

# Primary Percutaneous Coronary Intervention in a Patient with Acute Inferior Myocardial Infarction and Agenesis of Right Coronary Artery. "In Search of a Coronary Ostium"

Gabriele Giacomo Schiattarella<sup>1</sup>, Fabio Magliulo<sup>1</sup>, Vito Di Palma<sup>1</sup>,  
Giovanni Esposito<sup>1</sup> and Plinio Cirillo<sup>1\*</sup>

<sup>1</sup>Department of Advanced Biomedical Sciences, School of Medicine, University of Naples Federico II, Naples, Italy.

## Authors' contributions

*This paper was carried out in collaboration between all authors. Authors GGS, FM and PC perform the case and wrote the manuscript. Authors VDP and GE approve the manuscript. All authors read and approved the final manuscript.*

## Article Information

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**Case Study**

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## ABSTRACT

Coronary arteries with anomalous origin from the aorta may represent a trouble for interventional cardiologist, in particular in setting of acute coronary syndromes. Research of coronary ostium may cause crucial delay in reperfusion with important consequences for myocardial salvage. We described a case of inferior ST-elevation myocardial infarction (STEMI) complicated by bradyarrhythmia and hypotension, and treated with primary percutaneous coronary intervention (PCI) in a patient with agenesis of right coronary ostium. The patient had only a single left coronary artery occluded at the distal portion before a bifurcation with a huge branch that encompassed the theoretical territories of right coronary artery.

\*Corresponding author: E-mail: [pcirillo@unina.it](mailto:pcirillo@unina.it);

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## 1. INTRODUCTION

Coronary arteries with anomalous origin from the aorta or anomalous course may represent a trouble for interventional cardiologists. Percutaneous treatment of significant atherosclerotic stenosis of these arteries may be very challenging. These abnormalities are conventionally defined as variants occurring in less than 1% of the general population [1]. Their clinical presentations are widely variant, ranging from diagnosis after autopsy in young subjects with sudden cardiac death to widely asymptomatic forms [1]. Because these anomalous coronary arteries are usually not associated with other congenital cardiac malformations, patients do not show any clinical manifestations, thus, they are usually found, often incidentally, during coronary angiography. In the present report we describe the case of a patient admitted to our hospital with diagnosis of inferior ST-elevation myocardial infarction (STEMI) complicated by bradyarrhythmia and hypotension and treated with primary percutaneous coronary intervention (PCI). The peculiarity was that the patient did not have the right coronary artery (RCA) in the coronary tree.

## 2. CASE REPORT

A 46-year old man, heavy smoker, with history of arterial hypertension was admitted to our emergency room. He presented with chest pain, nausea, hypotension and diaphoresis since 90 minutes ago. At admission, the electrocardiography (ECG) showed elevation of the ST segment in the inferior leads with concomitant reciprocal depression in lateral leads (Fig. 1). In addition, an ultra-sensitivity cardiac troponin T assay was positive and a fast-track echocardiography displayed ipo-akinesia of the inferior and postero-lateral walls. Accordingly, a diagnosis of inferior wall ST-elevation myocardial infarction (STEMI) was made. The patient received 500 mg of acetylsalicylic acid intravenously and 180 mg of ticagrelor orally and was addressed to the cath-lab to perform primary PCI. In the cath-lab, patient had severe bradycardia and hypotension, thus, on the basis of ECG, we decided to immediately approach right coronary artery (RCA) with a 6 French Judkins right guiding catheter (Medtronic, Inc., Minneapolis, MN, USA) in order to obtain reperfusion as soon as possible. Surprisingly, we

were unable to achieve selective cannulation of RCA ostium by using this guiding catheter, thus, we tried to approach the coronary ostium by using other different guiding catheters including both Judkins and Amplatz coronary catheters, with different curves, but our tries were unsuccessful. The patient was stabilized by intravenous use of Atropine as well as fluid administration, and thus, we moved to evaluate left coronary artery by using a 6 French Judkins diagnostic catheter. The angiography of left coronary artery revealed atherosclerotic disease of left main and left anterior descending (LAD) in absence of significant stenosis. Moreover, the angiography showed the thrombotic occlusion of circumflex at its distal portion, close to the origin of three marginal obtuse branches, with a TIMI 0 flow (Figs. 2 A-B). We judged this occlusion to be the culprit lesion responsible for the STEMI. Thus, we approached and crossed it with 0.014 inch Balance Middle Weight Universal, (BMW - Guidant Corp., Santa Clara, California). Then, we performed manual thrombus aspiration with the Export catheter (Medtronic Inc., Minneapolis, Minnesota) obtaining vessel recanalization. Finally, an everolimus eluting stent Xience Xped (3,5 mm x 33 mm, Abbott® Vascular, Santa Clara, USA) was implanted obtaining a TIMI 3 flow. Surprisingly, the final angiography revealed that circumflex extension encompassed the theoretical territories of RCA till the aorta (Figs. 3 A-B). An angiography of aorta was performed to witness that RCA was absent, confirming the agenesis of RCA ostium in the absence of any other anomalies (type I aortic arch). The patient was discharged six days after hospitalization under optimized drugs therapy, with a complete recovery of myocardial function without regional ipo-akinesia.

## 3. DISCUSSION

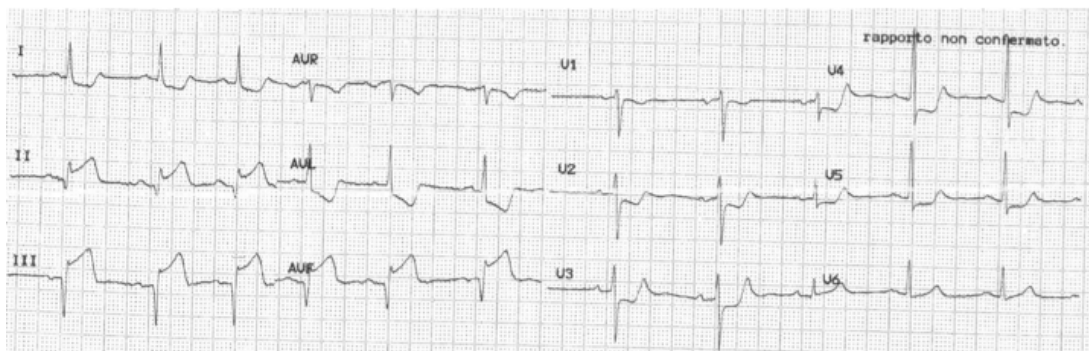
Coronary artery anomalies (CAAs) comprise a large number of very different conditions, with an extreme variability in clinical severity. According to the classification of Angelini and coworkers [2], these coronary anomalies may be reduced to the following categories:

- Anomalies of origin and course.
- Anomalous location of coronary ostium outside normal "coronary" aortic sinuses (eventually also located into left or right ventricle, pulmonary artery, aortic arch,

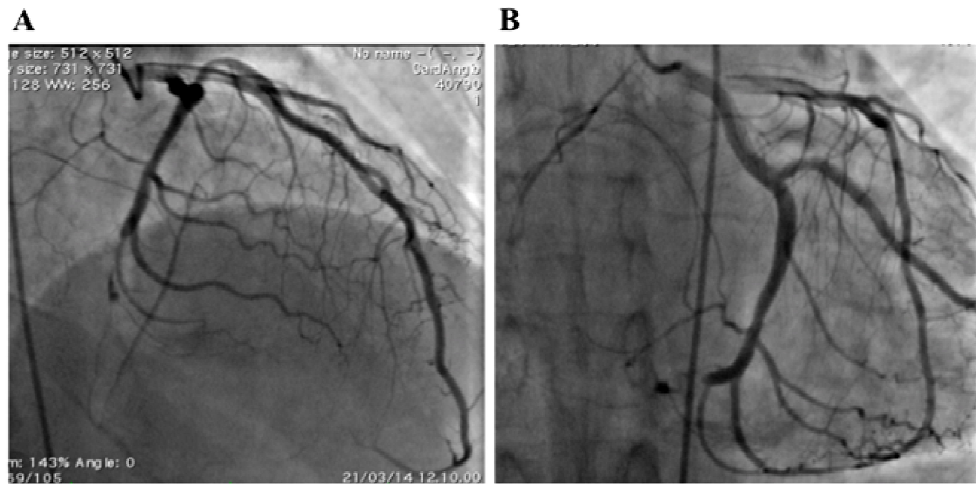
- innominate artery, descending thoracic aorta and other) or anomalous origination of coronary ostium from opposite, facing "coronary".
- Anomalies of intrinsic coronary arterial anatomy (such as congenital ostial stenosis or atresia, absent coronary artery of coronary hypoplasia, anomalous coronary course, coronary crossing, anomalous origination of posterior descending artery, split RCA or LAD, and others).
  - Anomalies of coronary termination (inadequate ramifications, fistulas).
  - Anomalous collateral vessels.

The incidence of CAAs seems to be extremely variable because it changes according to the different studies dealing with this issue. Specifically, Angelini et al. reported, in a series of 1950 patients subjected to coronary angiography, a global incidence of 5.64% [2], with a significant prevalence of anomalous origin of the RCA from the left sinus (0.92%) and of anomalous origin of the left coronary artery from the right sinus (0.15%). Other anomalies, such as myocardial bridge and split RCA, are not considered coronary anomalies but normal variants, due to their high prevalence (>1%) [2]. In another study, a review of the clinical and necropsy charts showed that 33% of sudden cardiac death of young militaries under training was related to anomalous origin of left coronary artery [3] while in a Israelite study concerning suddenly dead subjects < 40 years, the incidence of CAAs was 0.6% [4]. Anomalous origin and course of coronary artery might be discovered in about 0.29% of subjects undergoing coronary angiography; the most frequent types seem to be anomalous origin of Left Circumflex Artery (LCxA) from RCA/right

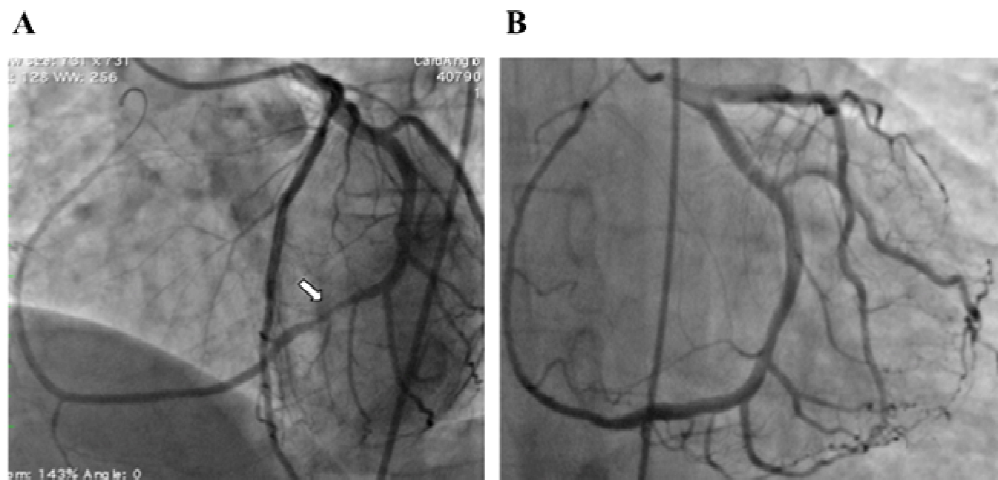
sinus of Valsalva (0.169%) while anomalous origin of RCA from Left Anterior Descending (LAD) or LCxA is less frequent, with an estimated prevalence of about 0.03% for pathologies involving RCA or left main/LAD [5]. Similarly, anomalous origin of RCA from LAD and/or LCxA artery has an estimated prevalence of 0.036% [5]. Single coronary artery may be associated with other congenital anomalies, such as transposition of the great vessels, coronary arteriovenous fistula, or bicuspid aortic valve [6]; its prognosis appears usually benign. This kind of coronary anomaly is not usually responsible of coronary hypoperfusion, but a potential increased risk of ischemic heart disease has been reported (till to 15% of prevalence in some studies) [7]. However, it is intuitive that a stenosis of a coronary artery in subjects with a single coronary vessel has a such different clinical meaning than in patients with a normal coronary tree. Thus, coronary abnormality must be always kept in mind specially in those cases in which the coronary ostium is not easy to engage or visualize by direct injection of contrast medium. The suspect of anomalies of the coronary tree has an important role in approaching patients with STEMI, because "the search of the ostium" might be time consuming and finally it leads to delay in the reperfusion time and, consequently, in prognosis. In the present case, after few attempts with several guiding catheters of engaging the right coronary ostium, we suspected a coronary anomaly and decided to perform angiography of the left coronary artery to evaluate and treat an hypothetical culprit lesion of this vessel. In such contexts, injection of contrast medium into the sinus of Valsalva and aortic angiography, preferably in two different projections, can help to individuate any form of CAAs.



**Fig. 1. An ECG revealing significant ST segment elevation in II, III and aVF leads with significant ST segment depression with high R waves in V2-V5 leads**



**Fig. 2. A coronary angiography revealed a thrombotic occlusion of the distal portion of circumflex branch of left coronary artery visualized in both left anterior oblique projection (A) and anteroposterior caudal projection (B)**



**Fig. 3. A. An angiography after manual thrombus aspiration with the Export catheter showed partial vessel recanalization and a critical stenosis of circumflex branch (arrow). B. The final angiography after everolimus-eluting-stent (Xience Xped 3,5 mm in diameter x 33 mm long) implantation showed excellent result without thrombus evidence, TIMI grade 3 and a long patent vessel extending to the theoretical territories of RCA**

Few other cases of unexpected RCA agenesis at coronary angiogram have been described in the context of acute coronary syndromes. Turhan and colleagues reported the case of patient evaluated for chest pain and ECG signs of myocardial ischemia. The angiography revealed a RCA arising from distal LCxA, following course, retrogradely, of the normal artery and terminating near sinus of Valsalva [6]. In another report, Papadopoulos et al. presented a case of acute coronary syndrome in which coronary angiography revealed agenesis of RCA ostium

and RCA originating from distal LCxA. [8]. Moreover, Chung et al. described the case of a 77-year-old man subjected to angiographic study for chest pain. Left coronary angiography showed a dominant LCxA, with an aberrant RCA from distal LCxA, which crossed the crux and continued to the right atrioventricular groove, covering the territory of the right coronary artery. After several unsuccessful attempts to engage RCA ostium, aortography confirmed the absence of the RCA ostium, and a subsequent contrast-enhanced 64-slice multi-detector cardiac

tomography also confirmed the absence of this vessel showing an extended LCxA supplying RCA territory [9]. Finally, Pourbehi et al described a coronary angiography demonstrated a single coronary artery originating from the left Valsalva sinus. The angiography revealed significant stenosis in the mid-portion of the LAD and in the distal portion of the LCxA, where there was the origin of an aberrant RCA. Angioplasty and stenting of the LAD and LCxA were done with durable resolution of symptoms [10]. In all these cases, patients were at "low risk" for acute coronary syndromes, on the contrary, in the present report we deal with an ST-elevation myocardial infarction with unstable clinical conditions in which the anomalous LCxA was the culprit vessel, causing hemodynamic instability.

#### 4. CONCLUSION

The main lesson to extrapolate from this case and the cited ones is: never forget the eventuality of a CAAs during a coronary angiography exam! The suspicion is often the first way to find them, so interventional cardiologists should always keep their existence in mind.

#### CONSENT

All authors declare that written informed consent was obtained from the patient for publication of this case report and accompanying images.

#### ETHICAL APPROVAL

It is not applicable.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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