ESC European Society of Cardiology

European Heart Journal - Case Reports (2025) **9**, ytaf112
https://doi.org/10.1093/ehjcr/ytaf112

CASE REPORT
Coronary intervention

Percutaneous coronary intervention in anomalous aortic origin of a coronary artery: a rare case report of a dual-left anterior descending artery with a pre-pulmonary course

Sara Jourani [1]*, Zakaria Laraichi [1], Mehdi Saighi Bouaouina[1], Cedric Gaultier[1], and Hakim Benamer [1,2]

[1]Hôpital Européen de Paris—GVM, 55 Rue Henri Barbusse, 93300 Aubervilliers, France; and [2]Institut Cardio-Vasculaire Paris-Sud, 6 Av. du Noyer Lambert, 91300 Massy, France

Received 29 November 2024; revised 20 February 2025; accepted 24 February 2025; online publish-ahead-of-print 3 March 2025

Background Anomalous aortic origin of a coronary artery (AAOCA) of the left anterior descending artery (LAD) is a rare congenital anomaly. Their percutaneous coronary intervention (PCI) when an ischaemia is documented remains challenging.

Case presentation We report the case of a 52-year-old patient from Bangladesh with dual-origin LAD arising from both left and right sinus with a pre-pulmonary course, presenting with exertional angina and documented myocardial ischaemia. Computed tomography (CT) scan confirmed the anatomical course of the AAOCA. Percutaneous coronary intervention was successfully performed using tailored techniques to treat significant atherosclerotic lesions.

Conclusion This case underscores the importance of CT scan in delineating the anatomical characteristics of AAOCA, and the feasibility and efficacy of PCI in symptomatic, non-high-risk AAOCA, emphasizing its role as a minimally invasive alternative within a multidisciplinary approach.

Keywords Case report AAOCA • Dual LAD • PCI of AAOCA • CT scan

ESC curriculum 2.4 Cardiac computed tomography • 3.1 Coronary artery disease • 3.3 Chronic coronary syndrome • 3.4 Coronary angiography • 9.7 Adult congenital heart disease

Learning points

- Recognize the rarity and clinical significance of an anomalous aortic origin of a coronary artery (AAOCA), particularly its potential to cause myocardial ischaemia.
- Understand the importance of non-invasive imaging modalities, such as coronary computed tomography angiography, in delineating complex coronary anatomies and guiding interventional strategies.
- Highlight the feasibility and safety of percutaneous coronary intervention for symptomatic non-high-risk AAOCA with documented ischaemia.

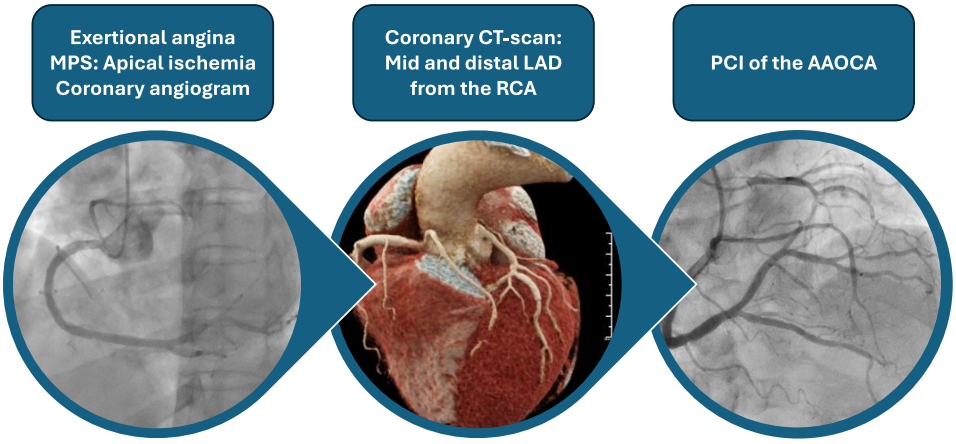
* Corresponding author. Tel: +33668486206, Email: s.jourani@gmail.com
Handling Editor: Nidhi Madan
Peer-reviewers: Andras Janosi; Dejan Milasinovic
Compliance Editor: Niklas Schenker

Introduction

Anomalous aortic origin of a coronary artery (AAOCA) is not uncommon congenital anomalies, with an angiographic prevalence of ~0.8%.[1] While anomalous right coronary artery (RCA) is more common, anomalous left coronary artery are rare with a prevalence of 0.02–0.03%.[1,2] Among the different types of courses in AAOCA, the inter-arterial course is the most associated with sudden cardiac death. Pre-pulmonary courses are rare (0.04%) and are generally considered benign.[1]

In this report, we describe a unique case of a left anterior descending artery (LAD) with a dual origin: the proximal segment arises from its usual sinus, while the mid and distal portions originate from the right sinus. Both segments follow the interventricular groove but are anatomically discontinuous. Furthermore, the AAOCA segment presented an atherosclerotic stenosis responsible for a documented, significant ischaemia on non-invasive imaging leading to percutaneous coronary intervention (PCI).

Summary figure



Timeline of the case report

MPS: Exercise testing and myocardial perfusion scintigraphy; LAD: Left ascendant artery; RCA: Right coronary artery ; PCI: Percutaneous coronary intervention ; AAOCA: anomalous aortic origin of a coronary artery

Case presentation

We report the case of a 52-year-old patient from Bangladesh, diabetic and hypertensive, referred for exertional angina Canadian Cardiovascular Society III. A stress myocardial scintigraphy was performed and revealed deep hypoperfusion in the antero-apical, septo-apical, and lateral walls with electric positivity on the stress test; resting left ventricle ejection fraction was 61%. His clinical examination revealed a blood pressure of 127/85 mmHg, a heart rate of 92 b.p.m., and a normal oxygen saturation. No murmurs were detected, and there were no signs of heart failure. His electrocardiogram showed a sinus rhythm without significant repolarization abnormalities.

We performed a diagnostic coronary angiogram in this context (*Figure 1*). Left injection revealed a stenosis on a third significant diagonal branch and a circumflex of very poor calibre. However, we were struck by the appearance of the LAD, which seemed to stop at its mid-segment without wrapping around the apex and did not present a stump that could suggest a chronic occlusion.

The injection of the right coronary sinus revealed a dominant RCA free of stenosis. At the end of the injection in right anterior oblique and left anterior oblique views, we noticed a vessel opening into the ostium of the RCA and following the classic path of an LAD. A non-selective injection into this artery with a diagnostic JR 4 catheter (Judkins Right) identified an ostial-proximal stenosis of this artery but did not allow complete opacification of the distality of the vessel. Percutaneous coronary intervention of the third diagonal was performed during this procedure (*Figure 1*).

The coronary CT scan performed for a better characterization of this AAOCA identified an artery whose course is compatible with a mid and distal LAD. This artery connects in the right coronary ostium and joins the interventricular groove to wrap around the apex of the heart (*Figure 2*).

Intervention

Given the evidence of ischaemia on stress myocardial scintigraphy in the apical territory, we decided to perform angioplasty on this AAOCA.

We used a 6F IM guiding catheter (Internal Mammary) through a right radial access to engage the ostium of the RCA. We first positioned a workhorse wire (*RUNTHROUGH® NS Extra Floppy*) in the right posterolateral artery to stabilize the guiding catheter, and then navigated within the AAOCA using a polymerjacket wire with a hydrophilic coating (*ASAHI SION® black*) (*Figure 3*).

Since the proximal injection did not allow the visualization of the distal part of the AAOCA, we performed a distal injection through a microcatheter, which revealed a severe stenosis in the mid LAD (*Figure 3*).

We treated the distal lesion with a drug-eluting stent (DES) 2.25 × 15 mm and the mid lesion with a drug-eluting balloon (DEB) 2.0 × 15 mm. The ostial-proximal segment was treated with a DES 2.5 × 15 mm (*Figure 4*).

Outcome

The final angiographic result was satisfactory. At the end of the procedure, a contralateral injection was performed, confirming the discontinuity of

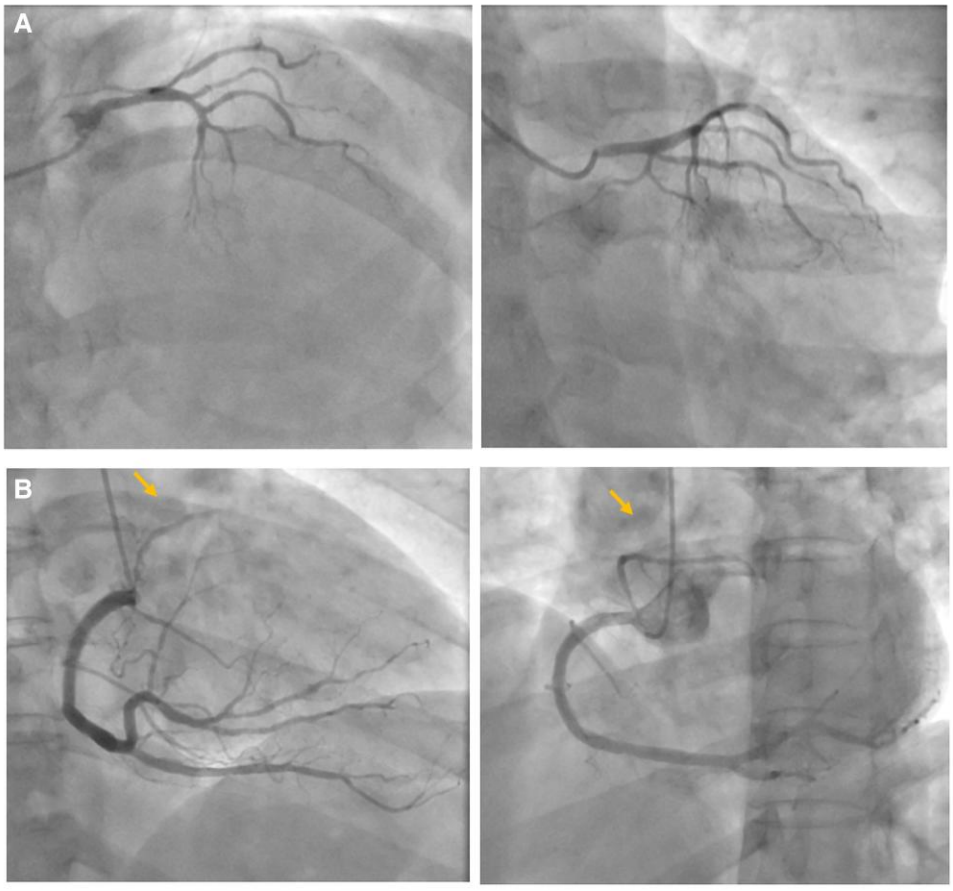


Figure 1 (*A*) Selective injection of the left main showing an 'interrupted left anterior descending artery' with a third diagonal stenosis; (*B*) right anterior oblique and left anterior oblique views of the right coronary artery showing a vessel originating from the right ostium (arrow).

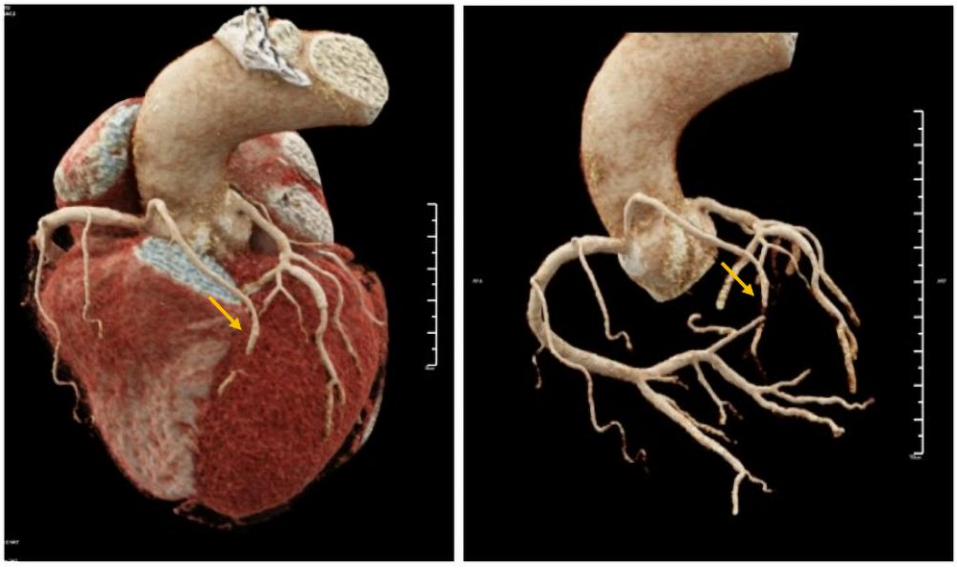


Figure 2 Coronary computed tomography scan showing that the anomalous aortic origin of a coronary artery is actually a vessel following the mid- and distal left anterior descending artery course (arrow).

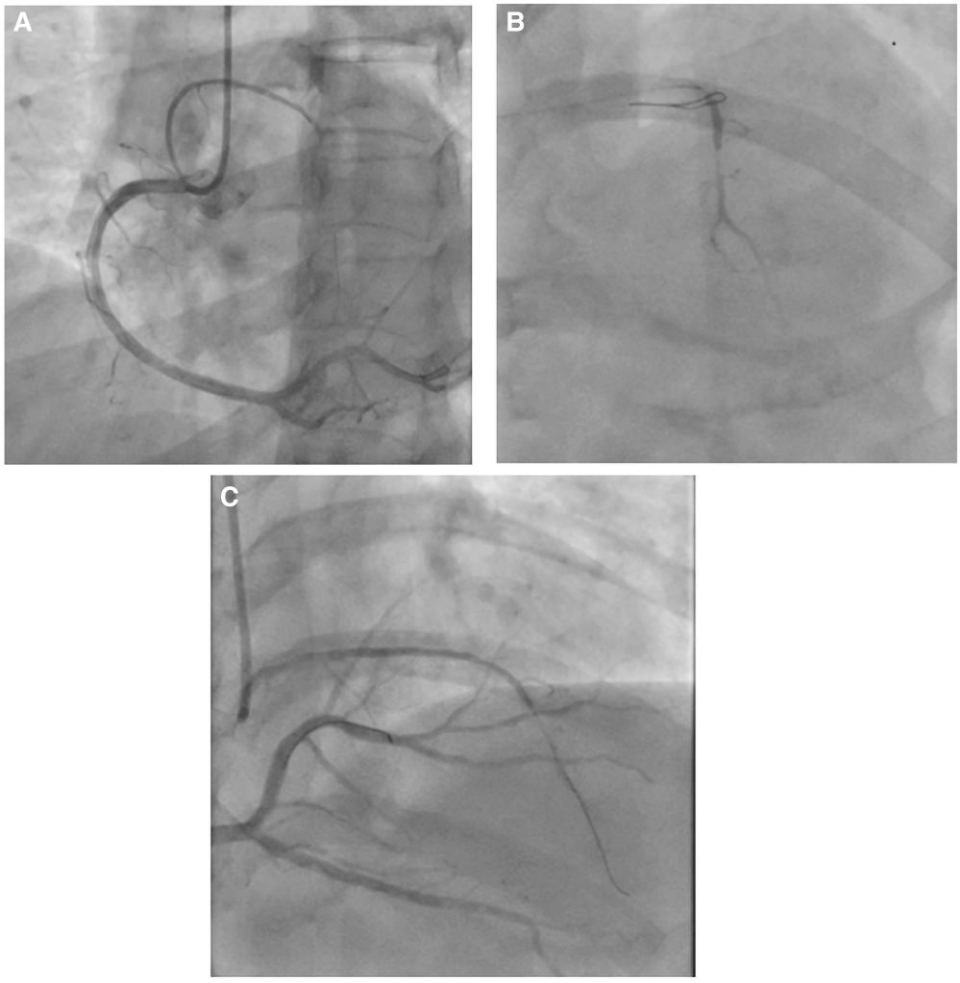


Figure 3 (*A*) Selective injection of the anomalous aortic origin of a coronary artery with an IM 6F guiding catheter; (*B*) distal injection through a microcatheter showing a severe atherosclerotic lesion of the distal segment; (*C*) complete wiring of the anomalous aortic origin of a coronary artery.

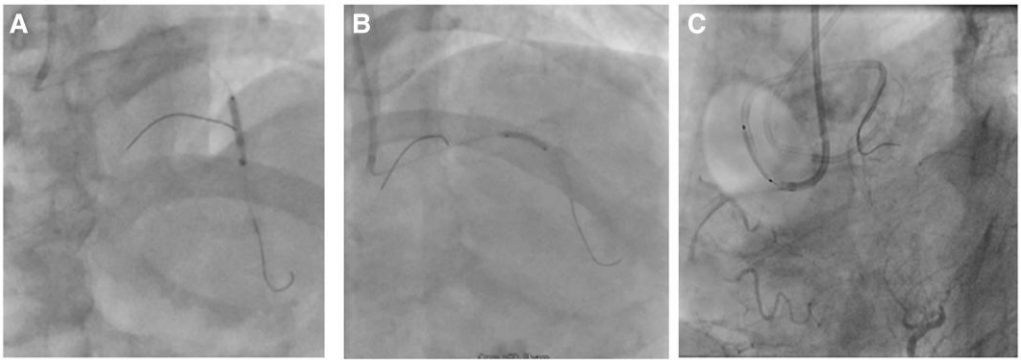


Figure 4 (*A*) Stenting of the distal segment with a 2.25 × 15 mm drug-eluting stent; (*B*) Angioplasty of the mid-segment with a 2.0 × 15 mm drug-eluting balloon; (*C*) stenting of the ostium with a 2.5 × 15 mm drug-eluting stent.

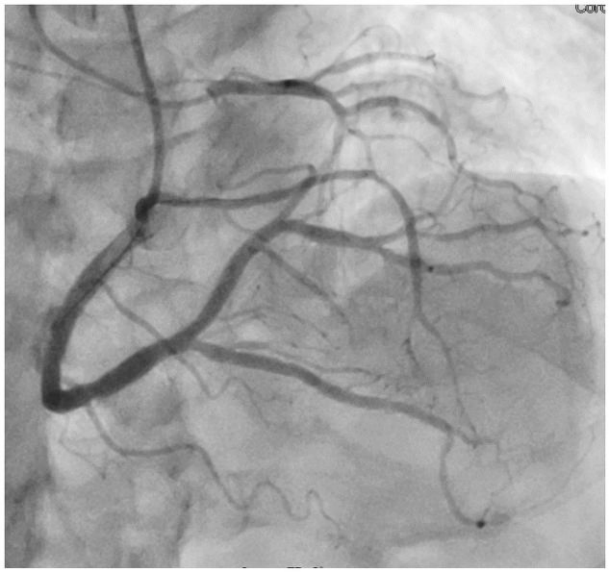


Figure 5 Dual injection of the left and right coronary ostia showing a dual-discontinuous left anterior descending artery.

the AAOCA with the native LAD (*Figure 5*). The post-procedural course was uneventful, and the patient was discharged the following day.

Discussion

This case highlights a rare anatomical variant of AAOCA that, to our knowledge, has not been previously described in the literature. In cases of AAOCA, the involvement of the LAD remains among the least frequent anatomical variations.[1–3] In our case, the proximal LAD originated from the left anterior sinus, however, its mid and distal portions originated from the opposite sinus, with both segments following the interventricular groove without any continuity between the native and anomalous portions.

Moreover, among the potential ectopic courses, a pre-pulmonary trajectory, as seen in our case, is particularly rare.[2,3]

In patients with AAOCA, myocardial ischaemia can result from both fixed and dynamic stenotic mechanisms.[4] Fixed stenotic factors include abnormalities in proximal or ostial luminal narrowing, while dynamic factors involve compression of the intramural segment within the aortic wall, the trajectory through the myocardium, or in some cases coronary spasm.[4,5] The prevalence of atherosclerotic disease, as shown in our case, is lower in pre-pulmonary or retro-pulmonary courses. In all cases, it is crucial to distinguish between congenital arterial narrowing and acquired arterial narrowing associated with atherosclerotic disease. The presence of atheroma in an inter-arterial course appears to be extremely rare.[6]

Risk stratification in patients with AAOCA heavily depends on imaging to evaluate the coronary anatomy and detect potential myocardial ischaemia. Cardiac computed tomography angiography (CTA) has revolutionized the non-invasive assessment of AAOCA, offering precise anatomical visualization.[7] Moreover, CTA has been instrumental in identifying coexisting atherosclerosis, a key factor in guiding clinical decisions.[8] In our case, coronary CTA was indispensable in delineating the anatomical characteristics of this AAOCA, enabling a more precise and informed interventional strategy.

Percutaneous coronary intervention for left AAOCA without an intramural course remains a relatively uncommon therapeutic approach, small case series have demonstrated the feasibility of PCI in such patients with low procedural risk.[9,10] The indication for PCI in those cases is based on the same criteria as those used for atherosclerotic coronary artery disease.[9] However, the technical challenges remain similar, including the difficulty of selective cannulation and insufficient passive support. Additional complexities may arise, such as a tortuous or elongated ectopic course and distal or complex lesions. Solutions may include the use of a guide catheter extension, anchoring the guide catheter with a distal balloon, or deploying a support wire strategy.[9] In our case, the use of an IM guiding catheter, along with a second guidewire positioned in the RCA for stabilization, was crucial to the success of the procedure. Although high-pressure implantation of DES has been shown to improve vessel remodelling in these anatomies, particularly in challenging cases of ectopic ostial narrowing,[2] we limited to inflation of the balloon, DEB, and DES to their nominal pressure considering the relatively small diameter of the treated AAOCA.

Lead author biography

Dr Sara Jourani is a Moroccan cardiologist, graduated from the Faculty of Medicine of Marrakech and Paris Cité University. She is currently pursuing a fellowship in interventional cardiology in France. With a strong commitment to advancing cardiovascular care in the field of interventional cardiology, she is actively involved in research and scientific publications, contributing to the enhancement of clinical practice.

Supplementary material

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

Consent: The authors confirm that written consent for submission and publication of this case report has been obtained from the patient in line with COPE guidelines.

Conflict of interest. None declared.

Funding: None declared.

Data availability

The data underlying this article are available in the article and in its online Supplementary material.

References

1. Cheezum MK, Liberthson RR, Shah NR, Villines TC, O'Gara PT, Landzberg MJ, et al. Anomalous aortic origin of a coronary artery from the inappropriate sinus of Valsalva. *J Am Coll Cardiol* 2017;**69**:1592–1608.
2. Gaudino M, Franco AD, Arbustini E, Bacha E, Bates ER, Cameron DE, et al. Management of adults with anomalous aortic origin of the coronary arteries: state-of-the-art review. *J Am Coll Cardiol* 2023;**82**:2034–2053.
3. Aubry P, Halna du Fretay X, Zendjebil S, Koutsoukis A, Farnoud R, Hyafil F, et al. Le registre AAOCA. *Ann Cardiol Angéiol* 2023;**72**:101690.
4. Bigler MR, Ashraf A, Seiler C, Praz F, Ueki Y, Windecker S, et al. Hemodynamic relevance of anomalous coronary arteries originating from the opposite sinus of Valsalva-in search of the evidence. *Front Cardiovasc Med* 2021;**7**:591326.
5. Angelini P, Uribe C. Anatomic spectrum of left coronary artery anomalies and associated mechanisms of coronary insufficiency. *Catheter Cardiovasc Interv* 2018;**92**:313–321.
6. Zendjebil S, Koutsoukis A, Rodier T, Hyafil F, Halna du Fretay X, Dupouy P, et al. AAOCA Investigators. Prevalence and location of coronary artery disease in anomalous aortic origin of coronary arteries. *Coron Artery Dis* 2024;**35**:633–640.

7. Dodd JD, Ferencik M, Liberthson RR, Cury RC, Hoffmann U, Brady TJ, et al. Congenital anomalies of coronary artery origin in adults: 64-MDCT appearance. *AJR Am J Roentgenol* 2007;**188**:W138–W146.
8. Grani C, Benz DC, Schmied C, Vontobel J, Mikulicic F, Possner M, et al. Hybrid CCTA/SPECT myocardial perfusion imaging findings in patients with anomalous origin of coronary arteries from the opposite sinus and suspected concomitant coronary artery disease. *J Nucl Cardiol* 2017;**24**:226–234.
9. Aubry P, Halna du Fretay X, Boudvillain O, Degrell P; AAOCA Working Group. Place of angioplasty for coronary artery anomalies with interarterial course. *Front Cardiovasc Med* 2020;**7**:596018.
10. Bigler MR, Kadner A, R€aber L, Ashraf A, Windecker S, Siepe M, et al. Therapeutic management of anomalous coronary arteries originating from the opposite sinus of Valsalva: current evidence, proposed approach, and the unknowing. *J Am Heart Assoc* 2022;**11**: e027098.