Cardiology Research and Cardiovascular Medicine
Hassan M, et al. Cardiolog Res Cardiovasc Med 8: 246.
www.doi.org/10.29011/2575-7083.100246
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Mini Review

Reviewing Successful Dual LAD Disease Intervention: A Radiological Diagnostic Approach and Literature Overview

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Citation: Hassan M, Hassan M, Zarak MS, Qadeer HT, Rana IA (2024) Reviewing Successful Dual LAD Disease Intervention: A Radiological Diagnostic Approach and Literature Overview. Cardiol Res Cardio vasc Med 9:246. DOI:https://doi.org/10.29011/2575-7083.100246

Received Date: 02 May, 2024; **Accepted Date:** 08 May, 2024; **Published Date:** 10 May, 2024

Abstract

We present the case of a 72-year-old female with acute chest pain and signs of myocardial ischemia. Cardiac catheterization revealed a bifid left anterior descending (LAD) artery, which was successfully treated with percutaneous intervention (PCI). The procedure involved crossing the lesion using Sion Black wire, followed by balloon dilatation and stent placement. Intravascular ultrasound confirmed adequate stent apposition. Post-dilation of the proximal stent edge was performed, resulting in excellent angiographic outcomes. The patient was discharged on dual antiplatelet therapy and guideline-directed medical therapy. This case highlights the successful management of a complex bifid LAD lesion using PCI.

History of Presentation

72 years old female who was a chronic smoker presents with complaints of chest pain 12 hours ago. The pain was centrally located, pressure like, constant in nature and radiating towards her back. The was some associated nausea and diaphoresis. Patient denies having such pain in the past. Vitals signs were within normal limits and the physical exam was unremarkable. Lab work was obtained that was significant for elevation of cardiac enzymes with ECG (Electrocardiogram) showing T -waves changes as shown concerning for ischemia (as shown in Figure 1). Patient was started on ACS protocol and planned for cardiac catheterization. As a part of work up Computed Tomography CT scan of Chest and Abdomen was also obtained that ruled out any aortic dissection or aneurysm. Patient underwent successful cardiac catheterization with Percutaneous Intervention PCI of her dual Left Anterior Descending (LAD) artery with 2.75x12 mm DES (Drug Eluting Stent) with post dilation to 3.0. The patient was closely monitored after the procedure and was later discharged on Dual Antiplatelet Therapy (DAPT) along with Statins, Beta Blocker and guideline directed therapy for heart failure with outpatient Cardiology follow up.

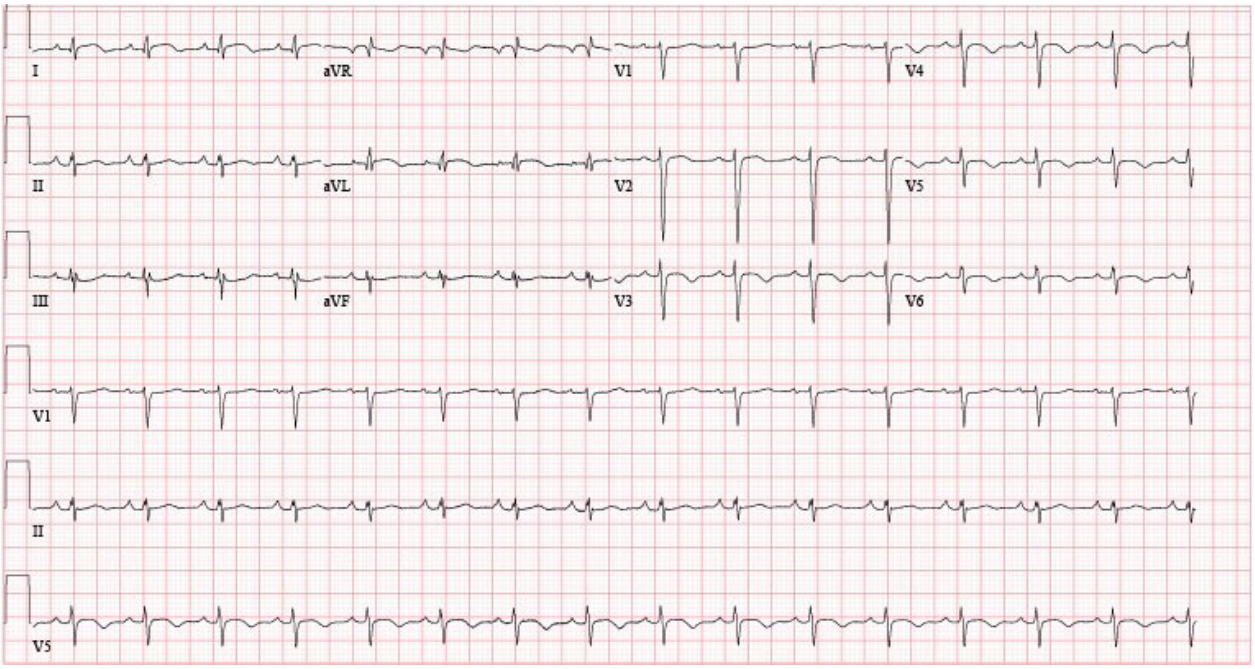
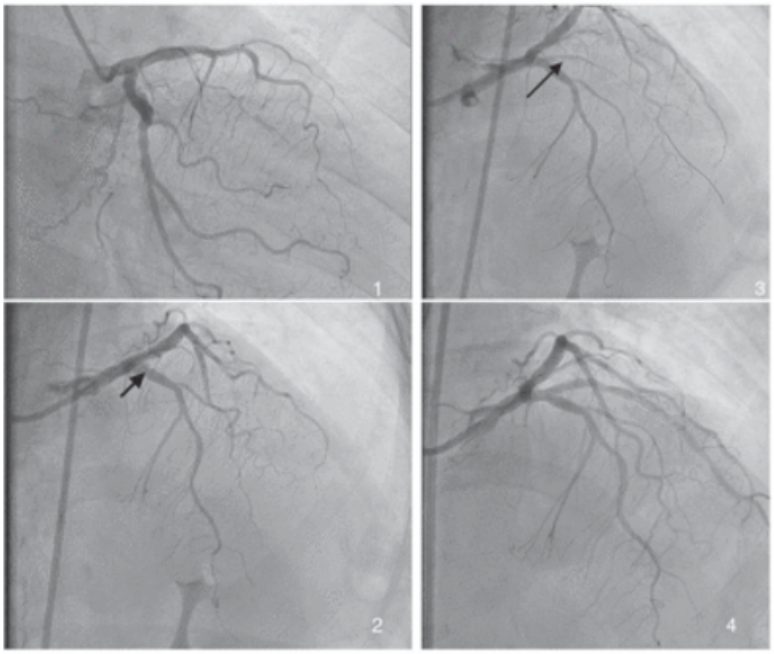


Figure 1: EKG showing T waves Inversions prominent in Anterolateral Lateral Leads

Management

The right femoral access site was prepared for cardiac catheterization. TIG (Tiger) catheter was used to engage left and right coronary arteries. Left and right coronary angiography was then performed in multiple views by injections of non-ionic contrast. Next JR 4 (Judkin R) catheter was exchanged for 6.0 Fr (French) guide catheter in preparation of intervention of the bifid LAD stump.

Next, using 6F EBU (Extra Back-up) guide catheter left main was engaged. After appropriate anticoagulation with heparin. Initial attempt to cross the lesion with Sion Blue was unsuccessful. Next Sion black was used to cross the lesion and was advanced into the distal vessel. A corsair microcatheter was used to exchange Sion black wire with Sion blue wire. Balloon dilatation was performed using 2.0 x 8 mm compliant balloon. A 2.75 x 12 mm stent was advanced into the vessel. The position of the stent was confirmed under fluoroscopic guidance and deployed. IVUS (Intra Vascular Ultrasound) catheter was advanced and automated pull back was performed that demonstrated well apposed stent in the distal segment and mild under expansion of the proximal stent. A 3.0 x 8 mm NC (Non-compliant) balloon was used to post dilate the proximal edge of the stent. A final cine was performed with excellent angiographic results post intervention with TIMI III (Thrombolysis in Myocardial Infarction) flow.



1)Angiogram demonstrated angiographically patent coronaries on conventional fluoroscopic view. 2) Step AP cranial view (AP44) showing a stop in the proximal LAD (Black arrow). 3) The stump was wired with Sion Black wire (Black arrow showing the wire). 4) Post PCI and ballooning showing a large second branch of the Bifid LAD system.

Discussion

Accurate diagnosis of dual LAD anomalies relies on advanced imaging techniques such as coronary angiography and computed tomography angiography (CTA) [1]. These modalities enable the identification and classification of the anomalies based on the proposed diagnostic criteria and novel classification systems [2]. The utilization of these diagnostic tools aids in the comprehensive assessment of the coronary anatomy and assists in making informed decisions regarding appropriate therapeutic interventions [3,4].

Treatment strategies for dual LAD anomalies are tailored to individual patients, considering factors such as the extent of coronary involvement, associated comorbidities, and clinical presentations [5, 6]. In cases of myocardial ischemia or significant stenosis, percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG) may be considered [7]. The choice of intervention requires careful evaluation, taking into account the anatomical characteristics and potential risks associated with each procedure [8].

While the literature on dual LAD anomalies is growing, there is still a need for further research and collaboration among clinicians, radiologists, and interventionists to enhance our understanding of these complex anatomical variations. This collaboration will contribute to refining diagnostic criteria, developing standardized management approaches, and improving patient outcomes [9].

Different Types of Dual LAD

Type IV Dual LAD: This is one of the most frequently encountered variants. It involves the long LAD arising from the right sinus of Valsalva, running in its usual course. The short LAD arises from the left sinus of Valsalva or the left main coronary artery. This type can present challenges during diagnostic procedures and interventions due to the complex anatomy [10].

Type VI Dual LAD: In this type, the long LAD originates from the left coronary artery, while the short LAD arises from the right coronary artery or its branches. This variation can lead to ischemic events and requires careful assessment to determine the appropriate treatment strategy.

Type XIII Dual LAD: This is a novel variant where both the long and short LADs arise separately from the left coronary artery, but they follow different courses. The long LAD takes its usual course, while the short LAD has an anomalous course. This type represents a unique anatomical variation and emphasizes the importance of thorough imaging evaluations for accurate diagnosis.

Type X Dual LAD: This variant involves two distinct LADs originating separately from the left coronary artery. The long LAD follows a normal course, while the short LAD takes a more proximal and higher course. This type may present challenges in diagnostic imaging and may require tailored treatment strategies.

Type V Dual LAD: In this type, the long LAD arises from the left coronary artery, and the short LAD arises from the right coronary artery. The short LAD usually supplies the inferior wall of the left ventricle. This variation can pose challenges during interventions due to the need for dual revascularization.

These are just a few examples of the various types of dual LAD anomalies reported in the literature. Each type has its unique anatomical characteristics and clinical implications. Accurate identification and classification of these anomalies are essential for appropriate management decisions and ensuring optimal patient outcomes [11].

It is important to note that the classification systems and terminology for dual LAD anomalies may vary across studies. As more cases are reported and further research is conducted, the understanding of these variations continues to evolve, leading to refinements in diagnostic criteria and classification systems [11].

Different Cardiac Angiography views while dealing with dual LAD

When performing an intervention, such as for dual LAD (Left Anterior Descending) coronary artery disease, different angle views during cardiac angiography can be beneficial. These views allow the interventional cardiologist to gain a comprehensive understanding of the coronary anatomy and plan the procedure accordingly [12].

Anterior-Posterior (AP) View: This is the standard frontal view where the X-ray beam passes from the front to the back of the patient. It provides a clear visualization of the main arteries, including the left and right coronary arteries. The AP view helps assess the overall flow pattern and identify any major obstructions. AP view provides an overview of the coronary anatomy and can identify the mid and distal LAD stenosis and access its impact on blood flow [13].

Right Anterior Oblique (RAO) View: In this view, the X-ray beam passes from the patient's right side to the left side at an oblique angle. RAO view is particularly useful for evaluating the left coronary artery system, including the dual LAD [14]. It allows the interventional cardiologist to visualize the course, branching, and any blockages in the LAD arteries.

Left Anterior Oblique (LAO) View: The LAO view is the opposite of the RAO view, with the X-ray beam passing from the patient's left side to the right side. It provides an alternative perspective to assess the coronary arteries, including the dual LAD. The LAO view can help identify specific blockages or stenoses that may not be clearly seen in other angles [15].

Cranial/Caudal View: These views involve tilting the X-ray beam in an upward (cranial) or downward (caudal) direction. These angles help to visualize the vessel origins and their relationship with other structures, such as the aorta. They can provide additional information about the dual LAD's location, severity of stenosis, and any adjacent anatomical variations.

Multiple Angles: Here, a combination of AP, RAO, and LAO views from various angles can be employed to assess the extent and severity of the disease along the entire length of the dual LAD system. The interventional cardiologist can use these views to determine the appropriate treatment strategy, considering the specific location and characteristics of the stenoses [16].

The approach to percutaneous coronary intervention (PCI) in a bifid left anterior descending artery (LAD) anomaly may differ from that in a scenario where the coronary vessels have a normal anatomy. The presence of a bifid LAD introduces anatomical complexities that require careful consideration during the PCI procedure [17].

Here are some key differences in the approach:

Anatomical Assessment: In bifid LAD anomalies, the anatomy of the coronary vessels, including the location, course, and branching pattern of the bifid segments, needs to be thoroughly evaluated. This assessment helps determine the best approach for lesion crossing, stent selection, and deployment [17].

Lesion Evaluation: The presence of a bifid LAD may involve two separate segments with their own lesion characteristics. Each segment should be individually evaluated for the severity and functional significance of any stenotic lesions. It is essential to assess the extent of disease and determine whether intervention is required in one or both bifid segments [18].

Guiding Catheter Selection: The choice of a guiding catheter becomes crucial in bifid LAD anomalies. Selecting a catheter that provides stable support and optimal engagement of both bifid branches is important for successful lesion crossing and stent delivery.

Wire Manipulation and Stenting: Navigation of the bifid LAD segments with guide wires requires careful manipulation to

ensure proper lesion crossing and stent delivery in each segment. The interventionalist must navigate each branch independently and choose appropriate stents based on the characteristics and dimensions of the lesions within each bifid segment [19].

Procedural Planning: The bifid LAD anatomy may require specific procedural planning, including the decision on whether to treat one or both segments, the order of intervention, and the selection of optimal access sites [19].

Adjunctive Imaging: The use of adjunctive imaging techniques such as intravascular ultrasound (IVUS) or optical coherence tomography (OCT) can provide valuable insights into the vessel morphology, lesion characteristics, and stent deployment in bifid LAD anomalies [19].

While there are differences in the approach, many fundamental principles of PCI remain the same, such as ensuring optimal lesion preparation, appropriate stent sizing, optimal stent deployment, and post-PCI assessment [20].

Follow up

The patient did not experience any major or minor post-intervention complications and was discharged home on dual antiplatelet therapy along with guideline recommended therapy for heart failure as tolerated. The patient was also scheduled for close outpatient follow up.

Conclusion

It is important to note that the approach to PCI in bifid LAD anomalies should be individualized, considering the patient's clinical presentation, lesion characteristics, anatomical complexity, operator expertise, and available resources. A multidisciplinary heart team discussion and collaboration among interventional cardiologists, imaging specialists, and cardiac surgeons may be valuable in planning and executing the procedure. Continued research efforts in this field will contribute to improved diagnostic accuracy, refined treatment strategies, and enhanced patient care.

Learning Objective/Highlights

To understand and better approach for complex dual LAD lesions using various angiographic imaging angles.

Disclosure: No financial or any other disclosure of any kind.

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