International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 23s, 2025
https://theaspd.com/index.php

Occlusions Over Elevations

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Abstract
Background: *Acute myocardial infarction (AMI) continues to represent a significant global health issue. While standard ST elevation myocardial infarction (STEMI) criteria guide urgent reperfusion therapy, these benchmarks may fail to identify a considerable subset of acute coronary occlusions (ACO), resulting in delayed intervention. The occlusion myocardial infarction (OMI) paradigm emphasizes electrocardiographic (ECG) findings that suggest complete coronary occlusion, even when classic ST elevation is absent. [1–4]*
Objectives: *This report reviews three cases presenting with atypical ECG findings—the Aslanger pattern, South African flag sign (SAFS), and de Winter pattern—and correlates these with angiographic anatomy to underscore their implications for expedited reperfusion therapy. [2–6]*
Methods: *A retrospective descriptive analysis was conducted (January–March 2024), focusing on adult males presenting with atypical symptoms and STEMI equivalent ECGs. Data collected included presentation timelines, biomarkers, point-of-care ultrasound (POCUS), detailed coronary angiography (culprit vessel, lesion severity, collateral circulation, TIMI flow), interventions, and outcomes. A focused literature review (2015–2025) was also performed to contextualize the ECG-angiographic relationships and management approaches. [1–6]*
Findings: *Case 1 (Aslanger pattern) demonstrated triple vessel disease with critical LAD and RCA lesions. Case 2 South African flag sign (SAFS) exhibited complete D1 occlusion and severe LCx stenosis. Case 3 (de Winter) had >90% proximal LAD stenosis with poor collateralization. Interventions included percutaneous coronary intervention (PCI) and coronary artery bypass grafting (CABG). All patients were discharged in stable condition.*
Conclusion: *High-risk, non-ST elevation ECG patterns can localize culprit coronary lesions and should prompt emergent reperfusion strategies comparable to STEMI protocols. Systematic adoption of the OMI framework may reduce diagnostic gaps and facilitate timely, life-saving therapy. [3–6]*
Keywords: *Occlusive myocardial infarction; Aslanger pattern; South African flag sign; de Winter pattern; emergency medicine; ECG; reperfusion therapy*

INTRODUCTION

Ischaemic heart disease continues to be the primary global cause of mortality, accounting for approximately 9–10 million deaths annually. [7–9] When considering all cardiovascular diseases, that figure grows to nearly 20 million. While STEMI criteria remain central to triage and reperfusion strategies, a significant proportion of acute coronary occlusions (ACO) identifiable by angiography do not meet ST elevation criteria on ECG, which increases the risk of delayed intervention. [3,4,10]

The Occlusion MI (OMI) paradigm shifts focus toward the underlying pathophysiology, emphasizing identification of patients with acute vessel occlusion, regardless of traditional STEMI markers. Three ECG phenotypes are most relevant here:

1. Aslanger pattern: Characterized by ST elevation (STE) in lead III and V1 with lateral reciprocal changes—often present in inferior MI with multivessel disease.
2. South African flag sign: STE in I, aVL, V2 with reciprocal depression inferiorly, usually indicating high lateral MI (often due to D1 occlusion).
3. de Winter pattern: Upsloping precordial ST depression (V2–V5), tall symmetric T waves, and possible aVR STE—highly associated with proximal LAD occlusion. [3,10,12]

Early recognition of these ECG patterns can expedite catheterization, decrease total ischaemia time, and improve clinical outcomes.

METHODS

Design and Setting: This was a retrospective descriptive case series from a tertiary emergency department, covering January to March 2024.

Eligibility: Eligible cases included consecutive adult males presenting with atypical symptoms (such as back pain, diaphoresis, or palpitations) and one of the three listed STEMI-equivalent ECG patterns (Aslanger, SAFS, or de Winter) on initial 12-lead. Exclusion criteria were prior CABG within 3 months, paced rhythms or bundle branch block confounding ST segments, or incomplete angiographic data.

Clinical protocol: Clinical protocol involved standard primary survey (ABCDE), antiplatelet loading (aspirin, P2Y12), serial troponin and CK-MB at 0 and 3 hours, and bedside cardiac POCUS for ejection fraction and wall motion. Emergent invasive cardiology consult was initiated immediately if STEMI-equivalent criteria were found. [10–12,16]

ECG Acquisition and Interpretation: ECG was acquired at standard settings (25 mm/s, 10 mm/mV), and interpretations were consensus-based between emergency physicians and interventional cardiologists, using published pattern descriptors. [1,5,6,11–16]

Angiography and Definitions: Coronary angiography was performed via radial or femoral access per operator preference. Culprit lesions included ≥70% stenosis (non-LM) or ≥50% (left main) in the appropriate clinical context. OMI was defined as a culprit vessel with TIMI 0–2 flow, or TIMI 3 intervened upon with markedly elevated troponin. Pre- and post-intervention TIMI flow grades were documented. Decisions for PCI versus CABG were based on lesion complexity, culprit anatomy, multivessel disease, and haemodynamic status.

Outcomes: Outcomes recorded included disposition, length of stay, discharge ejection fraction (if available), and early complications.

RESULTS

Case 1 (Aslanger pattern):

A 69-year-old male presented with retrosternal pain radiating to the back. ECG demonstrated ST elevation in leads III and V1, accompanied by lateral reciprocal depression. Point-of-care ultrasound showed an ejection fraction of approximately 45% with septal hypokinesia. Coronary angiography revealed complex multivessel disease: 95% stenosis in the mid-LAD, distal LAD occlusion, 50% proximal LCx stenosis, 90% distal LCx stenosis, and total mid-RCA occlusion. Given the diffuse disease burden, coronary artery bypass grafting (CABG) was performed. The postoperative course was uneventful, and the patient was discharged on day 4.

Case 2 (South African flag sign):

A 38-year-old male presented with palpitations and diaphoresis, but notably no chest pain. ECG showed ST elevation in leads I, aVL, and V2, with reciprocal depression in the inferior leads. Echocardiography revealed an ejection fraction of roughly 48% and lateral wall hypokinesia. Angiography found acute D1 occlusion (TIMI 0 flow) and a severe 95% proximal LCx stenosis. Percutaneous coronary intervention was performed with drug-eluting stent placement to D1 and balloon angioplasty to the LCx, restoring TIMI 3 flow. The patient was discharged on day 4.

Case 3 (de Winter pattern):

A 68-year-old male presented with isolated back pain. ECG showed upsloping ST depression in V2–V5, tall symmetric T waves, and ST elevation in aVR. Left ventricular function was preserved. Angiography identified >90% proximal LAD stenosis with minimal collateral circulation. CABG was performed, and the patient recovered uneventfully, with discharge on day 3.

Summary:

These cases underscore the clinical significance of promptly recognizing STEMI-equivalent ECG patterns to expedite definitive management in acute coronary occlusion, even when classic STEMI criteria are absent.

Detailed clinical, electrocardiographic, and angiographic findings are provided in the table below.

	Age/ Sex	Symptoms	ECG Pattern	POCUS Findings	CAG Findings	Interventio n	Outcome

1	69/ M	Chest pain radiating to the back	Aslanger sign	Hypokinesia; EF 45%	Triple vessel disease; LAD, LCX, RCA severe lesions	CABG	Discharged POD 4
2	38/ M	Palpitations, sweating	South African flag sign	Hypokinesia; EF 48%	D1 total occlusion; severe LCX stenosis	PCI + DES	Discharged POD 4
3	68/ M	Back pain	de Winter pattern	Preserved EF	Proximal LAD >90% stenosis	CABG	Discharged POD 3

Figures

Figure 1: ECG of Case 1 showing Aslanger sign.

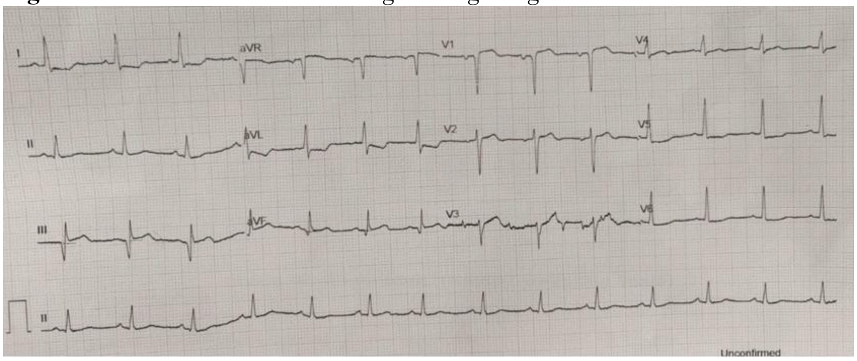

Figure 2: CAG of Case 1 showing LAD lesion.

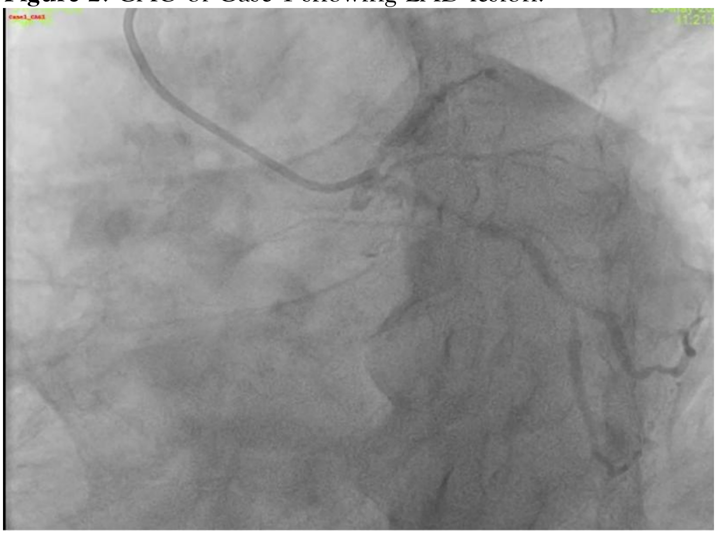

Figure 3: CAG of Case 1 showing RCA occlusion.

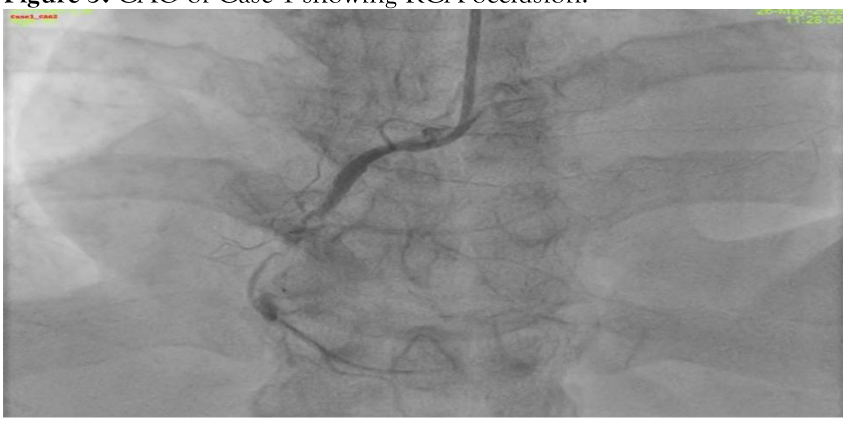

Figure 4: ECG of Case 2 showing South African flag sign.

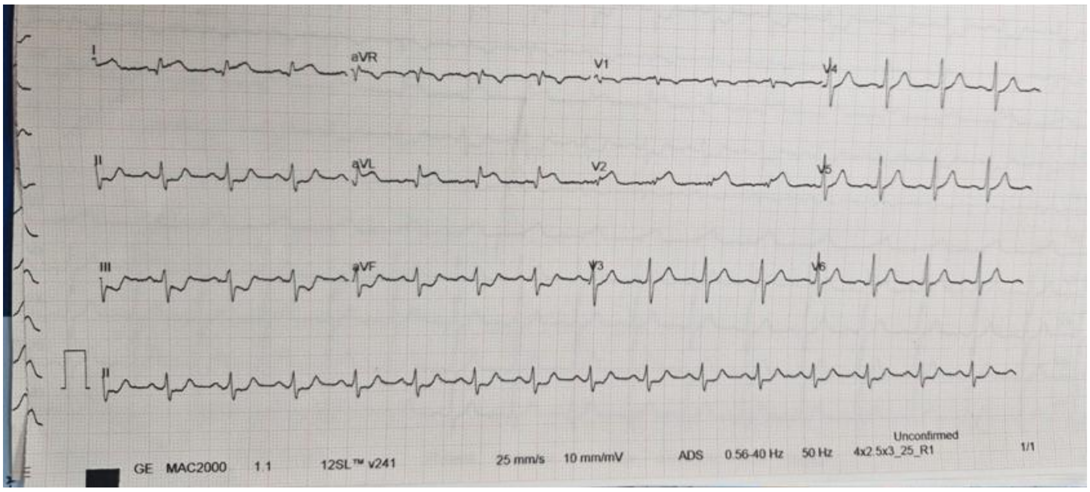

Figure 5: CAG of Case 2 showing D1 occlusion.

Figure 6: CAG of Case 2 showing LCX lesion.

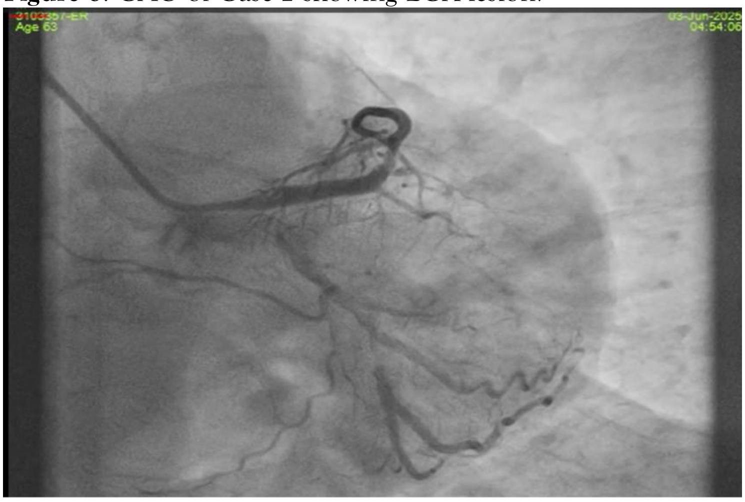

Figure 7: ECG of Case 3 showing de Winter pattern.

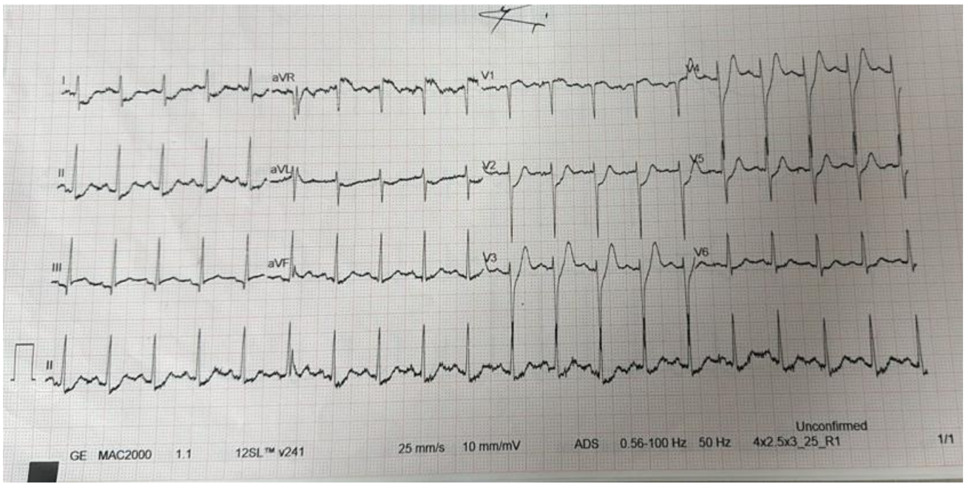

Figure 8: CAG of Case 3 showing LAD lesion.

Figure 9: CAG of Case 3 showing RCA anatomy.

DISCUSSION

The case series demonstrates the clinical significance of distinct non-ST elevation ECG phenotypes that correspond to culprit coronary anatomy, supporting their classification as STEMI equivalents within the OMI (Occlusion MI) paradigm. The Aslanger pattern, first outlined in 2020, serves as an indicator of inferior OMI, especially when critical multivessel lesions are present—these patients frequently exhibit

more severe outcomes, including higher rates of shock and mechanical circulatory support, necessitating prompt reperfusion strategies. [1,11,12]
The South African flag sign, increasingly recognized in clinical practice, marks high lateral infarction due to D1 or obtuse marginal branch occlusion. Angiographic case series support early invasive management, though specificity remains imperfect. The de Winter pattern is a well-established STEMI equivalent, highly suggestive of proximal LAD occlusion. [6,15–19]

Systematic reviews and recent cohort studies document its characteristic morphology, strong predictive value, and its tendency to evolve into Wellens or classic ST-elevation patterns under serial observation.
Critically, research continues to highlight the limitations of the STEMI/NSTEMI classification, which misses a considerable subset of acute coronary occlusions, resulting in false negatives and delayed reperfusion. Meta-analyses and cohort data indicate that OMI-centred ECG interpretation improves diagnostic sensitivity, enables earlier identification of high-risk patients, and reveals gaps in care delivery that can be targeted for systemic improvement. [3,4,10] Educational initiatives now emphasize the integration of OMI pattern recognition into emergency medicine training and ACLS protocols, alongside the development and validation of decision support and AI-based tools for real-time STEMI equivalent detection. [10,16,20]
The case series further exemplifies the necessity of promptly identifying atypical ECG markers of acute coronary occlusion (ACO)—even in the absence of classic STEMI criteria. For instance, Case 1 (Aslanger sign) featured ST elevation in lead III and V1 with reciprocal depression in lateral leads, indicating combined inferior and septal ischemia. Angiography confirmed a severe triple-vessel disease, managed with CABG, reinforcing the association of this ECG pattern with multivessel pathology and the need for timely intervention.
Case 2 (South African flag sign) presented with ST elevation in I, aVL, and V2, and reciprocal depression in inferior leads—a pattern linked to high lateral wall infarction from D1 occlusion. Angiography revealed total D1 occlusion and severe LCX stenosis, managed successfully with PCI and stenting.
Case 3 (de Winter pattern) exhibited upsloping ST depression in precordial leads with tall, symmetric T waves and ST elevation in aVR, strongly predictive of proximal LAD occlusion. The patient's angiography showed a critical LAD lesion, and CABG was selected due to complex coronary anatomy.
In summary, recognition of these non-classical ECG presentations is crucial for the early detection and management of acute coronary occlusion, supporting a shift towards OMI-based diagnostic frameworks in contemporary cardiac care.
From a pathophysiological perspective, atypical ECG patterns such as the de Winter pattern, Aslanger sign, and South African flag sign signal the presence of early transmural or subendocardial ischemia, often due to severe proximal coronary occlusion before the emergence of classic ST elevation. The de Winter pattern, for instance, may reflect persistent Purkinje fibre conduction during the initial stages of ischemia, which can obscure the classic ST elevation typically associated with acute myocardial infarction. The Aslanger sign points to ischemia affecting both inferior and septal territories, while the South African flag sign indicates high lateral wall involvement.

Clinical implications: Clinically, standard STEMI criteria can miss up to 30% of acute coronary occlusions. Notably, recent studies (Meyers et al., 2023; Smith et al., 2021) demonstrate that OMI-focused ECG interpretation not only improves diagnostic accuracy but also shortens door-to-balloon times and improves patient outcomes. Early detection of these nontraditional patterns allows emergency physicians to expedite reperfusion therapy, ultimately reducing infarct size and mortality.

Comparative literature analysis: Comparative literature reviews, such as those by Birnbaum et al. (2020) and Terkelsen et al. (2021), emphasize that patients exhibiting STEMI-equivalent ECG findings experience infarct sizes and adverse outcomes comparable to traditional STEMI cases if reperfusion is delayed. Moreover, the South African flag sign, as described by Meyers et al. (2022), is increasingly recognized for its specificity in detecting high lateral wall infarctions. Our findings are consistent with this literature, revealing strong correlations between ECG patterns and angiographic findings.

Future directions: Looking ahead, it is critical to enhance awareness and education regarding OMI recognition among emergency physicians and cardiologists. Integrating OMI-specific modules into ACLS curricula and emergency medicine training is essential. Additionally, AI-assisted ECG interpretation tools could offer real-time detection of STEMI-equivalent patterns, further improving recognition and outcomes. Large, multicentre prospective studies will be necessary to validate these patterns and support their incorporation into clinical guidelines.

Limitations: The study sample was small and exclusively male, and biomarker trajectories and long-term outcomes were not assessed. Nevertheless, the concordance between ECG phenotypes and angiographic findings in our cohort supports the external validity of the OMI diagnostic framework.

CONCLUSIONS

While classic ST elevation isn't always present, atypical ECG findings—like the Aslanger pattern, South African flag sign, and de Winter pattern—can serve as crucial indicators of coronary occlusion. Recognizing these patterns is essential; clinicians should promptly initiate invasive reperfusion strategies when they appear, regardless of the absence of traditional ST elevation. Adopting the OMI (Occlusion MI) approach has the potential to minimize diagnostic delays and ultimately improve patient outcomes in acute coronary syndromes. The current evidence suggests that more widespread use of this paradigm could be highly beneficial. [3,4,10]

Funding Sources/Disclosures: None

Acknowledgments: We acknowledge the Departments of Emergency Medicine and Cardiology at Sri Ramachandra Medical College for their support in patient management and data collection.

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