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(CASE REPORT)

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When the inferior wall speaks in anterior myocardial infarction: The wrap-around LAD Phenomenon

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Abstract

Acute myocardial infarction (AMI) remains a leading cause of morbidity and mortality worldwide. Anterior myocardial infarction classically presents with ST-segment elevation in precordial leads, often accompanied by reciprocal ST depression in inferior leads. However, in rare situations, anterior MI may present with concomitant inferior ST-segment elevation. This atypical electrocardiographic pattern is most frequently explained by occlusion of a wrap-around left anterior descending artery (LAD), which supplies a significant portion of the inferior wall. We report the case of a 58-year-old man admitted for acute chest pain with simultaneous anterior and inferior ST-segment elevation, in whom coronary angiography revealed a distal occlusion of a large wrap-around LAD. Early recognition of this pattern is essential, as it reflects a large ischemic territory and is associated with a high risk of complications.

Keywords: Anterior myocardial infarction; Inferior ST-segment elevation; Wrap-around LAD; Coronary angiography; Primary PCI

1. Introduction

Acute myocardial infarction (MI) continues to be a major public health issue and a leading cause of death globally. Anterior myocardial infarction (AMI) is among the most common and severe forms, associated with substantial mortality and long-term morbidity. The anterior wall of the left ventricle is mainly supplied by the left anterior descending coronary artery (LAD), and its occlusion results in extensive myocardial damage.

Typically, AMI is characterized on electrocardiography (ECG) by ST-segment elevation in precordial leads V2 to V6, with reciprocal ST-segment depression in inferior leads (II, III, and aVF). Nevertheless, concomitant inferior ST-segment elevation may be observed in some cases. This unusual presentation is most often related to a wrap-around LAD, a variant in which the LAD extends beyond the apex to supply part of the inferior wall. We describe such a case and discuss its clinical and angiographic implications.

2. Case Presentation

A 58-year-old man, a former smoker and alcoholic who had been abstinent for 30 years, was admitted to our department for acute chest pain. His medical history was notable for psychiatric illness treated with antidepressants. Family history revealed coronary artery disease in his mother and sudden cardiac death in a sister at the age of 47.

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On January 5, 2024, the patient experienced sudden-onset, prolonged, constrictive chest pain radiating to the right upper limb. Initially neglected, the pain worsened five days later and became associated with vomiting and profuse sweating, prompting consultation with a private general practitioner. An ECG was performed, and the patient was referred to a hospital, then transferred to our emergency department approximately 14 hours after the presumed onset of symptoms.

The patient denied dyspnea, palpitations, neurological deficits, or intermittent claudication. There was no history suggestive of infection. On physical examination, he was conscious and in pain but hemodynamically stable. Blood pressure was 136/84 mmHg, heart rate 106 beats/min, and oxygen saturation 98% on room air. Cardiac auscultation revealed normal heart sounds without murmurs or signs of heart failure.

Electrocardiography (Figure 1) demonstrated ST-segment elevation in leads I, aVL, II, aVF, and V2 to V6, indicating concomitant anterior and inferior myocardial infarction (Figure A). Transthoracic echocardiography showed moderate left ventricular systolic dysfunction with an ejection fraction of 42%, akinesia of the apex, and akinesia of the mid and apical segments of the anterolateral and inferoseptal walls. The left atrium was enlarged with spontaneous echo contrast but no visible thrombus.

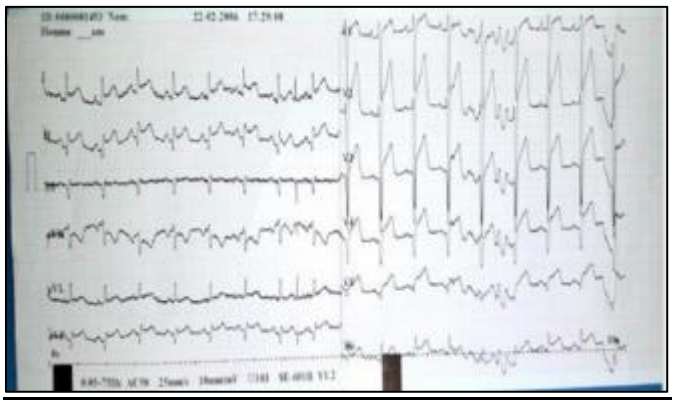

Figure 1 ECG showing ST segment elevation in leads I, aVL, II, aVF and V2 to V6

Emergency coronary angiography revealed a proximal intermediate lesion of the LAD and a distal LAD occlusion beyond the first diagonal branch (D1) (Figure 2). The left circumflex artery was large and dominant, while the right coronary artery was small. Primary percutaneous coronary intervention (PCI) of the LAD was performed, with implantation of a drug-eluting stent (Synergy® 3.5 × 28 mm)

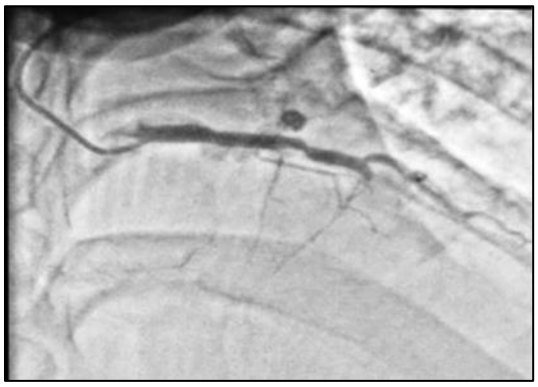

Figure 2 CAG: proximal intermediate lesion and distal LAD occlusion with the stump of the artery

Following successful revascularization, repeat angiography demonstrated a large wrap-around LAD extending beyond the apex to the inferior wall, as well as the presence of a second diagonal branch (D2) (Figure C). The patient had an uneventful hospital course and was discharged on day five without complications.

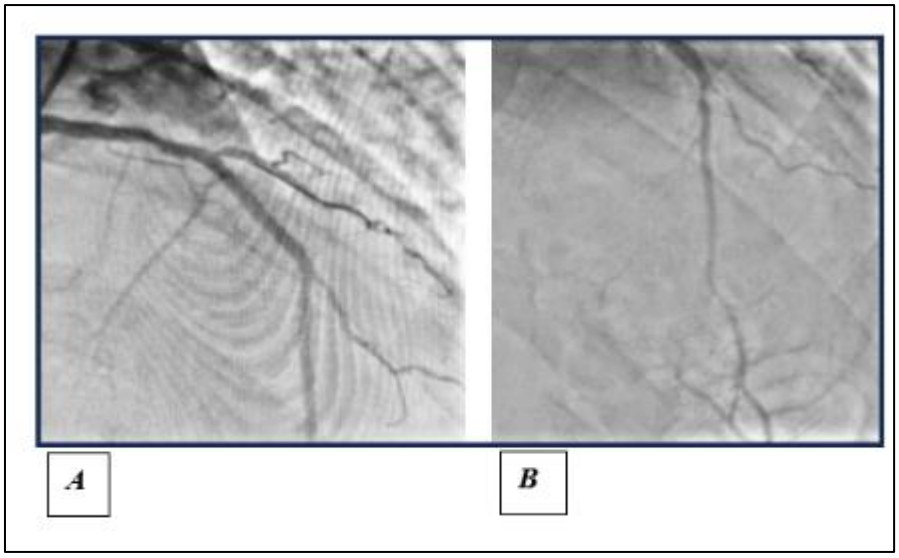

Figure 3 A PCI with with stent showing the LAD artery andrevelation of D2 – B: Image of the Wrap Around LAD

3. Discussion

This case highlights an uncommon yet clinically significant presentation of acute myocardial infarction (AMI), characterized by simultaneous anterior and inferior ST-segment elevation on electrocardiography. Although anterior ST-segment elevation typically reflects occlusion of the left anterior descending artery (LAD) with reciprocal ST depression in inferior leads, the presence of concomitant inferior ST elevation represents an atypical pattern that should prompt consideration of specific coronary anatomical variants. In our patient, coronary angiography demonstrated a distal occlusion of a wrap-around LAD, providing a clear anatomical explanation for inferior wall involvement.

A wrap-around LAD is classically defined as an LAD that extends beyond the cardiac apex to supply at least one-quarter of the inferior wall of the left ventricle, most reliably identified on post-reperfusion coronary angiography, particularly in the right anterior oblique projection. In this anatomical configuration, distal LAD occlusion can result in ischemia affecting both the anterior and inferior myocardial territories, thereby producing combined ST-segment elevation in precordial and inferior leads.

Several studies have established a strong association between this ECG pattern and the presence of a wrap-around LAD. Bozbeyoğlu et al. reported that although a wrap-around LAD was present in approximately one-third of patients with AMI, concomitant inferior and anterior ST-segment elevation was observed in only 11% of cases; however, nearly three-quarters of these patients had a wrap-around LAD. Similarly, Sapin et al. demonstrated that all patients presenting with combined inferior and anterior ST-segment elevation had a wrap-around LAD, reinforcing the diagnostic value of this ECG pattern. Tamura et al. further confirmed these findings, reporting a 100% association between inferior ST elevation in anterior MI and wrap-around LAD occlusion in their cohort.

The clinical importance of this presentation lies in the extent of myocardial ischemia and the prognostic implications. Occlusion of a wrap-around LAD compromises a large myocardial territory encompassing both anterior and inferior walls, which is associated with a larger infarct size, more severe left ventricular dysfunction, and a higher incidence of adverse outcomes, including acute heart failure, malignant ventricular arrhythmias, mechanical complications, and increased mortality. Moreover, inferior ST-segment elevation in this context may lead to diagnostic confusion with primary inferior MI, potentially delaying appropriate reperfusion therapy if the underlying mechanism is not promptly recognized.

From a practical standpoint, early identification of concomitant inferior and anterior ST-segment elevation on ECG should alert clinicians to the possibility of a distal LAD occlusion involving a wrap-around artery. This recognition is particularly relevant in emergency and pre-hospital settings, where ECG interpretation guides urgent management decisions. Rapid referral for coronary angiography and prompt reperfusion remains essential to limit myocardial damage and improve clinical outcomes in these high-risk patients.

In conclusion, this case underscores the importance of integrating ECG findings with an understanding of coronary anatomy. Awareness of the wrap-around LAD variant and its characteristic electrocardiographic presentation can facilitate timely diagnosis, guide appropriate therapeutic strategies, and ultimately improve prognosis in patients presenting with atypical patterns of ST-segment elevation myocardial infarction.

4. Conclusion

Concomitant inferior ST-segment elevation in anterior myocardial infarction is most commonly associated with occlusion of a wrap-around LAD. This presentation reflects a large ischemic territory and carries a high risk of adverse outcomes. Emergency physicians, general practitioners, cardiologists, and interventional cardiologists should be aware of this pattern and act rapidly to ensure early diagnosis and prompt reperfusion.

Compliance with ethical standards

Acknowledgments

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Disclosure of Conflict of Interest

The authors declare that they have no conflicts of interest related to this publication.

Ethical Approval

Ethical approval was not required for this case report according to the institutional policies. The study was conducted in accordance with the ethical standards of the Declaration of Helsinki.

Informed Consent

Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

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