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RESEARCH ARTICLE

ROTATRIPSY-ASSISTED PCI OF A HEAVILY CALCIFIED MID LAD LESION IN A PATIENT WITH UNSTABLE ANGINA AND REDUCED EJECTION FRACTION

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Abstract

This case report highlights the successful use of rotatripsy—a hybrid approach combining rotational atherectomy and intravascular lithotripsy (IVL)—for the treatment of a severely calcified mid left anterior descending (LAD) artery lesion in a patient with unstable angina and reduced left ventricular ejection fraction (LVEF). The strategy enabled effective lesion preparation and stent delivery in a setting where traditional balloon angioplasty was likely to fail. This case emphasizes the growing role of advanced calcium modification techniques in complex coronary interventions, particularly in patients with unstable angina and compromised cardiac function.

Introduction:-

Heavily calcified coronary lesions present significant challenges in percutaneous coronary intervention (PCI), often leading to suboptimal stent expansion, stent malapposition, and poor long-term clinical outcomes. Mid LAD lesions, in particular, carry high prognostic relevance due to the large myocardial territory they supply and their association with major adverse cardiac events. In patients with both unstable angina and reduced LVEF, these challenges are compounded by the acute ischemic state and limited ability to tolerate complications from PCI. Rotatripsy—the combined use of rotational atherectomy (RA) and intravascular lithotripsy (IVL)—has emerged as an effective strategy for modifying complex calcific plaques that are resistant to conventional balloon-based techniques [1–4].

Case Presentation:

A 63-year-old male with hypertension, hyperlipidemia, a history of smoking, and reduced LVEF of 35% presented with crescendo angina over the preceding 48 hours. His condition was classified as unstable angina based on the evolving nature of his chest pain. Physical examination was unremarkable. The electrocardiogram (ECG) showed inverted T waves in leads V2–V6, II, III, and aVF, consistent with ischemia involving both anterior and inferior myocardial territories. Serial troponin assays were negative, indicating the absence of myocardial necrosis despite clinical and ECG signs of ischemia.

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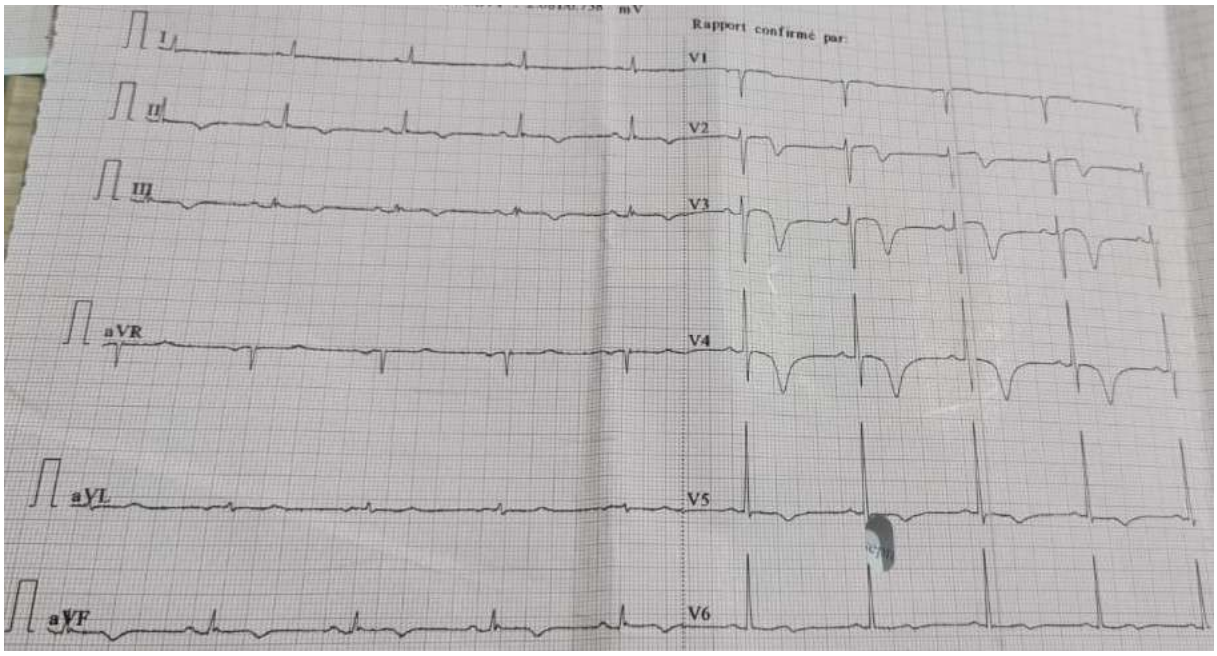

Figure 1 : Baseline ECG showing T wave inversions in leads V2–V6, II, III, and aVF, consistent with anterior and inferior ischemia.

Initial transthoracic echocardiography (TTE) revealed severely reduced left ventricular systolic function with an ejection fraction (LVEF) of 35%, along with regional wall motion abnormalities characterized by akinesis of the mid to apical anterior and inferior walls. Coronary angiography revealed a heavily calcified occlusion in the mid LAD, a normal left circumflex artery (LCX), and a 100% occlusion of the proximal right coronary artery (RCA) with a heavily calcified chronic total occlusion (CTO) segment. The distal RCA was filled retrogradely via collateral circulation from the left coronary system (Figure 3).

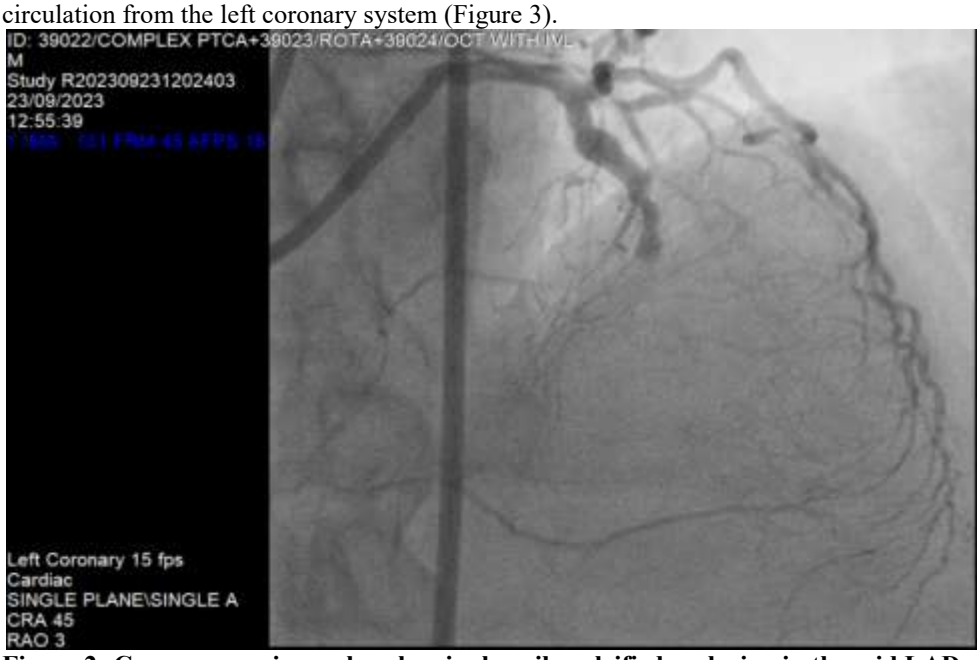

Figure 2: Coronary angiography showingheavily calcified occlusion in the mid LAD

Procedure:

The procedure was performed via right radial artery access using a 7F guiding catheter. Given the lesion's morphology and the severity of calcification, a rotatripsy approach was selected. The lesion was first crossed with a workhorse wire (BMW Universal II), which was then exchanged for a RotaWire floppy through a microcatheter. Rotational atherectomy was carried out using a 1.5 mm burr at a rotational speed of 160,000 rpm, with multiple short runs (<20 seconds) to modify superficial calcific plaque (Figure 3). Care was taken to minimize decelerations and maintain adequate burr advancement. Optical Coherence Tomography (OCT) confirmed residual circumferential calcium.

FIGURE 3: Rotational atherectomy with 1.5 mm burr in progress.

Following atherectomy, IVL was performed using a 3.0 x 12 mm Shockwave balloon delivering 80 pulses at 4 ATM. A 3.5 × 18 mm drug-eluting stent (DES) was deployed and post-dilated with a non-compliant balloon. Final angiography showed excellent stent expansion and TIMI 3 flow.

After atherectomy, Optical Coherence Tomography (OCT) was performed, confirming persistent deep, concentric calcification with >270° arc and >0.5 mm thickness, justifying further plaque modification. A Shockwave IVL balloon (3.0 × 12 mm) was then advanced over the same wire. IVL therapy was delivered with 80 pulses at 4 atm, resulting in visible disruption of deep calcium arcs on repeat OCT imaging, confirming adequate lesion compliance. A 3.5 × 18 mm drug-eluting stent (DES) was deployed across the lesion at 12 atm, followed by high-pressure post-dilation with a non-compliant balloon (3.75 × 15 mm at 20 atm). Final OCT demonstrated excellent stent expansion and apposition, and angiography confirmed restoration of TIMI 3 flow with no residual stenosis or dissection (Figures 4 and 5).

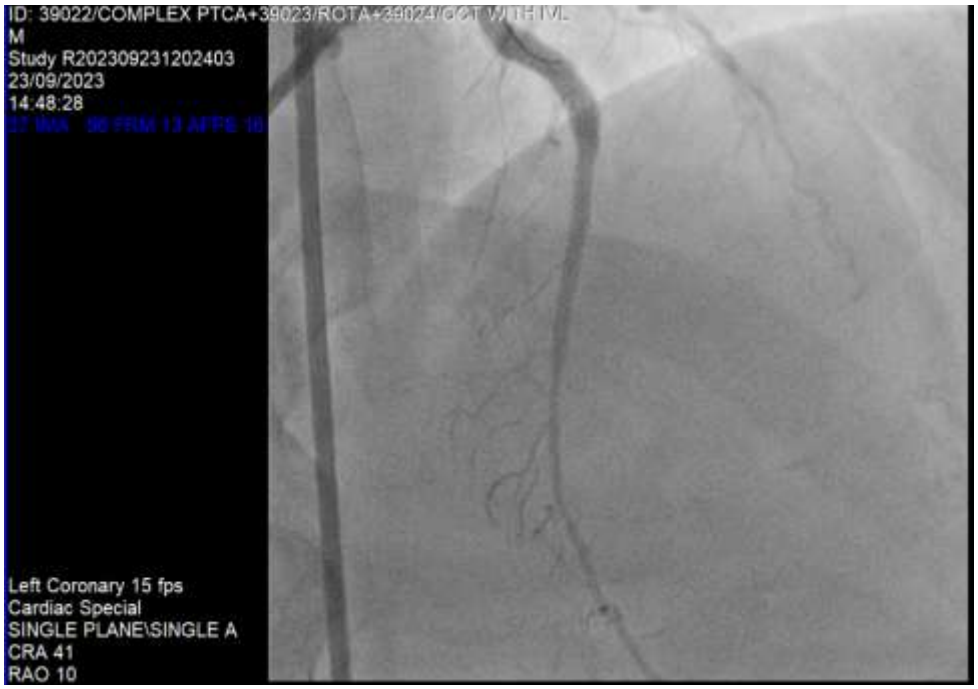

FIGURE 4: Final angiogram post-stenting showing excellent expansion and TIMI 3 flow (cranial view)

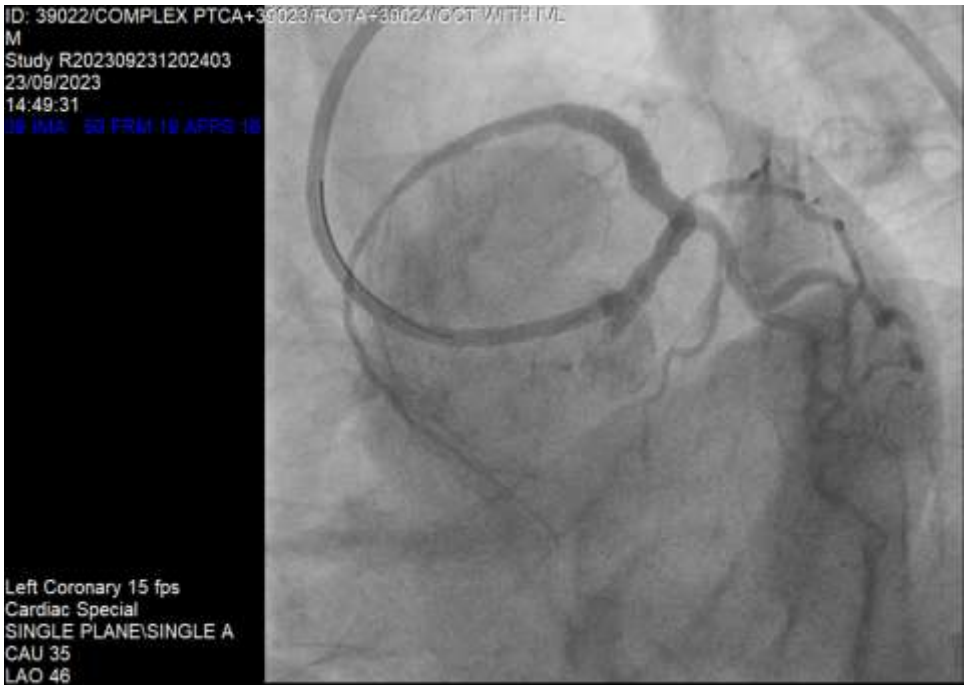

FIGURE 5 : Final angiogram post-stenting showing excellent expansion and TIMI 3 flow (spider view)

Discussion:

Heavily calcified coronary lesions pose a formidable challenge during PCI due to their rigidity, resistance to balloon expansion, and predisposition to complications such as dissection, underexpansion, stent malapposition, and restenosis. These challenges are especially critical when the lesion is located in the mid LAD, a region that supplies a large portion of the left ventricular myocardium and is closely associated with patient prognosis. In patients with reduced LVEF and unstable angina, these concerns are further exacerbated by the acute ischemic

state and limited cardiac reserve.

In this case, the decision to use rotatripsy—the combination of rotational atherectomy (RA) followed by intravascular lithotripsy (IVL)—was driven by angiographic and intravascular imaging findings indicating deep, circumferential, and nodular calcium. While RA alone is effective at modifying superficial calcium, it often fails to impact deeper layers. IVL, on the other hand, targets deep calcium by generating sonic pressure waves that fracture the calcium, improving lesion compliance. Combining both techniques, rotatripsy leverages the strengths of each modality, resulting in superior lesion preparation [2, 3, 4, 6].

Rotational atherectomy initially debulked the lesion and facilitated the use of adjunctive devices, such as the Shockwave IVL balloon. After RA, OCT confirmed that significant calcium remained, prompting the use of IVL to further modify the lesion. The IVL pulses achieved visible calcium fracture, allowing for successful stent delivery and full expansion, as confirmed by angiography and optimal TIMI 3 flow.

Several studies and case series have demonstrated the safety and efficacy of combining RA with IVL. This approach has shown promising outcomes in complex coronary anatomies, including left main bifurcations and long, diffuse calcified segments [3, 4, 7]. While prospective randomized trials are still limited, the technique is increasingly adopted in high-volume centers as part of a tailored strategy for complex calcium modification. The use of intracoronary imaging (e.g., IVUS or OCT) is crucial for optimal planning, execution, and assessment of results.

It is important to recognize that rotatripsy may increase procedural time and cost and should be reserved for lesions where standalone atherectomy or IVL may fail. Patient selection, lesion morphology, and institutional expertise must be considered when choosing this strategy. Nonetheless, in selected patients—particularly those with unstable angina or reduced LVEF—rotatripsy offers a viable, less invasive, and effective solution.

This case demonstrates how a strategic, multimodal approach can achieve optimal results in technically challenging cases, especially in patients with unstable angina and reduced LVEF. By using rotatripsy, we avoided surgical referral and enabled full lesion expansion, which is critical for long-term patency and clinical success.

Conclusion:

Rotatripsy provides a powerful and effective strategy for the treatment of heavily calcified coronary lesions, particularly in the proximal or mid LAD. This case exemplifies its role in enabling safe and successful PCI in anatomically and technically challenging settings, particularly in patients with both unstable angina and reduced ejection fraction.

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8. **Keys words :**Percutaneous coronary intervention (PCI), Rotatripsy, Rotational atherectomy (RA), Intravascular lithotripsy (IVL), Optical coherence tomography (OCT)