CATHALOGUE

OPEN ACCESS

CASE REPORT

Outcomes of Percutaneous Coronary Intervention in Heavily Calcified Left Anterior Descending Artery using Rotational Atherectomy

Waseem Ashraf & Waqas Jamil
Ch. Pervaiz Elahi Institute of Cardiology, Wazirabad-Pakistan.

Citation:
Ashraf W, Jamil W. Outcomes of Percutaneous Coronary Intervention in Heavily Calcified Left Anterior Descending Artery using Rotational Atherectomy. Cathalogue. 2023; 1(1): 19-24

Corresponding Author Email:
asiamdc@gmail.com

Funding:
The author(s) received no specific funding for this work.

Conflicts of Interests:
The authors have declared that no competing interests exist.

Received 08/07/2023
Accepted 14/08/2023
First Published 05/09/2023

Abstract

Introduction: Left anterior descending artery (LAD) stenosis presents grave risks including myocardial infarction, heart failure, and mortality. While coronary artery bypass grafting is a preferred option, some cases require percutaneous coronary intervention (PCI) due to contraindications for surgery. In situations where heavily calcified LAD vessels complicate revascularization, rotational atherectomy (RA) emerges as an advanced technique. This case study explores the successful application of PCI with RA in managing LAD-related reversible ischemia, highlighting patient selection and intravascular ultrasound (IVUS) guidance.

Case Presentation: A female patient exhibited reversible LAD ischemia, carrying high risks of adverse cardiac events. Unsuitable for surgical intervention, PCI with RA was considered. Intravascular ultrasound confirmed severe calcification, guiding procedural planning. Under guidance, RA effectively addressed the calcified plaque, followed by stent placement to restore blood flow. IVUS post-stenting confirmed optimal stent expansion and apposition.

Results: Utilizing RA in PCI achieved successful revascularization of the heavily calcified LAD. IVUS played a crucial role, ensuring precise lesion assessment, plaque modification, and stent optimization. Post-PCI, the patient experienced symptom relief and enhanced myocardial perfusion. Follow-up revealed sustained improvements in symptoms and cardiac function, reinforcing the efficacy of this approach.

Conclusion: In cases unsuitable for surgical revascularization, PCI with rotational atherectomy proves valuable for treating heavily calcified LAD lesions. This study emphasizes thorough patient evaluation, precise lesion assessment via IVUS, and careful procedural planning. The successful outcome underscores RA-assisted PCI's potential to improve patient well-being and address LAD stenosis-induced ischemic risks, advocating its integration for challenging LAD cases.

Keywords

Percutaneous Coronary Intervention, Heavily Calcified, Left Anterior Descending Artery, Rotational Atherectomy, Intravascular Ultrasound.

Published by Pakistan Society of Interventional Cardiology

Introduction

Calcified lesions within coronary arteries present interventional cardiologists with the challenge of selecting appropriate revascularization strategies. In cases of a single calcified vessel with favourable anatomy but substantial calcium burden, traditional percutaneous coronary intervention (PCI) may prove ineffective, necessitating the utilization of rotablation with atherectomy as a viable approach. It's important to note that vessels with thrombus or acute dissection are contraindications for atherectomy. The presence of calcium deposits often serves as a precursor to and indicator of adverse cardiovascular events, with implications of inflammation, scarring, or potential thrombus formation[1].

Furthermore, coronary stenoses marked by circumferential or significant vessel calcification exhibit a rigid nature that often resists dilation through conventional balloon angioplasty. In such cases, achieving optimal stent dilation and maximal vessel wall apposition becomes challenging[2]. The deployment of stents within heavily calcified vessels, without prior atherectomy, can lead to complications such as thrombosis, restenosis, and even stent fracture[3]. This case serves to emphasize the key steps involved in rotational atherectomy in a patient with a calcified proximal LAD, where PCI was performed instead of considering the case for coronary artery bypass grafting.

Case Presentation

A 65-year-old female patient, diagnosed with diabetes and hypertension and hailing from a lower socioeconomic background, had been taking anti-ischemic medication for a couple of months. She developed exertional chest pain accompanied by sweating and had been under regular clinical follow-up. Informed consent was obtained after providing her with a detailed explanation of the upcoming procedure.

The case took place at Chaudry Pervaiz Elahi Institute of Cardiology in Wazirabad. The patient presented herself at the outpatient department with a classical history of exertional angina. Upon physical examination, no remarkable findings were observed, and her vital signs were within normal limits. Initial routine investigations were carried out, revealing a normal sinus rhythm on electrocardiogram (ECG) with T-wave inversion in leads V1 to V6. Cardiac troponin levels were negative, and blood parameters, including a complete blood picture and other laboratory values, fell within the normal range. An echocardiography assessment displayed an ejection fraction above 60% with normal segmental kinesis. Despite her ongoing antianginal medications, her symptoms persisted.

Given her ECG findings and the persistence of symptoms, the likelihood of an ischemic condition was considered, prompting the decision to schedule her for coronary angiography. The procedure revealed severe disease in the left anterior descending artery (LAD) along with calcification.

Diagnostic Assessment

The baseline blood reports yielded normal results. Similarly, cardiac biomarkers fell within the normal range. Echocardiography confirmed normal findings and exhibited regular kinesis. The electrocardiogram (ECG) displayed T-wave inversions in leads V1 to V6. Subsequent diagnostic coronary angiography revealed an extended calcified disease segment in the mid left anterior descending artery (LAD).

Guiding Case Selection for Rotational Atherectomy: Indications and considerations for case selection were meticulously reviewed.

Calcified Vessels: Particularly when extensive calcium deposition is evident.

Resistance to Dilation: When conventional dilation techniques prove ineffective.

Risk of In-Stent Restenosis: Cases where the potential for restenosis is high post-stent placement.

Mild Calcium (Ca++ <90° arc): Routine PCI might suffice.

Moderate Calcium (Ca++ 90-180° arc): Non-compliant balloon, plaque modification tools (e.g., cutting balloon, scoring balloon), or even Rotablator may be considered.

Heavy Calcium (Ca++ >180° arc): Rotablator is often indicated.

Avoidance of Unfavourable Anatomy: Cases involving severe tortuosity, pronounced bend angles, and calcium in combination with angulation are considered high risk.

Guarding Against Complications: Factors such as guide wire bias and the potential for perforation were taken into account.

Notably, coronary calcium scoring, especially when Ca ARC >270, tends to align with cases more suitable for atherectomy, as depicted in the accompanying figure.

Therapeutic Intervention

During the therapeutic intervention, various types of atherectomy procedures were considered, including rotational atherectomy, directional atherectomy, excimer laser, and orbital atherectomy, all founded on the principles of differential cutting and orthogonal displacement of friction. The procedure commenced with the introduction of a 3.5 guide catheter through a 7-Fr femoral sheath. Guided by the intravascular ultrasound (IVUS) findings, the decision was made to proceed with rotablation targeting the left anterior descending artery (LAD).

The process began by wiring the LAD through the femoral guide, followed by a transition to a Rota wire via a Caravel microcatheter (ASAHI). The LAD was effectively subjected to burring using a 1.75 rotaburr spinning at 160,000 rpm, facilitated through the femoral guide. Subsequently, the same 1.5 rotaburr at 160,000 rpm was employed to burr the circumflex artery.

The results of the angiography post-rotablation were highly promising, leading to the subsequent steps of stenting. This phase involved the deployment of a 3.0 x 32mm drug-eluting stent (DES) followed by post-dilatation utilizing a 3.25 x 12mm non-compliant (NC) balloon. The comprehensive approach yielded an excellent outcome, evidenced by the achievement of TIMI III flow.

Follow-Up and Outcomes

Following the successful completion of the percutaneous coronary intervention (PCI), we attained TIMI III flow in the left anterior descending artery (LAD) without encountering any complications. The patient exhibited a favourable tolerance to the procedure, indicating a smooth recovery process. Subsequent to the intervention, regular follow-up assessments revealed a notable alleviation of the patient's symptoms, accompanied by an evident enhancement in her functional capacity.

Discussion

With the advent of balloon angioplasty as a treatment option for obstructive coronary artery disease (CAD), although effective in restoring blood flow in diseased coronary arteries, it comes with notable drawbacks and potential adverse outcomes. Acute closure or restenosis can manifest either shortly or over time, while issues such as intimal tears or thrombus ruptures can initiate a process of progressive plaque remodelling, leading to recoil, inflammation, and neointimal formation[1]. This scenario has driven continuous evolution and refinement of percutaneous coronary intervention (PCI) procedures to counteract the unpredictable responses that balloon angioplasty alone can trigger.

Incorporating techniques like pre-dilation using semi-compliant and cutting balloons has shown promise. However, challenges persisted in effectively addressing residual atheroma or coronary calcium until the introduction of debulking devices into the equation. As we progress into the next era of coronary

intervention procedures, directional atherectomy, laser ablation, and rotational atherectomy emerge as promising horizons, further empowered by the insights provided by intravascular ultrasound (IVUS)[2].

Within the realm of complex coronary lesion treatment, IVUS proves invaluable for assessing plaque morphology and characteristics, thereby enhancing procedural outcomes. Before embarking on rotational atherectomy (RA), a meticulous evaluation of the coronary lesion is imperative to avert potential complications[3]. It is worth noting that the left anterior descending artery (LAD) typically offers a suitable lumen for RA, barring instances of ostial or left main stem (LMS) disease. At our institution, the Rotablator device was available with burr sizes ranging from 1.25 to 2.0 mm. While both Rotablator (Boston Scientific) and the Diamondback 360° Coronary Orbital Atherectomy System (Cardiovascular Systems) serve as commonly employed debulking tools in various setups, devices other than Rotablator may offer greater efficacy in tortuous lesions[4].

However, it's important to acknowledge the limitations encountered in our study due to equipment availability and challenges aligning appropriately sized burrs with vessel dimensions. Additionally, patients with tortuous vessels were excluded due to limitations imposed by available devices. Remarkably, the course of post-procedure monitoring revealed no occurrence of adverse events or unanticipated complications. This positive outcome underscores the effectiveness of the intervention and the patient's well-managed response to the treatment approach.

Conclusion

This case study highlights the successful use of rotational atherectomy-assisted PCI in calcified LAD lesions with favourable anatomy. It underscores the importance of patient selection, equipment readiness, and IVUS guidance, potentially offering a low-risk revascularization strategy.

Learning points

- Careful patient selection based on vessel anatomy and calcium burden is crucial.
- Adequate equipment preparation is essential to manage potential complications.
- Utilizing IVUS before and after rotational atherectomy aids in optimizing procedural outcomes.

References

1) Patrick Whitlow, Ravi Nair. Rotational Atherectomy. General description of procedure, equipment, technique. 2019. Available at: https://www.thecardiologyadvisor.com/home/decision-support-in-medicine/cardiology/rotational-atherectomy/
2) Matsukawa R, Matsuura H, Tokutome M, Okahara A, Hara A, Okabe K, Kawai S, Mukai Y. Use of a Cutting Balloon Reduces the Incidence of Distal Embolism in Acute Coronary Syndrome Requiring Predilatation Before Stenting. Circ Rep. 2022;4(8):345-352.
3) Ku PM, Huang TY, Chen ZC, Woo M, Hung JS. IVUS-guided rotational atherectomy for unexpandable paclitaxel-eluting stent: A case report and review of literature. JGC. 2013;10(3):226-229.
4) Kato T, Fujino M, Takagi K, Noguchi T. The rotational atherectomy with a guide extension catheter for calcified and tortuous lesions in left anterior descending artery: a case report. BMC Cardiovascular Disorders. 2021;21:1-4.

Figure/Video

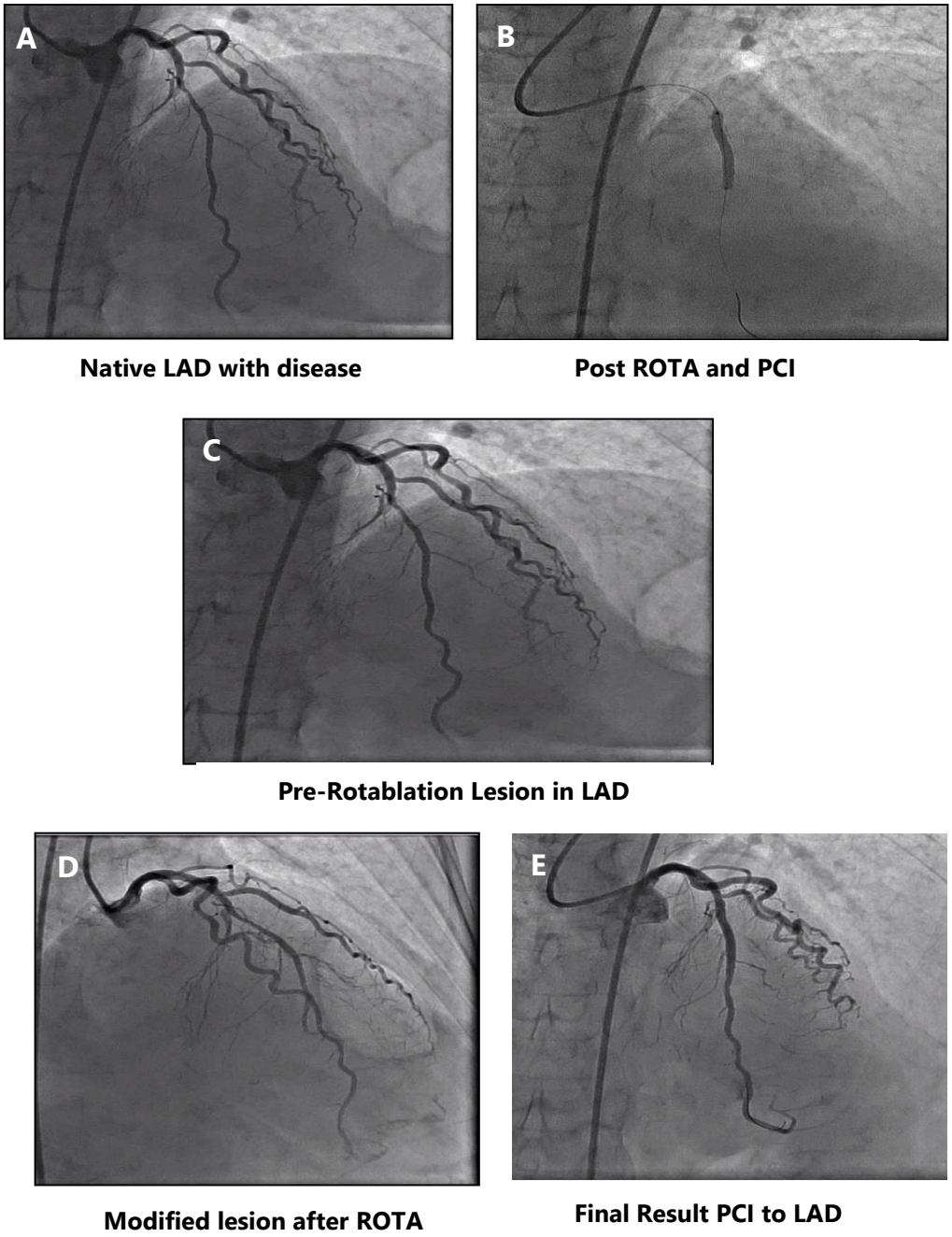

Figure 1 a-e: Angiographic views of LAD in Pre-Rotablation and Post Rotablation with PCI

Supplementary Materials

Supplementary Videos: