 sounds with no murmurs or pedal edema. There was no raised jugular venous pressure.

His blood tests revealed: Hb 15 g/dL, hematocrit 44.6%, platelet count $369 \times 10^9/L$, low-density lipoprotein 135.94 mg/dL,

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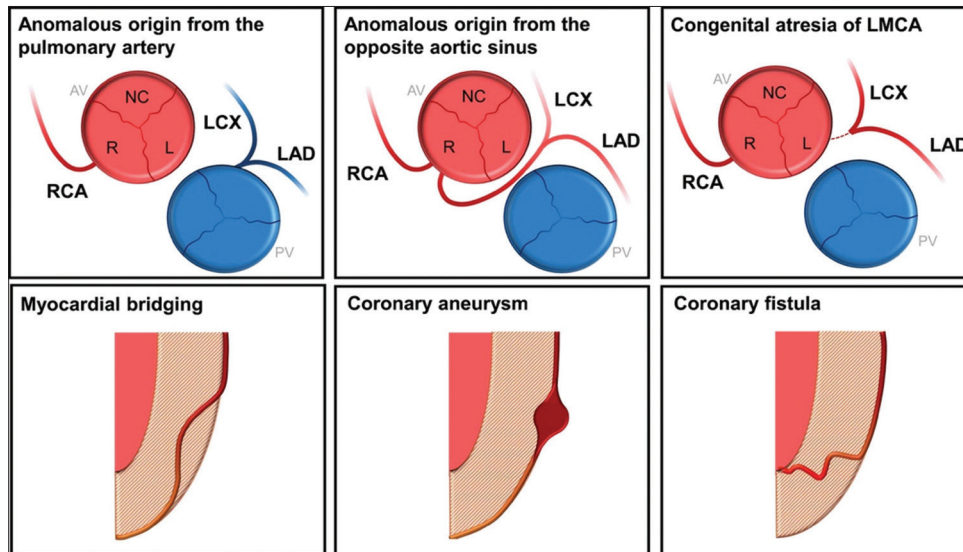


Figure 1: Schematic representation of the major types of coronary artery anomalies. AV: Indicates aortic valve, L: Left coronary sinus, LAD: Left anterior descending coronary artery, LCX: Circumflex coronary artery, LMCA: Left main coronary artery, NC: Non-coronary sinus, PV: Pulmonary valve, R: Right coronary sinus, RCA: Right coronary artery

high-density lipoprotein 30.37 mg/dL, HbA1C 6.41%, potassium 4.02 mmol/L, sodium 140.16 mmol/L, and creatinine 0.87 mg/dL. His electrocardiogram recorded in an emergency room (ER) showed evolved ST elevation in lead V1 and hyperacute changes in V2 and V3. His inferior leads were also involved with Q waves in leads II and III (Fig. 2). His cardiac enzymes were found to be elevated (Trop I 65.8 ng/L).

He was diagnosed with anterior evolved ST-elevation MI (STEMI) with the involvement of inferior leads and taken emergently to the cardiac catheterization laboratory for primary PCI. A 2 D echocardiography was done before PCI, which showed regional wall motion abnormalities with hypokinetic left anterior descendent (LAD) segments and an overall preserved left ventricular systolic function with an ejection fraction=53–55%. He also had a mild mitral regurgitation. Coronary angiography revealed 99% sub-occlusion of the proximal LAD artery as the culprit lesion (Fig. 3a), which was successfully stented with 1 drug-eluting stent with the good end result and TIMI 3 flow (Fig. 3b). His RCA angiography was highly challenging and the RCA ostium could be detected only after an aortography was performed. Cannulation of the artery ostium was not possible with the standard catheters due to its high take-off origin from the anterior wall of the right coronary sinus. After trying with multiple catheters (Judkins right, extra backup, amplatz right), we very finally successful in engaging the RCA ostium with Amplatz left 0.75. Coronary angiography showed 90–95% subocclusion of the proximal RCA with high take-off anomalous origin from the anterior wall of the right coronary sinus (Fig. 4a).

A balance middle weight guide wire 0.014" × 190 cm was crossed through the RCA sub-occlusion and parked in distal PDA. Using the anchor technique [5,6] with a 2 × 10 mm non-compliant balloon, we were able to get good support from the guide catheter (Fig. 4b).

Next multiple balloon angioplasties were performed using 2 × 10 mm and 2.5 × 15 mm semi-compliant balloons at 10–12 atm. pressure (Fig. 5a). This was followed by the implantation of a

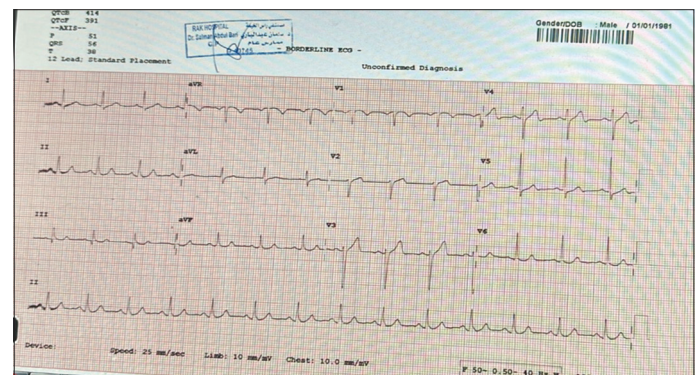


Figure 2: Electrocardiogram of the patient recorded on presentation in the emergency room, showing evolved ST elevation in lead V1 and hyperacute changes in V2 and V3. The inferior leads are also involved with Q waves in leads II and III

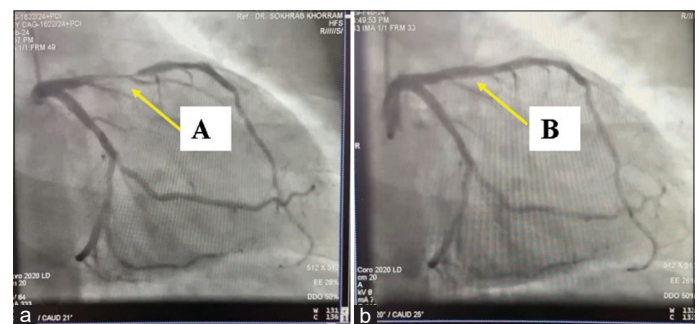


Figure 3: (a) CAG showing 99% sub-occlusion of the proximal to mid LAD as the culprit lesion; (b) LAD after successful percutaneous coronary intervention and implantation of 1 drug-eluting stent. LAD: Left anterior descending, CAG: Coronary angiogram

drug-eluting stent 2.25 × 32 mm at 12 atm. pressure. The stent was then post-dilated with a 2.75 × 10 mm NC balloon, inflated at 16–18 atm. pressure. Immediate angiography showed excellent end results with TIMI 3 flow achieved (Fig. 5b).

The patient was shifted to the intensive care unit and discharged after 48 h in stable condition. The hospital course was

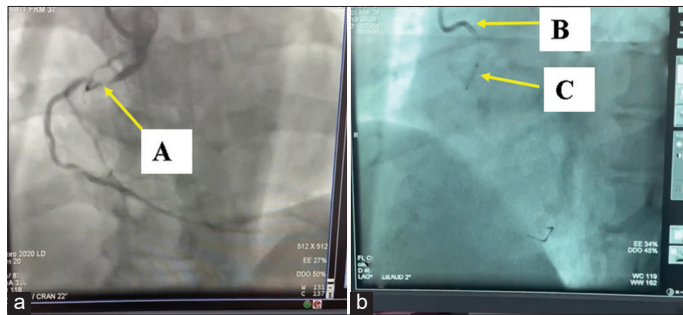


Figure 4: (A) CAG showing 90–95% sub-occlusion of the proximal RCA; (B) CAG showing high take-off anomalous origin of the RCA from the anterior wall of the right coronary artery sinus. (C) Using the anchor technique with a 2 × 10 mm non-compliant balloon to get a good guide catheter support. CAG: Coronary angiogram, RCA: Right coronary artery

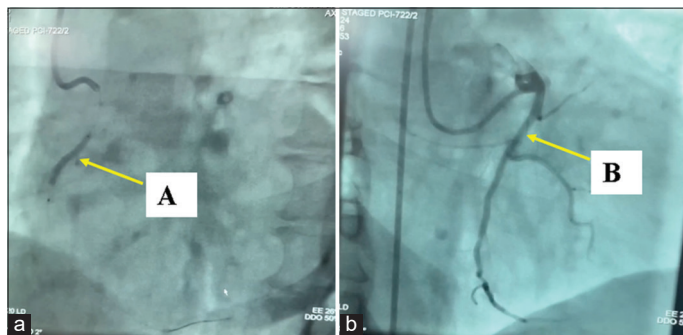


Figure 5: (a) Balloon angioplasty done with 2.5 × 15 mm Semi-compliant balloons at 10–12 atm. pressure; (b) Immediate angiography after stent implantation with excellent end result and thrombolysis in myocardial infarction flow 3

uneventful. The patient remains clinically and hemodynamically stable during his regular visits to the outpatient department for cardiac follow-up and medicine refills.

DISCUSSION

The prevalence of anomalous origin of the RCA is 0.25% [7]. Anomalous high take-off origin of the RCA arising from the anterior wall of the right coronary sinus is a variation of such congenital abnormality. When such patients present to the ER with acute STEMI, primary PCI poses a different challenge altogether. This includes prompt detection of the anomalous origin, optimal selection of guide catheter, and using ingenious techniques during PCI [8]. Our case highlights the interventional challenges to be kept in mind during angioplasty of such anomalous RCA lesions. This case is unique, as this anomaly can disrupt the appropriate management of acute coronary syndrome [9,10].

Proper guide catheter selection to ensure selective engagement, co-axial alignment, and support is paramount. Difficulty in tracking hardware should be anticipated due to acute angulation, high take-off, and sharp bends. Operators should be armed with buddy wires, anchor balloons, and guide extensions [11].

Our patient presented to the ER with acute anterior wall STEMI with the involvement of the inferior wall. His angiography revealed a high take-off origin of the RCA arising from the anterior

wall of the right coronary sinus. Since we were aware of the RCA anomalies, as we had recently encountered a case of another RCA anomaly with the RCA ostium arising from the left coronary sinus, in a relatively elective case, we could successfully manage this case in the acute emergent setting of STEMI, minimizing contrast load and avoiding complications.

By using an appropriate guide catheter (Amplatz left 0.75), and using the balloon anchoring technology during the intervention, we were able to perform successful PCI, with stenting of the anomalous RCA lesion and establishing TIMI 3 flow.

An anomalous RCA might originate from the anterior wall of the ascending aorta, from the left sinus of Valsalva with a separate ostium from the left main coronary artery, from the left main coronary artery (as a single coronary artery), or from the pulmonary trunk [5,12,13].

An anomalous origin of the RCA from the opposite sinus or from the LAD artery with interarterial course is a very rare congenital anomaly with an increased risk of sudden cardiac death. Surgery is the treatment of choice in these patients, though coronary angioplasty with stenting has been described and had good results, with <13% restenosis rate in 5 years, and improved symptoms in 71% of cases at 1-year follow-up [14,15].

CONCLUSION

Anomalous origin of the RCA arising from the high anterior wall of the right coronary sinus is a rare congenital abnormality. The condition increases the technical complexity of PCI, particularly in the setting of an acute STEMI. Rapid recognition of this congenital anomaly and selection of an appropriate guide catheter are keys to achieving timely reperfusion and a good outcome.

AVAILABILITY OF DATA AND MATERIALS

The data supporting the findings of the article are available in the patient's electronic medical records at RAK Hospital: Cardiology Department, RAK Hospital, Al Qusaidat, P O Box No: 11393, Ras Al Khaimah UAE+971-7-207-4444. <https://rakhospital.com>, mail@rakhospital.com.

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