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CASE REPORT

Transradial Approach to Coronary Angiography and Percutaneous Intervention in Patients with Dextrocardia with Situs Inversus.

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Abstract

Background: Patients with dextrocardia pose unique challenges in coronary angiography and percutaneous intervention due to variations in coronary artery anatomy. Accessing and manipulating coronary arteries in these patients require careful consideration due to their mirror-image anatomy. Radial artery access has emerged as a potential solution, but its efficacy and feasibility in dextrocardia patients need further exploration.

Case Presentation: We present a case of a patient with dextrocardia and situs inversus who underwent coronary angiography and percutaneous intervention. The patient's anomalous coronary artery anatomy posed challenges in accessing and engaging the target vessel using conventional techniques. Radial artery access was chosen, and an AR catheter (Amplatz right) was utilized to navigate the anomalous right coronary artery. Additionally, mirror-image fluoroscopy techniques were employed to facilitate catheter manipulation.

Management & Results: Proper preparation and utilization of radial artery access enabled successful diagnostic and therapeutic coronary interventions in the patient with dextrocardia. The AR catheter proved to be instrumental in accessing the anomalous coronary anatomy, overcoming the technical difficulties associated with conventional catheters. Mirror-image fluoroscopy provided valuable guidance during catheter manipulation, enhancing procedural success.

Conclusion: The transradial approach represents a viable option for coronary angiography and percutaneous intervention in patients with dextrocardia. Careful consideration of coronary anatomy variations, along with appropriate catheter selection and imaging techniques, can facilitate successful procedures in this unique patient population. Further studies are warranted to validate the efficacy and safety of this approach in a larger cohort of dextrocardia patients.

Keywords

NSTEMI, Situs inversus, Coronary angiography, Transradial approach, Image acquisition

Introduction

Coronary artery disease (CAD) is a prevalent condition worldwide, affecting millions of individuals annually. Among the diverse spectrum of patients, those with dextrocardia (DC), a rare congenital disorder characterized by the heart being located on the right side of the chest, present unique challenges in the management of coronary artery disease. Despite the rarity of dextrocardia, estimated to affect 1 in ten thousand newborns, the prevalence of coronary atherosclerosis among these individuals is comparable to that of the general population. Therefore, understanding the intricacies of coronary angiography and percutaneous intervention in patients with dextrocardia is imperative for effective management.

The structural variance inherent in dextrocardia poses significant challenges during invasive procedures such as coronary angiography. In traditional coronary angiography, accessing and engaging the coronary ostia may be hindered due to the altered cardiac anatomy. This necessitates careful consideration of alternative approaches, including interventional techniques, to overcome these obstacles and ensure successful procedures.

The history of invasive coronary angiography (ICA) dates back to 1962 when Ricketts and Abrams performed the first procedure using the transfemoral technique. However, documentation of dextrocardia in the context of coronary angiography didn't emerge until nearly a decade later. It wasn't until 1973 that the challenges specific to dextrocardia were recognized within the realm of invasive coronary angiography.

The advent of percutaneous coronary intervention (PCI) brought about significant advancements in the field of interventional cardiology. In 1989, Campeau reported his experience with the percutaneous approach to invasive coronary angiography, utilizing the radial coronary artery. This technique offered potential benefits such as reduced vascular complications and improved patient comfort compared to traditional femoral access.

Despite the promising aspects of the transradial technique, its application in patients with dextrocardia remained relatively unexplored until recent years. It wasn't until eighteen years after Campeau's initial demonstration that the transradial approach was first showcased in a patient with dextrocardia. This milestone underscored the importance of adapting interventional techniques to accommodate the unique anatomical challenges presented by dextrocardia.

Case Presentation

Mr. X, a 70-year-old male with a medical history significant for diabetes mellitus, hypertension, dyslipidemia, and smoking, presented to the emergency room with chest pain lasting several hours. Despite recently experiencing a cerebrovascular accident, he remained hemodynamically stable upon arrival. The electrocardiogram (ECG) revealed reversed normal R wave progression in precordial leads and limb lead reversal, accompanied by dynamic ST changes in precordial leads. Mild troponin leakage was observed during the initial workup, and the patient's symptoms resolved following ischemic treatment. Subsequently, he was transferred to the Coronary Care Unit (CCU) for further evaluation and management.

Diagnostic Assessment

Given the clinical presentation and diagnostic findings, the decision was made to proceed with invasive coronary angiography (ICA) to assess the coronary artery anatomy and potential lesions. The procedure was performed via a right trans-radial approach. The JL4 5F catheter was successfully advanced through the aorta, oriented towards the right side of the spine, and used to cannulate the left coronary artery (LCA) with ease in the anteroposterior (AP) view. The subsequent left angiogram revealed a critical lesion in the proximal left anterior descending artery (LAD) and an 80% lesion in the proximal left circumflex artery (LCX).

To enhance visualization and comprehension of the coronary anatomy, mirror image techniques were employed with the assistance of a technologist. Specifically, the left anterior oblique (LAO) cranial view was mirrored to a right anterior oblique (RAO) cranial view to facilitate understanding of the LAD lesion. Spider view images were acquired in the original RAO caudal projection and mirrored to left anterior oblique (LAO) caudal to assess the distal left main and ostial configuration of the LAD and LCX.

Efforts to selectively engage the right coronary artery (RCA) in the RAO view were unsuccessful due to its anomalous origin. Despite attempts with various catheters, including AL 0.75 and AL 0.15 5F, the RCA could not be engaged selectively. Aortography with a pigtail catheter through a programmed injector revealed a non-obstructive RCA with minimal irregularities.

Therapeutic Intervention

Following discussion with the patient and his family, a decision was made to proceed with two-vessel angioplasty. The patient consented, and the procedure was performed via left radial access. A 6F Judkin Left 4.0 guide catheter was used to engage the left coronary artery in the AP projection. Predilation of the LAD lesion was performed with a 2.5x20mm balloon at 16 atmospheres, followed by implantation of two drug-eluting stents (2.5x30mm and 3.5x18mm) at nominal pressure. Postdilation was carried out with a noncompliant balloon (3.5x15mm) at 22 atmospheres, achieving successful revascularization with TIMI-III flow.

Subsequently, the same guide catheter wire was navigated into the LCX, and direct stenting with a drug-eluting stent (3.0x18mm) at nominal pressure was performed without complications.

Selective engagement of the RCA was achieved successfully with an AR diagnostic catheter in the RAO view with counter-clockwise rotation movement. Selective angiography of the RCA revealed no significant disease.

Throughout the coronary angiography and percutaneous coronary intervention (PCI) procedures, adjustments were made for picture acquisition to accommodate the unique anatomical considerations. Despite challenges posed by the patient's dextrocardia, successful visualization and treatment of coronary lesions were achieved (Figure 3).

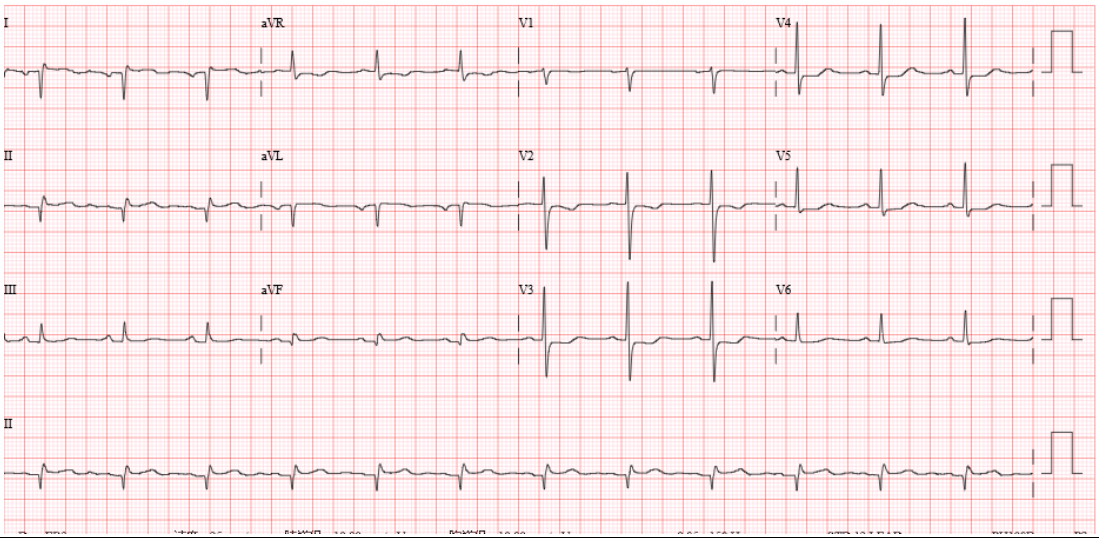

Figure 1: Sinus rhythm with marked extreme axis deviation with ST depression in V2-V5 leads.

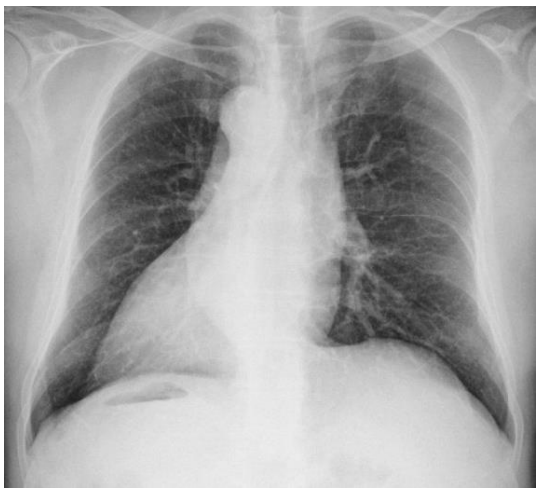

Figure 2: Cardiac apex is pointing to the right and the aortic arch and stomach bubble located on the right

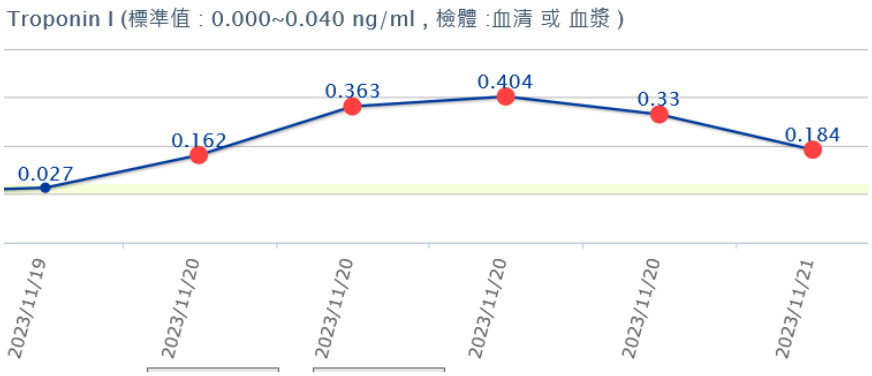

Figure 3: Troponin levels are showing typical rise and fall pattern indicating ischemic pattern.

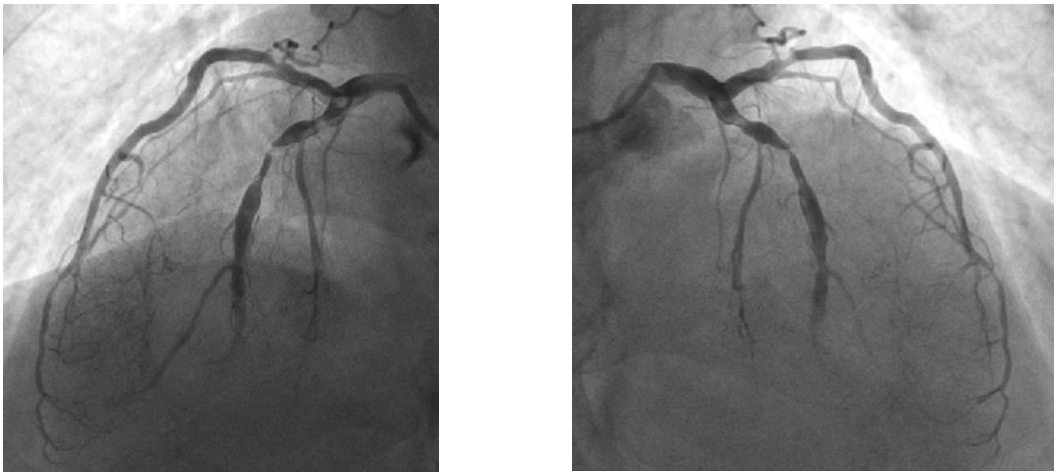

Figure 4A: (Original LAO cranial projection showing JL 4 5F showing LAD critical lesion actual image with mirror image into RAO- cranial projection)

Figure 4B: (Original RAO-caudal projection LCX severe lesion with actual and mirror image view into LAO-caudal mirror)

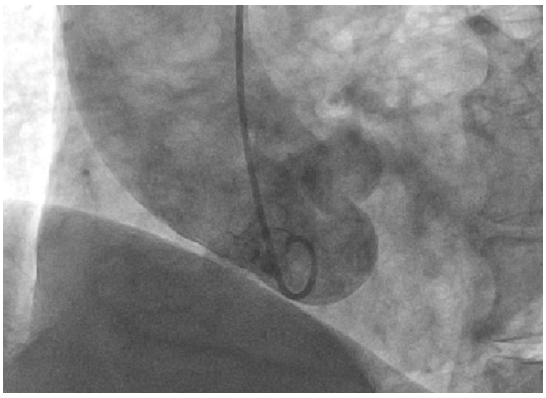

Figure 4C: (aortogram showing RCA in mirror image view of LAO projection but actual image was formed of RAO projection)

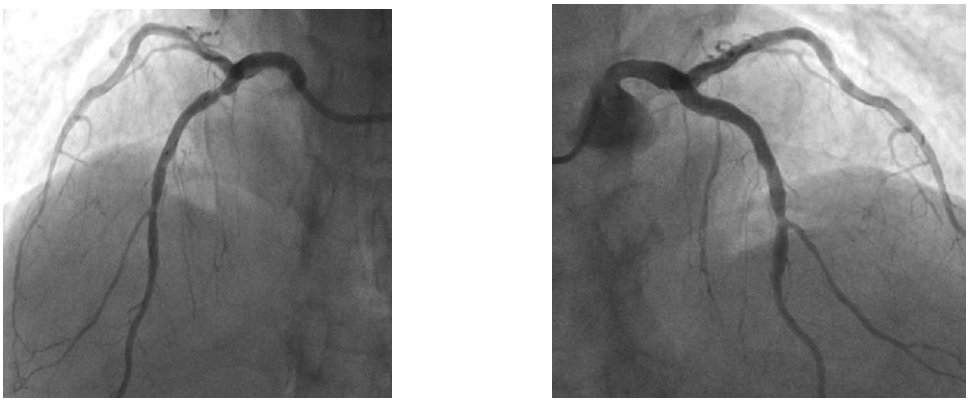

Figure 5 A-B: (Actual LAO cranial projection converted into mirror image of RAO cranial showing successful angioplasty of Left anterior descending artery)

Figure 5C: (Mirror image of actual image of RAO-caudal projection showing successful angioplasty of LCX)

Figure 5D: (Actual image of LAO-cranial projection showing successful angioplasty Final image)

Figure 5E: (Actual image of RCA angiogram RAO view)

Figure 5F: (LAO mirror image of RCA but actual view was RAO plane view)

Follow-up and Outcomes

The results of the case revealed characteristic features of dextrocardia with situs inversus on chest X-ray, confirming the left ventricular apex on the right side and gas shadowing on the right side. Coronary angiography via a right trans-radial approach demonstrated critical lesions in the proximal left anterior descending artery (LAD) and an 80% lesion in the proximal left circumflex artery (LCX). Utilization of mirror image techniques enhanced visualization and comprehension of the coronary anatomy, aiding in accurate lesion assessment. Despite attempts, selective engagement of the right coronary artery (RCA) in the RAO view was unsuccessful, though aortography revealed a non-obstructive RCA with minimal irregularities. Subsequent two-vessel angioplasty via left radial access resulted in successful predilation and stent implantation in the LAD and LCX, achieving optimal revascularization with TIMI-III flow. Direct stenting of the LCX and selective angiography of the RCA showed no significant disease.

Regarding outcomes, the successful completion of two-vessel angioplasty led to optimal revascularization and restoration of coronary flow without complications. Despite the challenges posed by the patient's dextrocardia, meticulous adjustments for picture acquisition during coronary angiography and percutaneous coronary intervention facilitated successful visualization and treatment of coronary lesions. The patient was subsequently transferred back to the Coronary Care Unit for post-procedural care and ongoing management, ensuring continued monitoring and optimization of his cardiovascular health.

Discussion

The co-occurrence of non-ST-elevation myocardial infarction (NSTEMI) with situs inversus dextrocardia represents a clinical rarity, underscoring the importance of thorough investigation and management in such cases. A comprehensive review of literature, including searches through databases like PubMed, reveals limited documented instances, emphasizing the scarcity of this clinical presentation and the necessity for meticulous clinical evaluation.

Distinguishing NSTEMI in the context of situs inversus dextrocardia demands heightened vigilance, particularly in interpreting diagnostic tests such as the electrocardiogram (ECG). Failure to promptly recognize the presence of dextrocardia can lead to misinterpretation of ECG findings, potentially resulting in delayed or incorrect diagnosis. In our case, characteristic radiographic features, including reversed broncho situs and a right-sided cardiac profile, were instrumental in confirming the diagnosis alongside clinical findings.

Conducting invasive coronary procedures, including coronary angiography (CA) and percutaneous coronary intervention (PCI), in patients with situs inversus dextrocardia presents

distinct challenges for healthcare providers. While the transfemoral approach has traditionally been favored due to familiarity and ease of access, our case opted for a transradial approach, reflecting the adaptability and evolving techniques in interventional cardiology. Previous reports have highlighted difficulties in catheter engagement, with conventional catheters often proving ineffective in accessing the anomalous coronary anatomy. This necessitates careful consideration of alternative catheters and approaches, such as the utilization of the Judkins Left 4 catheter in our case.

Innovative imaging modalities and techniques play a crucial role in overcoming technical challenges encountered during coronary interventions in patients with situs inversus dextrocardia. The "horizontal sweeping reversal" method, pioneered by Goel PK, offers a promising strategy for optimizing image acquisition and analysis. By employing a double-inversion method, this technique facilitates clearer visualization of coronary anatomy, aiding operators in navigating the mirror-image anatomy encountered in situs inversus dextrocardia.

Conclusion

the management of NSTEMI in conjunction with situs inversus dextrocardia necessitates a multidisciplinary approach and careful consideration of patient-specific factors. Challenges pertaining to arterial access, catheter selection, torque maneuvers, and image interpretation underscore the importance of expertise and innovation in interventional cardiology. Continued research and collaboration among clinicians are essential for refining strategies and optimizing outcomes in this unique patient population.

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