



When the LAD Takes Over: An Unusual Cause of Multi-Territory Infarction by a Hyper-Dominant LAD

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Abstract

A 62-year-old male presented with acute coronary syndrome (ACS) with anterior and inferior wall ST-elevation myocardial infarction (STEMI). Coronary angiography revealed a rare hyper-dominant left anterior descending (LAD) artery with triple vessel disease (TVD). Following successful thrombolysis with reteplase, the patient was managed with standard ACS therapy and referred for coronary artery bypass grafting (CABG). This report highlights the significance of hyper-dominant LAD in multi-territory ischemia and discusses its implications in management.

Keywords: Hyper-dominant LAD; Coronary artery anomaly; Multi-territory myocardial infarction; Coronary angiography; Triple vessel disease (TVD)

List of Abbreviations: ACS - Acute Coronary Syndrome; AP - Anteroposterior; BNP - Brain Natriuretic Peptide; CABG - Coronary Artery Bypass Grafting; CBC - Complete Blood Count; ECG - Electrocardiogram; HS-Troponin I - High-Sensitivity Troponin I; LAD - Left Anterior Descending (artery); LAO - Left Anterior Oblique; LCx - Left Circumflex (artery); LVEF - Left Ventricular Ejection Fraction; MR - Mitral Regurgitation; PCI - Percutaneous Coronary Intervention; RAO - Right Anterior Oblique; RCA - Right Coronary Artery; RFT - Renal Function Tests; STEMI - ST-Elevation Myocardial Infarction; TR - Tricuspid Regurgitation; TVD - Triple Vessel Disease

Case Report

Introduction

Coronary artery anomalies, though rare, can have significant clinical implications, particularly in acute coronary syndrome (ACS). This case report describes a 62-year-old male presenting with ACS due to a unique coronary anomaly—a hyper-dominant left anterior descending (LAD) artery. This rare anatomical variant, observed in less than 1% of individuals, extends the LAD's perfusion territory to areas typically supplied by the right coronary artery (RCA) or left circumflex artery (LCx). Consequently, occlusion of the hyper-dominant LAD can result in extensive multi-territory myocardial infarctions, as seen in this patient. Initial thrombolysis alleviated ischemic symptoms, but coronary angiography revealed triple-vessel disease with critical LAD involvement, necessitating coronary artery bypass grafting (CABG). This case emphasizes the importance of recognizing hyper-dominant LAD arteries in ACS, as their presence complicates the clinical presentation and management. Early detection through imaging and tailored interventions is critical to improving outcomes in patients with this high-risk coronary anomaly.

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History of presentation

The patient, a 62-year-old male, presented with acute chest pain lasting six hours, accompanied by diaphoresis and a profound sense of impending doom. Notably, he denied symptoms of dyspnea, syncope, or palpitations. On examination, his blood pressure was 100/60 mmHg in the right arm while supine, and his pulse was regularly irregular at 150 beats per minute. Chest auscultation revealed normal vesicular breath sounds without crepitations, murmurs, or extra heart sounds, though S1 was variable.

Past medical history

The patient had no history of prior myocardial infarction, percutaneous coronary intervention (PCI), or coronary artery bypass grafting (CABG), indicating no previously documented cardiac events or interventions. His medical history was significant for systemic hypertension, which was well-controlled with amlodipine. There was no known history of diabetes mellitus, dyslipidemia, or other significant cardiovascular risk factors such as smoking or a family history of premature coronary artery disease. This background suggested that the current presentation of acute coronary syndrome (ACS) was the first manifestation of ischemic heart disease in this patient.

Differential diagnosis

The differential diagnosis for this patient includes several potential causes of his presentation. The foremost consideration is ST-elevation myocardial infarction (STEMI) within the spectrum of acute coronary syndrome (ACS), given the classic symptoms of chest pain, diaphoresis, and electrocardiographic findings indicative of multi-territory myocardial ischemia. Another possibility is unstable angina, a condition within ACS that could present with similar symptoms but without definitive ST-segment elevation on the electrocardiogram or biomarker evidence of myocardial necrosis. Lastly, a non-ST elevation myocardial infarction (non-STEMI) associated with atrial fibrillation is a potential

differential, characterized by ischemic symptoms and evidence of myocardial injury in the absence of ST-segment elevation. Each of these conditions requires careful evaluation of clinical, electrocardiographic, and biomarker data to confirm the diagnosis and guide appropriate management.

Investigations

The patient underwent a series of diagnostic evaluations to confirm the diagnosis and assess the severity of his condition.

Electrocardiogram (ECG) revealed ST-elevation myocardial infarction (STEMI) with anterior and inferior wall involvement. (Figure 1).

Biomarkers demonstrated a significant elevation in high-sensitivity Troponin I (HS-Troponin I), consistent with acute myocardial injury, while brain natriuretic peptide (BNP) was mildly elevated at 135 pg/mL, suggesting a degree of cardiac strain. Other laboratory parameters, including complete blood count (CBC) and renal function tests (RFT), were within normal limits.

Echocardiography showed notable left circumflex artery (LCx) territory akinesia, severe tricuspid regurgitation (TR), and severe mitral regurgitation (MR). The left ventricular ejection fraction (LVEF) was reduced to 35%, indicating significant left ventricular systolic dysfunction.

Coronary Angiography Findings revealed triple vessel disease (TVD) with the following detailed observations: (Table 1 and Figure 2-5).

These findings confirmed the presence of high-risk coronary anatomy, necessitating prompt and comprehensive management to address both the acute myocardial infarction and the underlying multi-vessel disease.

Management

The patient received thrombolysis with reteplase, administered as an initial 10-unit IV bolus over 2 minutes, followed by a second 10-unit bolus 30 minutes later.

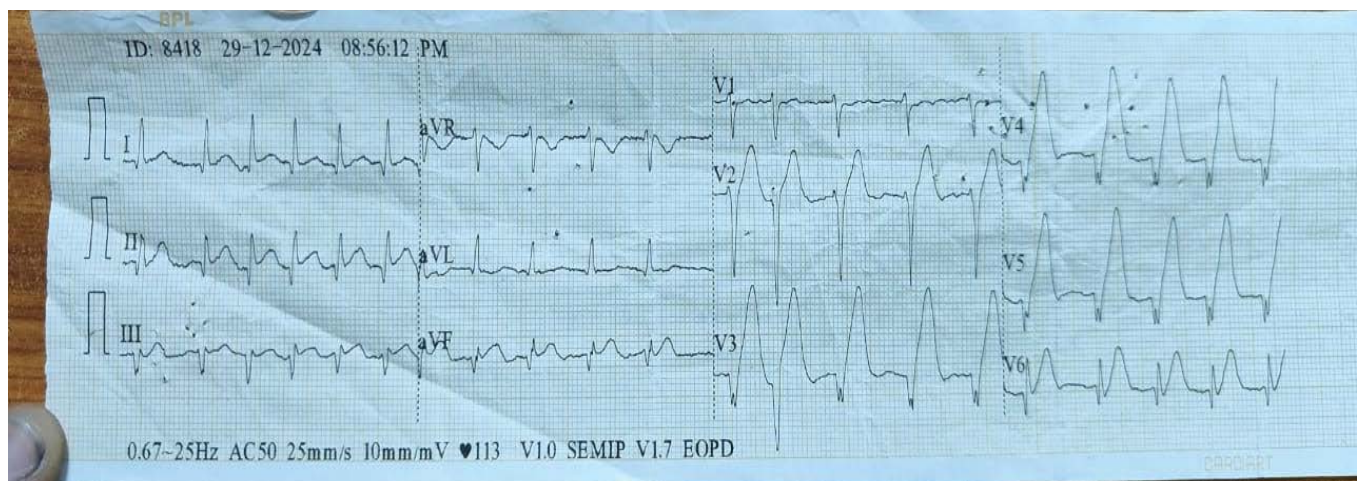


Figure 1: ECG of the patient at presentation.

Successful thrombolysis was indicated by prompt symptom resolution and normalization of the ST-segment on the ECG. In addition to thrombolysis, the patient was managed with standard acute coronary syndrome (ACS) therapy, which included:

- Antiplatelet therapy: Aspirin (loading dose) and clopidogrel (for dual antiplatelet therapy).
- Statin therapy: Atorvastatin (to lower cholesterol and reduce the risk of future cardiovascular events).
- Beta-blockers: To manage heart rate and reduce myocardial oxygen demand.
- ACE inhibitors: To alleviate strain on the heart and improve outcomes in ACS.

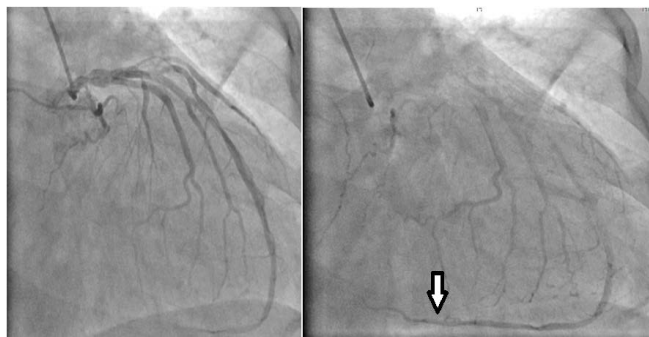


Figure 2: RAO Cranial View depicting the LAD extending upto the crux.

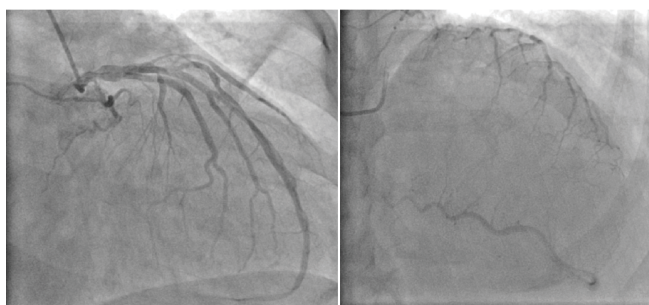


Figure 3: AP Cranial view showing the LAD's hyper-dominance.

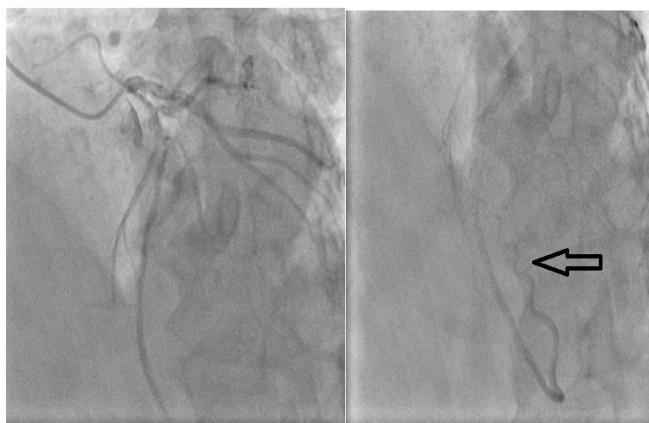


Figure 4: LAO Cranial view depicting hyper-dominant LAD.

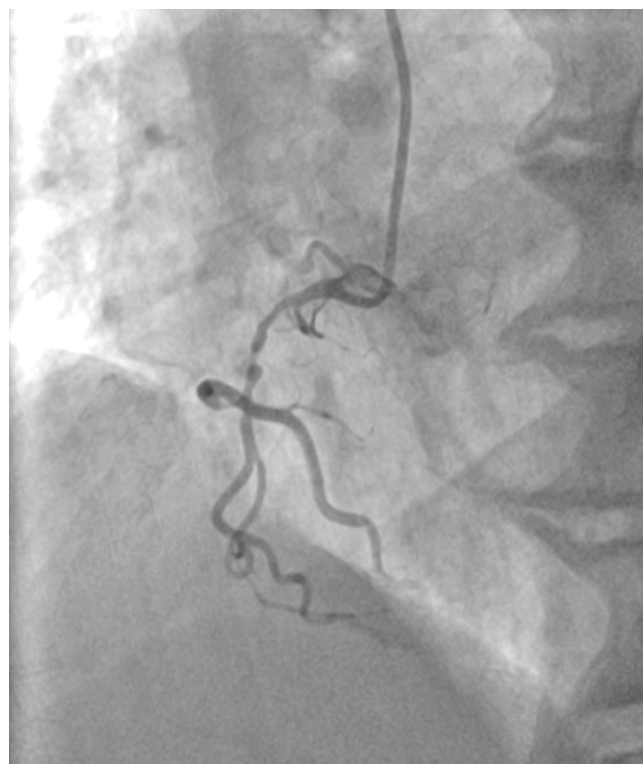


Figure 5: Non-dominant RCA.

Table 1: Coronary Angiography findings of the patient.

Vessel	Findings
LMCA	Normal
LAD (Hyper-dominant)	Lesions:-Osteo-proximal 80%, mid 90%, distal 50%; D1 osteo-proximal 80%
Ramus Intermedius	Lesions:- Proximal 40%; bifurcation with upper division ostial 90%, lower division 50%
LCX	Osteo-proximal plaquing
RCA	Non-dominant, proximal to mid 80% lesion

Due to the presence of triple-vessel disease (TVD) with high-risk coronary anatomy, specifically involving a hyper-dominant left anterior descending artery (LAD), the patient was referred for coronary artery bypass grafting (CABG) to address the complex coronary lesions and optimize long-term prognosis.

Discussion

A hyper-dominant left anterior descending (LAD) artery is a rare and clinically significant coronary anomaly, occurring in less than 1% of individuals [1]. In this condition, the LAD artery takes on an unusual role, supplying not only the anterior and septal walls but also areas typically served by the right coronary artery (RCA) or left circumflex artery (LCx). This anomaly significantly increases the risk

of extensive myocardial infarction (MI), as its occlusion can simultaneously affect multiple myocardial territories, including the anterior, septal, and inferior walls. The identification of this anomaly is critical for optimizing patient outcomes, particularly in the context of acute coronary syndrome (ACS). Current clinical guidelines underscore the importance of early detection of such anatomical variants through advanced imaging techniques [2], including coronary angiography and computed tomography (CT) imaging. Timely interventions, such as thrombolysis or percutaneous coronary intervention (PCI), are vital for limiting the extent of infarction and improving patient prognosis [3]. However, in cases involving complex coronary anatomy, coronary artery bypass grafting (CABG) remains a cornerstone of treatment, as demonstrated in this particular case. The presence of hyper-dominant LAD in ACS cases with atypical clinical presentations or multi-territory involvement warrants heightened clinical vigilance [4,5]. Early and decisive intervention, tailored to address these anatomical variants, has been shown to significantly improve survival rates in patients with such high-risk coronary anomalies. The management of these cases emphasizes the necessity for individualized care to mitigate the risk of extensive myocardial damage and enhance long-term outcomes.

Follow-up

The patient demonstrated clinical improvement post-thrombolysis and was discharged in stable condition. Follow-up included optimization of medical therapy and CABG evaluation.

Conclusion

Hyper-dominant LAD arteries are associated with multi-territory myocardial infarctions, necessitating prompt recognition and intervention. These anomalies can be identified on the ECG when ischemic changes are observed in more than two myocardial territories simultaneously.

Effective management requires a multi-disciplinary approach, combining thrombolysis, medical therapy, and, when indicated, surgical intervention, to optimize patient outcomes.

Learning Objectives

1. Recognize the clinical significance of hyper-dominant LAD anomalies.
2. Understand the implications of multi-territory infarctions in ACS.
3. Highlight the role of ECG in identifying coronary artery anomalies.

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