

# Left main-like bifurcation primary percutaneous coronary intervention case report: anomalous right coronary artery ostium from the left anterior descending

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## Background

A single coronary artery ostium (SCAO) is estimated to be present in 0.066% of the general population. The proximal coronary course and the relationship with surrounding structures are related to malignant vs. benign prognoses. We present a case of SCAO with the right coronary artery (RCA) arising from the mid-left anterior descending (LAD), complicated by anterior and inferior STEMI because of acute thrombotic occlusion at the bifurcation and its percutaneous management.

## Case summary

A 56-year-old male was admitted with sudden onset of resting chest pain. His ECG showed an anterior, inferior, and right ventricular STEMI. Via trans-radial access, coronary angiography showed significant stenoses at the left main and the circumflex but also a thrombotic occlusion at the proximal segment of the LAD while no RCA was seen. After crossing the LAD occlusion, the dominant RCA appeared from the mid-LAD. A provisional stent technique was performed achieving good results. Coronary computed tomography angiography showed an SCAO congenital anomaly with a patent stent in the bifurcation accompanied by diffuse coronary artery disease causing mild stenosis of the left main, proximal, and distal circumflex.

## Discussion

The RCA arising from the mid-LAD with pre-pulmonic course has been described in only 37 cases. One reported an LAD/RCA bifurcation treatment with two stents technique in a stable scenario. The present is the first case reported of an acute thrombotic occlusion of an LAD/RCA bifurcation clinically resulting in a left main equivalent STEMI treated successfully with primary percutaneous coronary intervention using a bifurcation technique.

## Keywords

Percutaneous coronary intervention • ST elevation myocardial infarction • Coronary vessel anomalies • Single coronary artery ostium • Computed tomography angiography • Case report

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## Learning points

- Be aware of unusual ST-segment myocardial infarction ECG patterns and its unusual but possible anatomic (angiographic and tomographic) correlations.
- Be aware of the multiple anatomic, functional, and pathophysiological implications in patients with single coronary artery ostium (SCAO).
- Be aware of a simple percutaneous coronary intervention for acute thrombotic occlusion of the bifurcation of the right coronary artery originating from the left anterior descending in an SCAO.

## Introduction

A single coronary artery ostium (SCAO) with the right coronary artery (RCA) arising from the mid-left anterior descending (LAD) with pre-pulmonic course, although usually having a benign prognosis, can potentially manifest as a simultaneous anterior and inferior + right ventricle STEMI. Treatment of STEMI in anomalous coronary arteries may offer frequently operative challenges, but interventionists need to keep in mind these rare coronary patterns that may require creative empirical technical adjustments.

## Timeline

Day 1	Chest pain onset 8 h before arrival to de emergency room, diagnosis of anterior, inferior, and right ventricular STEMI
Day 1	Primary percutaneous coronary intervention of the right coronary artery (RCA)/mid-left anterior descending (LAD) bifurcation with provisional stent technique (door-to-device time 60 min, total ischaemic time 540 min)
Day 2	Recovery in the coronary care unit
Day 4	Coronary computed tomography angiography for complete evaluation of the coronary artery disease
Day 5	SPECT showed an LVEF of 38% and non-transmural infarctions with viability in both LAD and RCA territories
Day 6	Discharged home after heart team evaluation

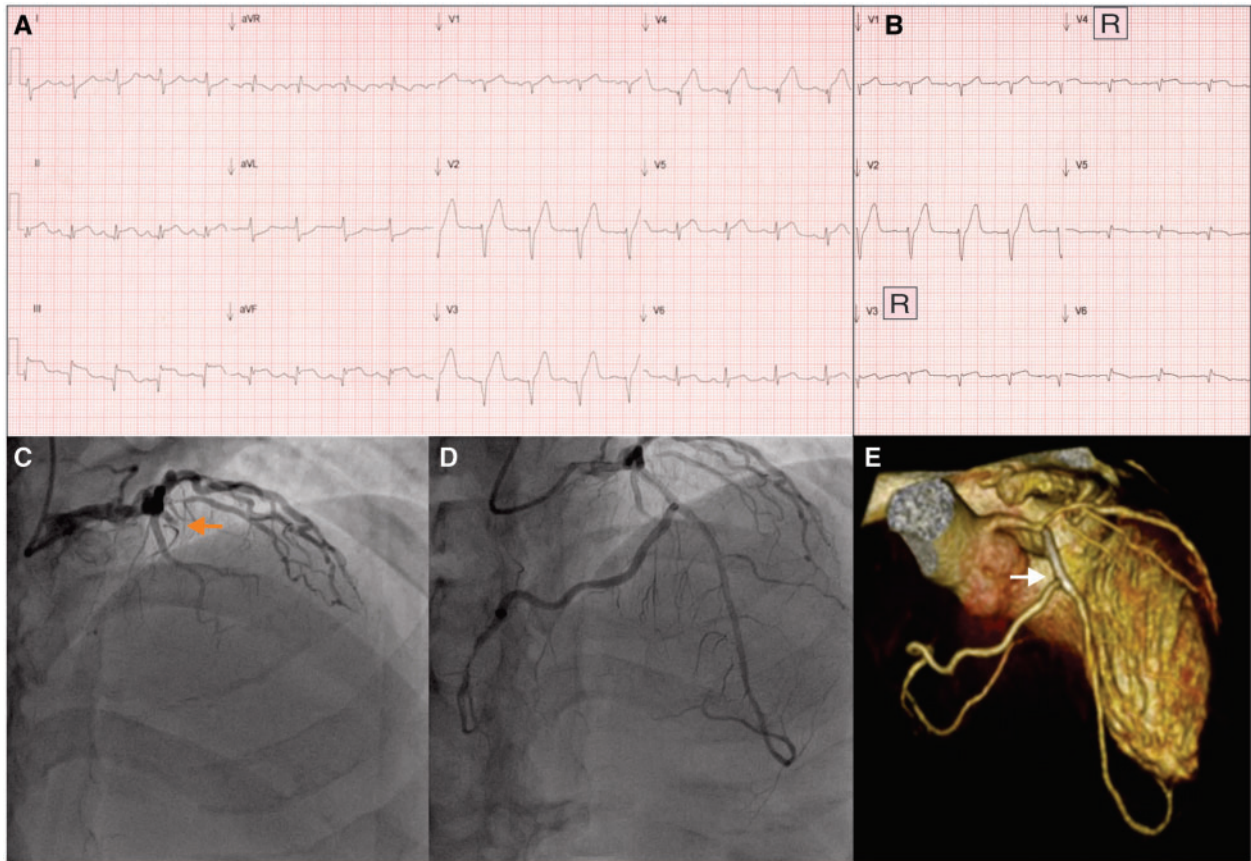
## Case presentation

A 56-year-old-male patient was admitted with sudden onset of resting chest pain. Upon arrival, he had ongoing chest pain and his ECG showed signs of anterior, inferior, and right ventricular STEMI (Figure 1A and B). The patient was a former smoker, obese male, with dyslipidaemia with a 5-year history of effort-related angina. Upon arrival, he was haemodynamically stable, ECG showed an ST-segment elevation in L2, L3, aVF, V3–V6, and V3R–V4R leads (Figure 1A and B). He was given morphine and nitroglycerine while directly transferred to the catheterization laboratory for primary emergent percutaneous coronary intervention (PCI). Via right trans-radial artery access, we began with the finding of a surprising anatomic pattern. There were significant stenoses at the left main and the circumflex but, most

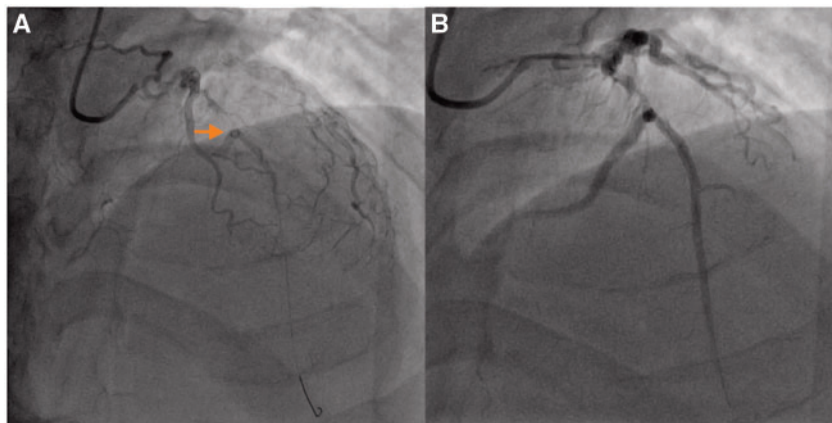
importantly, there was a seemingly thrombotic occlusion at the proximal segment of the LAD (Figure 1C), while no RCA was observed at the right sinus of Valsalva. After cannulating the left coronary ostium with a JL 4 guide, we were able to cross to the distal LAD with a Balance Middleweight Universal II® (Abbott, Chicago, IL, USA) guide-wire. Once the lesion was crossed antegrade flow was recovered and the dominant RCA became apparent in the mid-LAD [Thrombolysis in Myocardial Infarction (TIMI) 1, Figure 2A]. Just after balloon dilation of the proximal LAD, TIMI 3 antegrade flow was recovered into both RCA and LAD: the proximal course of the RCA was epicardial and pre-pulmonic (Figure 2B). Angiographic evidence of thrombus was suggested at the mid-segment of the RCA (Figure 3A and Video 1). Shortly after, sudden loss of flow from the proximal LAD appeared, compromising the RCA/LAD bifurcation (Figure 3B). A 3.0 mm × 23 mm drug-eluting stent was deployed to the proximal mid-segments of the LAD (Figure 4), jailing but not obstructing the ostium/flow of the ectopic RCA, and achieving good angiographic results in both coronary arteries (Figure 1D and Video 1). Patient was discharged home after 6 days. During his hospital stay, the transthoracic echocardiogram showed an left ventricular ejection fraction (LVEF) of 40% (Video 2), the coronary computed tomography angiography (Figure 5A and B) showed an SCAO congenital anomaly with a patent stent in the LAD accompanied by diffuse coronary artery disease causing a 50% stenosis of the distal left main, proximal, and distal circumflex and severe stenosis of diagonal and marginal branches. The anomalous RCA had a patent ostium with a 25–49% stenotic non-calcified plaque in its mid-segment not suggestive of clot. A few days after the pPCI, a SPECT (201-Thallium) with Stress-Redistribution was performed which showed non-transmural infarctions in the LAD and the RCA territories, an LVEF of 38% and viability of myocardial tissue in both coronary territories. With these results, the patient was planned for coronary artery bypass surgery. The patient was awaiting surgery at last follow-up.

## Discussion

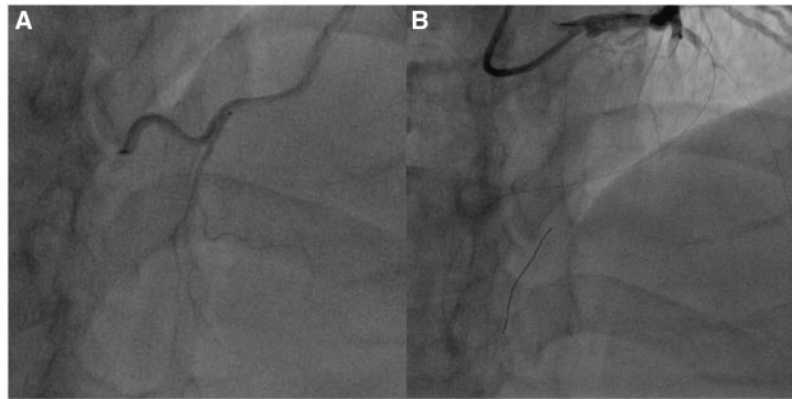
Coronary arteries anomalies include several, congenital variation in the ostial location and in proximal course. An SCAO (a better name than 'single coronary artery')<sup>1,2</sup> is estimated to be present in 0.014–0.066% of general population at traditional angiography.<sup>3</sup> The concept of a 'single coronary artery' has been used in cardiology for a long time<sup>4</sup> but it has been corrected recently to 'single coronary ostium with ectopic origin of a coronary artery from the opposite artery'. It is the proximal course of the ectopic coronary artery that may cause functional issues.<sup>1,2</sup> The proximal coronary course and the relationship with surrounding structures are of paramount diagnostic importance because those features are related to malignant vs. benign prognoses.<sup>1,2</sup> The pre-pulmonic (in front of the pulmonary



**Figure 1** EKGs at arrival with standard leads showing anterior and inferior ST-segment elevation (A) and the right precordial leads showing right ventricle ST-segment elevation (B). Left coronary artery angiography showing the thrombotic occlusion (orange arrow) of the mid-segment of the left anterior descending (C). Final angiographic results of the primary percutaneous coronary intervention at the right coronary artery/mid-left anterior descending bifurcation with both fully patent coronary arteries (D). A three-dimensional reconstruction from the coronary computed tomography angiography depicting the single coronary artery ostium, the completely expanded stent at the bifurcation (white arrow) and its relationship with surrounding structures (E).



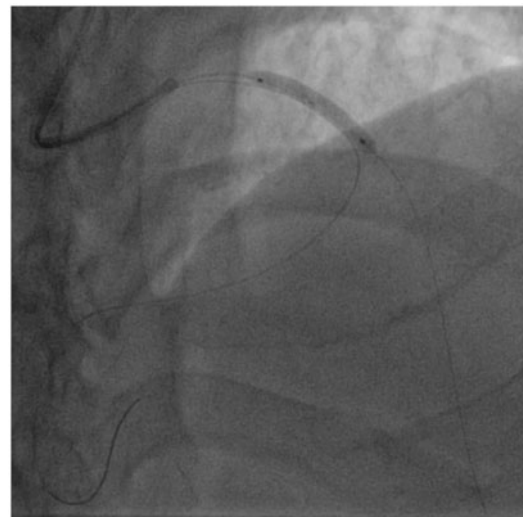
**Figure 2** Right coronary artery ostium appearing from the mid-left anterior descending (orange arrow) after passing a guidewire to cross into the distal left anterior descending (A). After pre-dilation of the proximal left anterior descending, full visualization of the left anterior descending and the right coronary artery was achieved with some gain of antegrade flow (B).



**Figure 3** Right coronary artery angiography obtained by selective right coronary artery microcatheter injection, allowing visualization of sub-occlusive thrombus in its mid-segment (A) followed by re-occlusion of both left anterior descending and right coronary artery from the bifurcation (B) occurring just before balloon dilation of the thrombotic mid-segment of the right coronary artery (likely occurring by local embolism).



**Video 1** Right coronary artery and left anterior descending bifurcation primary percutaneous coronary intervention. Primary angioplasty of right coronary artery/mid-left anterior descending bifurcation with provisional stent technique.



**Figure 4** Stent deployment (provisional single-stent strategy) in the proximal mid-left anterior descending.

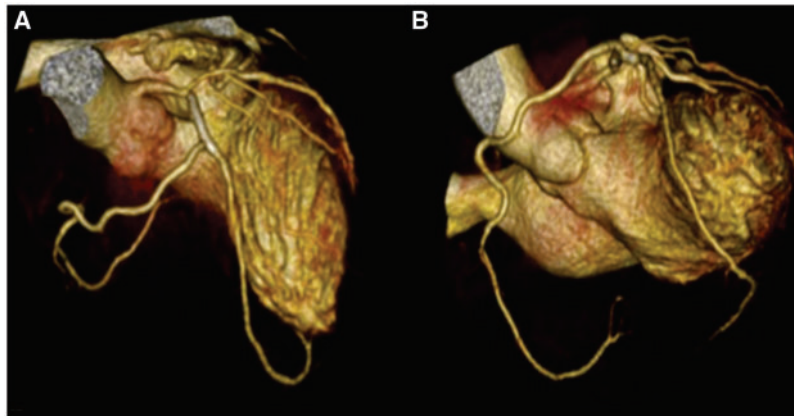
artery) course of the ectopic RCA was the anomaly in the present case, and this is a generally benign anomaly<sup>5</sup> (per se not causing any coronary insufficiency, unless it features coronary spasm).<sup>1,2,6</sup> It is important to be aware that some cases of ectopic RCA have origin from the LAD or left main (LM) can have an intramural, pre-aortic (in front of the aorta but intramural) course (~0.3% of all R-ACAOS-IM),<sup>7</sup> with a very different physiology and prognosis. Obviously, acquired atherosclerotic disease can change the clinical course in such cases as in any other.<sup>8</sup>

In the literature, the RCA arising from the mid-LAD with pre-pulmonic course has been described in only 36 cases in a 2009 comprehensive review.<sup>9</sup> Of such 36 cases, 20 had a >50% stenosis involving one or more vessels: 5 of those proceeded to have PCI and 10 to coronary artery bypass grafting. In each of the cases undergoing PCI

only the LAD was treated with stents, and no cases of stenting of the anomalous RCA had been previously reported at that time.<sup>9</sup>

It is important to be aware that spasm of the pre-pulmonic ectopic RCA can also be the cause of possible RCA occlusion, that if sustained, can lead to thrombosis.<sup>1,6</sup> At the more recent publication of Khan et al.<sup>10</sup> in 2019, 37 similar cases of SCAO with acquired coronary stenoses were reported, 21 of them showing a >50% stenosis in one or more vessels and 6 treated with PCI. They also reported the first two stents (en culotte) approach technique for LAD/RCA ostial bifurcation.<sup>10</sup> To the best of our knowledge, the present is the first case ever reported of an acute thrombotic occlusion of an LAD/RCA bifurcation in SCAO clinically resulting in a simultaneous anterior and inferior STEMI (a left main equivalent).





**Figure 5** Coronary computed tomography angiography at 4 days follow-up. The three-dimensional reconstructions after percutaneous coronary intervention showed good results (A and B) allowing the evaluation of the coronary pattern and the relationship with some of the surrounding structures.



**Video 2** Post-primary percutaneous coronary intervention trans-thoracic echocardiogram. Apical four, three, and two chambers views showing an LVEF of 40% with hypokinesia of the apex, inferior, and inferolateral wall with Type II diastolic dysfunction.

## Supplementary material

Supplementary material is available at *European Heart Journal - Case Reports* online.

## Lead author biography



Julio I. Farjat Pasos at present is serving as Chief Fellow of Interventional Cardiology at Ignacio Chavez National Cardiology Institute.

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**Slide sets:** A fully edited slide set detailing this case and suitable for local presentation is available online as [Supplementary data](#).

**Consent:** The author/s confirm that written consent for submission and publication of this case report including image(s) and associated text has been obtained from the patient in line with COPE guidance.

**Conflict of interest:** The authors have no conflicts of interest to declare.

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