

Navigating Mirrored Anatomy: Primary Percutaneous Coronary Intervention in Dextrocardia

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Abstract Dextrocardia with situs inversus is a rare congenital condition in which thoracoabdominal organs follow a complete mirror orientation. While individuals are often asymptomatic, the management of acute coronary syndrome in this setting poses significant diagnostic and interventional challenges due to reversed anatomical relationships. We report a 60-year-old man with known dextrocardia who presented with acute anterior myocardial infarction. The initial ECG, recorded with standard left-sided precordial leads, failed to show clear ST-segment elevation; however, repositioning the leads to the right hemithorax revealed marked anterior ST elevation. Coronary angiography required systematic technical adaptation, including alternative catheter selection and “mirror-opposite” fluoroscopic projections to visualize the left anterior descending artery correctly. Primary percutaneous coronary intervention was successfully performed using an Amplatz Left 1 catheter for the left coronary artery and an Amplatz Right 1 catheter for the mirrored right coronary ostium. This case underscores the critical need for early recognition of dextrocardia and a structured approach to adapting catheter selection and angiographic views to ensure safe and effective coronary intervention in this challenging anatomical setting.

Keywords: Dextrocardia, Situs inversus, Acute coronary syndrome, Percutaneous coronary intervention, Coronary angiography, Anatomical variation

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specific technical adjustments required to overcome the challenges posed by the mirrored coronary anatomy.

1. Introduction

Dextrocardia with situs inversus is an uncommon congenital condition in which thoracic and abdominal organs follow a complete mirror-image arrangement. With an estimated prevalence of approximately 1 in 10,000 individuals, most cardiologists will have limited exposure to this anatomical variant in their clinical practice [1]. Although often asymptomatic, dextrocardia becomes clinically significant when acute coronary syndrome occurs, as the reversed cardiac orientation alters electrocardiographic interpretation and modifies the expected engagement paths during coronary angiography.

Primary percutaneous coronary intervention remains the preferred reperfusion strategy in acute ST-segment elevation myocardial infarction (STEMI). However, successful intervention in dextrocardia requires not only recognition of the anatomical inversion but also systematic adaptation of catheter selection, fluoroscopic projections, and guidewire manipulation [2,3]. Failure to identify the underlying condition early may delay diagnosis, impair visualization, or compromise procedural success.

We herein report a case of successful emergency PCI in a patient with dextrocardia and situs inversus, detailing the

2. Case Presentation

A 60-year-old man with a history of hypertension, active smoking, and known dextrocardia with complete situs inversus presented to the emergency department with intense retrosternal chest pain lasting one hour, associated with diaphoresis and nausea. On examination, he was hemodynamically stable. Cardiac auscultation localized the apex beat to the right hemithorax, with symmetrical peripheral pulses and no signs of heart failure.

The initial 12-lead ECG, recorded with standard left-sided precordial placement, showed a negative QRS in lead I and a positive aVR, with poor R-wave progression—an ECG pattern suggestive of dextrocardia rather than true anterior ischemia Figure 1. Because of the discordance between symptoms and the initial tracing, the ECG was repeated in the cardiac intensive care unit with all precordial leads repositioned on the right hemithorax. This right-sided ECG revealed marked ST-segment elevation in the anterior leads, confirming an acute anterior STEMI. This correction prevented misdiagnosis and prompted immediate activation of the catheterization

laboratory.



Figure 1. Standard ECG showing dextrocardia pattern

Twelve-lead ECG recorded with left-sided precordial placement demonstrating negative lead I, positive aVR, and absent R-wave progression suggesting dextrocardia.

Coronary angiography was performed via right femoral access, chosen over a transradial approach to ensure reliable catheter support and timely engagement in this acute setting of mirror-image anatomy. A 6F sheath was used. Selective engagement of the left coronary artery was challenging due to the complete mirror-image anatomy. Initial attempts using a Judkins Left 4 catheter failed to achieve coaxial alignment. An Amplatz Left 1 catheter provided better orientation and stable cannulation. Angiography revealed a proximal left anterior descending artery (LAD) occlusion with TIMI 0 flow [Figure 2](#).

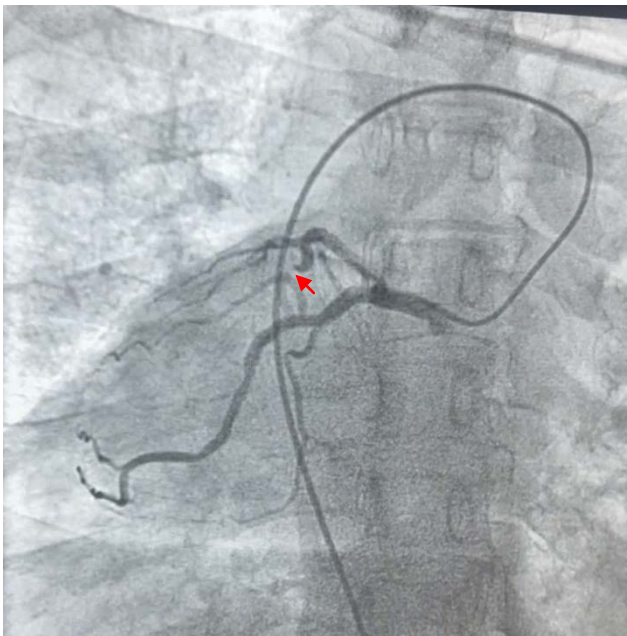


Figure 2. Proximal LAD occlusion in mirrored anatomy

Coronary angiography obtained in RAO 10° / Caudal 17° projection using an Amplatz Left 1 catheter, demonstrating a proximal LAD occlusion with TIMI 0 flow (red arrow) in complete situs inversus.

Standard angiographic projections, such as LAO cranial or RAO caudal, were inadequate because of the reversed spatial configuration. Clear visualization was achieved

using “mirror-opposite” projections, specifically RAO cranial restoring familiar geometry of the LAD and septal branches [Figure 3](#).

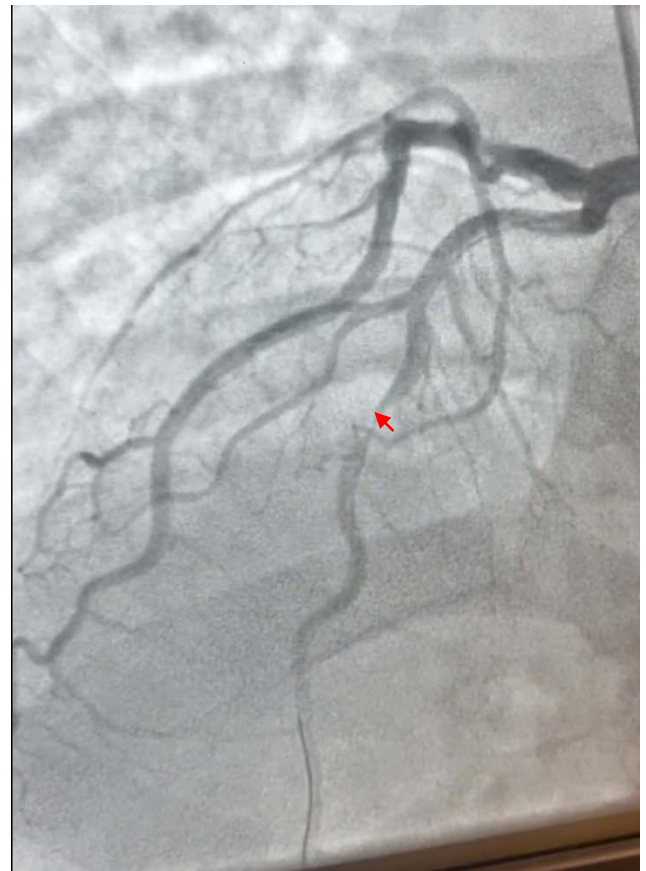


Figure 3. Mirrored RAO cranial projection improving LAD visualization

Use of a mirror-opposite RAO 10° / Cranial 26° projection after successful guidewire crossing of the lesion, providing optimal delineation of the occluded LAD segment (red arrow) and septal branches in complete situs inversus.

Crossing the lesion was initially difficult due to reversed vessel angulation, which repeatedly caused the guidewire to slip out of the occluded LAD segment. Using controlled torque, gentle rotation, and increased support from the AL1 catheter, a hydrophilic workhorse wire successfully crossed the lesion. Pre-dilatation with a semi-compliant balloon was followed by implantation of a drug-eluting stent adapted to angiographic measurements. Final angiography under mirrored projections showed optimal stent expansion and full restoration of TIMI 3 flow [Figure 4](#).

Post-PCI angiography obtained in RAO 10° / Cranial 26° projection, demonstrating optimal stent expansion and complete restoration of TIMI 3 flow in the LAD under mirror-image anatomy.

Engagement of the right coronary artery was also technically demanding. A Judkins Right 4 catheter repeatedly failed to align with the mirrored ostium. An Amplatz Right 1 catheter provided the correct orientation and stable engagement, allowing complete visualization of the RCA, which showed no significant stenosis [Figure 5](#).



Figure 4. Final angiographic result after LAD stenting

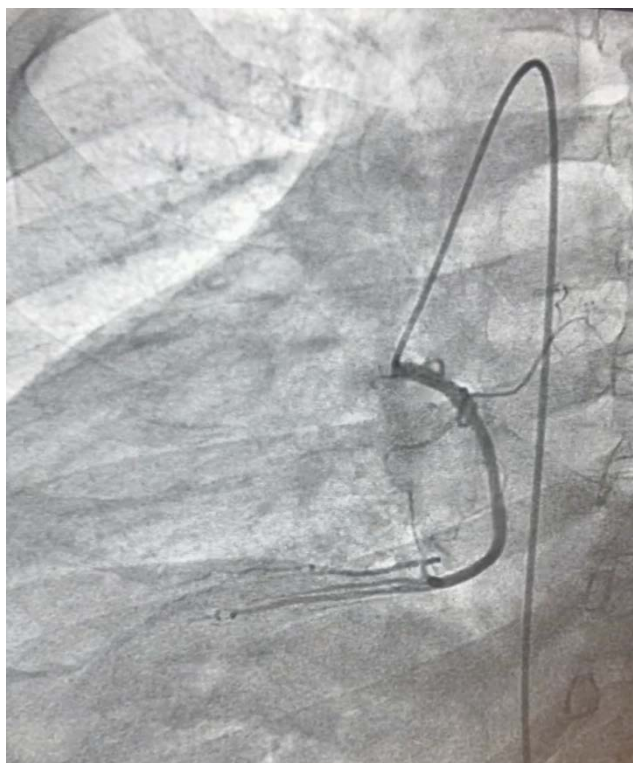


Figure 5. Right coronary engagement with Amplatz Right catheter

Selective RCA angiography in situs inversus obtained in LAO 25° / Caudal 5° projection using an Amplatz Right 1 catheter, demonstrating a normal, unobstructed right coronary artery.

The patient remained stable throughout the procedure and was transferred to the coronary care unit. Right-sided ECGs showed progressive resolution of ST-segment

elevation, and cardiac biomarkers peaked at levels consistent with an anterior myocardial infarction. The recovery was uneventful, and he was discharged 48 hours later under optimal medical therapy with scheduled follow-up.

3. Discussion

Dextrocardia with situs inversus presents several diagnostic and procedural challenges in the setting of acute coronary syndrome, and these continue to be highlighted in recent interventional literature. The first source of diagnostic error often lies in electrocardiographic interpretation. When precordial leads are placed on the left hemithorax, the reversed cardiac orientation produces non-physiological patterns that may obscure true ischemic changes. An additional pitfall is confusing true dextrocardia with inadvertent limb-lead reversal; although both may produce a negative QRS in lead I and a positive aVR, the absence of normal R-wave progression in the precordial leads strongly favors dextrocardia. Recognizing this distinction is essential, as considering the tracing an artefact may delay necessary right-sided ECG acquisition. Recent publications underline that recognition of the characteristic limb-lead pattern—particularly a negative QRS in lead I and a positive aVR—should prompt immediate repositioning of the precordial leads to the right side to avoid missing ST-segment elevation [4]. In our case, anterior ischemia became apparent only after right-sided lead placement, underscoring the continued importance of this adjustment in modern emergency practice.

From an interventional standpoint, coronary angiography in situs inversus requires operators to invert their usual anatomical references mentally. The mirrored orientation of the coronary ostia frequently limits the effectiveness of standard Judkins catheters. Contemporary series have reported that Amplatz-type catheters provide more consistent coaxial alignment and superior backup support for both left and right coronary engagement in mirrored anatomy [4]. A practical heuristic suggested in recent reports is to anticipate the inverted take-off angles and favor early use of AL catheters for the left system and AR catheters for the right system, as these shapes more naturally align with the mirrored coronary origins. Our experience mirrors these findings, as the AL1 and AR1 catheters allowed stable cannulation where Judkins catheters repeatedly failed.

Fluoroscopic interpretation must also be adapted. Conventional projections used for levocardia do not accurately represent vessel geometry when the heart is positioned as a mirror image. Recent case reports demonstrate that employing “mirror-opposite” fluoroscopic views restores familiar spatial relationships and facilitates accurate evaluation of lesion morphology, bifurcation anatomy, and stent positioning [5,6]. A simple mapping can guide operators during image acquisition:

- ⇒ *Standard LAO cranial* → *Mirror RAO cranial*
- ⇒ *Standard RAO caudal* → *Mirror LAO caudal*
- ⇒ *Standard LAO caudal* → *Mirror RAO caudal*

Using this predictable inversion facilitates reconstruction of usual angiographic anatomy in the

catheterization laboratory. In our patient, reversing LAO and RAO angles was essential to delineate the proximal LAD occlusion and ensure precise stent deployment.

Guidewire manipulation represents an additional layer of complexity. Because vessel curvature is reversed, torque response becomes counterintuitive, risking subintimal passage if not controlled. Recent procedural reports emphasize slow, deliberate manipulation with adequate catheter support to maintain wire stability in mirrored anatomy [7]. Our experience was consistent with these observations, as gradual torque adjustment and catheter reinforcement were required to navigate the LAD safely.

Collectively, recent literature confirms that primary PCI in dextrocardia is feasible and safe when clinicians anticipate the diagnostic pitfalls and apply methodical procedural adaptations. However, available evidence remains limited to isolated case reports and small observational series. The development of pooled registries or multicenter datasets could help refine best practices and standardize procedural strategies for clinicians confronted with mirror-image coronary anatomy. In routine practice, a concise checklist may be useful when dextrocardia is suspected: (1) verify limb-lead pattern and repeat ECG with right-sided precordial leads; (2) anticipate mirrored coronary take-offs; (3) consider early use of Amplatz-type catheters; (4) apply mirror-opposite fluoroscopic projections; and (5) advance guidewires cautiously with reinforced catheter support. Our case contributes further evidence that timely reperfusion can be achieved even in emergency settings when ECG interpretation, catheter selection, fluoroscopic views, and wiring strategy are systematically adjusted to account for mirror-image anatomy.

4. Conclusion

This case highlights three essential points for clinicians confronted with acute coronary syndrome in dextrocardia. First, recognizing the condition promptly avoids diagnostic delay, particularly when standard ECG patterns appear discordant with symptoms. Second, coronary angiography can be performed safely and efficiently when operators anticipate the mirror-image anatomy and select catheters accordingly. Finally, adapting fluoroscopic views and guidewire handling allows precise lesion assessment and successful stent deployment. These key considerations enable timely reperfusion and favorable outcomes even in the setting of reversed cardiac anatomy.

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Competing Interests

The authors declare that they have no competing interests.

List of Abbreviations

ACS – Acute coronary syndrome
ECG – Electrocardiogram
PCI – Percutaneous coronary intervention
LAD – Left anterior descending artery
RCA – Right coronary artery
STEMI – ST-segment elevation myocardial infarction
TIMI – Thrombolysis in Myocardial Infarction

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