Case Report

Orbital Atherectomy : A Valuable Addition to The Armamentarium for Coronary Calcification Modification

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Abstract :

Background :

Severe coronary artery calcification remains a major challenge in percutaneous coronary intervention (PCI), often resulting in suboptimal stent expansion and adverse outcomes.

Case Summary :

A 63-year-old male with Class III angina and heavily calcified left anterior descending (LAD) artery disease underwent orbital atherectomy-assisted PCI. Adequate plaque modification enabled successful deployment of two stents. Optical coherence tomography (OCT) confirmed optimal stent expansion and apposition with no significant residual stenosis.

Conclusion :

Orbital atherectomy is a safe and effective modality for calcium modification in complex coronary lesions, particularly in high-risk patients unsuitable for surgical revascularization.

Keywords :

Orbital atherectomy; coronary calcification; PCI; LAD; OCT

Introduction :

Coronary artery calcification poses a significant challenge in contemporary interventional cardiology, particularly in elderly patients and those with multiple comorbidities. Severe calcification adversely affects lesion preparation, stent delivery, and optimal expansion, thereby increasing the risk of restenosis and major adverse cardiac events (MACE).[1]

Severely calcified coronary lesions are associated with higher procedural complexity and poorer clinical outcomes. Emerging plaque modification technologies such as orbital atherectomy offer potential advantages over conventional techniques and warrant further clinical evaluation.[2]

Case Presentation :

A 63-year-old male presented with exertional angina (Canadian Cardiovascular Society Class III) persisting for six months despite optimal medical therapy. Coronary angiography revealed single-vessel disease with severe, long-segment stenosis involving the proximal to mid LAD. The lesion demonstrated extensive “tram-track” calcification (Fig. 1).

The patient declined coronary artery bypass grafting (CABG). Additionally, he was considered high-risk for surgical intervention due to underlying chronic obstructive pulmonary disease (COPD) and overall frailty.

Given the severity of calcification, a decision was made to proceed with orbital atherectomy-assisted PCI after obtaining informed consent.

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Procedure :

Orbital atherectomy was performed using a standard technique, achieving effective modification of the calcified plaque. This facilitated smooth delivery and deployment of two coronary stents in the LAD.

Post-procedural OCT imaging confirmed excellent stent expansion and apposition, with no significant residual stenosis (Fig. 2). Final angiography demonstrated satisfactory restoration of vessel lumen and TIMI III flow.

The patient had an uneventful recovery and was discharged in stable condition after two days.

Discussion :

Severe coronary calcification remains one of the most important determinants of PCI complexity and outcomes. Inadequate lesion preparation in such cases can lead to stent under-expansion, increased risk of restenosis, and adverse cardiac events.[3]

Orbital atherectomy utilizes an eccentrically mounted, diamond-coated crown that rotates in an orbital fashion, allowing differential sanding of calcified plaque while preserving compliant vessel tissue. This mechanism enables circumferential calcium modification and improves vessel compliance.

Compared to rotational atherectomy, orbital atherectomy provides continuous blood flow during ablation, which may contribute to a reduced incidence of slow-flow or no-reflow phenomena. Additionally, its ability to modify calcium in a circumferential manner facilitates improved stent expansion.[4]

The system offers several procedural advantages, including the use of a single crown for varying vessel diameters and a relatively simplified device platform. These features contribute to ease of use and a favorable learning curve.

However, certain limitations should be considered. Orbital atherectomy may be less suitable in highly tortuous vessels, balloon-uncrossable lesions, or in the presence of visible thrombus. Cost considerations may also limit its widespread adoption in resource-constrained settings.

While rotational atherectomy remains the traditional standard for heavily calcified lesions, orbital atherectomy offers procedural advantages that may translate into improved clinical outcomes in selected patients. However, large-scale randomized comparative studies remain limited. Patient was discharged after 2 days.

Advantages of Orbital Atherectomy :

1. **Superior Plaque Modification :** The orbital motion allows for bidirectional ablation (back-and-forth movement) and modifies calcium over the entire circumference, often resulting in deeper tissue modifications than other methods.
2. **Versatility & Ease of Use :** A single crown size can treat vessels of varying diameters (2.5 mm to 4.0 mm).
3. The system frequently uses the "Viper Wire," which is easy to navigate, often eliminating the need for a microcatheter.
4. **Reduced Complications :** Compared to traditional methods, it has a lower incidence of slow-flow and lower risk of the device entrapment.
5. **Smaller Access Site :** It is well-suited for trans radial access, which is often preferred for patient comfort and reduced bleeding.

6. Ease of use : Simpler learning curve.

Disadvantages of Orbital Atherectomy :

1. **Vascular Complications :** While rare, risks include coronary perforation, vessel dissection, or spasms, particularly in highly tortuous or long vessels.
2. It is costlier as compared to traditional rotaablation.
3. **Less Acute Lumen Gain :** Some studies suggest that orbital atherectomy may result in less immediate, maximum luminal enlargement compared to traditional rotational atherectomy.
4. It is not suitable for very tortuous vessel, balloon uncrossable lesions and lesions with visible thrombus

The MACE results in ORBIT II (with orbital atherectomy) were lower at three years compared to two years in the ROTATAXUS study, in which patients underwent rotational atherectomy.

Conclusion :

Orbital atherectomy is a safe and effective modality for the management of heavily calcified coronary lesions. It provides favorable procedural characteristics, including improved plaque modification and reduced complication rates.

It is particularly valuable in high-risk patients who are unsuitable for surgical revascularization. Further studies are warranted to establish its comparative efficacy and long-term outcomes relative to existing atherectomy techniques.

Figures :

Figure 1 : Pre-procedure coronary angiogram showing severe calcified LAD lesion with characteristic tram-track appearance.

Figure 2: Post-procedure angiogram demonstrating well-expanded stents with restoration of luminal patency

Declarations

Funding : None

Conflict of Interest : None declared

Ethical Approval : Not required for single case report

Informed Consent : Obtained from patient

References :

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