CATHALOGUE

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CASE REPORT

Navigating the Uncrossable: Utilizing GuideLiner for Complex Coronary Lesions

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Abstract

Background: Coronary calcification occurs when calcium accumulates in the plaque within the walls of the coronary arteries, serving as an early indicator of coronary artery disease. Managing calcified lesions is challenging, and various techniques can be employed, including cutting balloons, scoring balloons, high-pressure balloons, rotational atherectomy, orbital atherectomy, lithotripsy, and, notably, GuideLiner-assisted techniques.

Case Presentation: We present two cases involving calcified lesions that were successfully treated using the GuideLiner technique. The first case involves a 64-year-old male with a history of diabetes and hypertension who presented with non-ST elevation myocardial infarction (NSTEMI) and demonstrated normal left ventricular (LV) function. The second case features a 60-year-old male, also with a history of diabetes and hypertension, who presented with NSTEMI and moderate LV systolic dysfunction. In both instances, the GuideLiner technique played a crucial role in facilitating successful interventions for the complex calcified lesions.

Results: In both cases, while the lesions were easily crossed with semi-compliant and non-compliant balloons, stent delivery was initially unsuccessful. The use of the GuideLiner provided the necessary coaxial support to navigate the complex lesions, allowing for successful stent deployment. This approach not only facilitated the procedure but also enabled it to be performed via transradial access, avoiding the need for a shift to transfemoral access.

Conclusion: The GuideLiner technique proved to be an effective and safe method for the percutaneous treatment of complex coronary lesions when conventional angioplasty devices faced challenges. Its application, particularly in the transradial approach, enhances procedural success and minimizes fluoroscopy time, thereby reducing radiation exposure risks.

Keywords

Calcified lesion, the Un-crossable lesion, Guide Liner, angioplasty.

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Introduction

Managing complex coronary anatomies poses significant challenges for interventional cardiologists, particularly in cases involving extreme vessel tortuosity, chronic total occlusions (CTOs), or significant calcification[1,2]. These anatomical complexities can result in several critical obstacles during percutaneous coronary interventions (PCI), including inadequate support from guiding catheters, difficulties in advancing wires or balloons, and the inability to deliver stents effectively to target lesions. Each of these challenges can complicate procedures and may ultimately impact patient outcomes[3].

Recent advancements in technology and techniques have revolutionized the field of coronary intervention. In particular, innovations in CTO revascularization have dramatically reduced the reliance on surgical myocardial revascularization[4]. Procedures that were once deemed too risky or technically unfeasible can now be addressed through minimally invasive techniques, allowing for faster recovery times and fewer complications for patients[5].

The modern era of PCI has seen the introduction of lower-profile balloons and enhanced stent deliverability, making interventions more efficient and less traumatic than they were 15-20 years ago[5,6]. However, despite these technological improvements, the importance of robust backup support cannot be overstated. Effective backup support is essential for the successful advancement of guide wires, balloons, and stents during PCI, particularly in complex cases.

To optimize backup support, interventional cardiologists employ various strategies tailored to the unique challenges presented by each case. These include using guide catheters with high passive backup against the opposite aortic wall, which can enhance stability during wire and balloon manipulation. Active intubation techniques further improve access to difficult lesions, while the use of stiffer wires provides additional rigidity, allowing for better navigation through tortuous pathways. Additionally, employing "buddy wires" can reinforce stability and improve the likelihood of successful wire advancement.

Among the most promising innovations in this field are guide catheter extension devices, such as the GuideLiner® catheter (Vascular Solutions Inc.). This device facilitates deeper intubation into the coronary artery, enhancing coaxiality and support during interventions[7]. By improving procedural outcomes, the GuideLiner allows cardiologists to approach complex lesions with increased confidence and precision, ultimately leading to better patient outcomes[7]. The ability to overcome the barriers presented by complex coronary anatomies represents a significant advancement in the practice of interventional cardiology, offering new hope for patients with challenging coronary diseases.

Case 1: Case Presentation

A 64-year-old man with a history of diabetes and hypertension presented with acute chest pain and diaphoresis. He was diagnosed with non-ST elevation myocardial infarction (NSTEMI), demonstrating a normal ejection fraction and no segmental wall motion abnormalities on echocardiogram.

Case 1: Diagnostic Assessment

Coronary angiography, performed via the right radial artery, revealed a normal bifurcating left main stem. Significant findings included moderate mid-stenosis in the left anterior descending artery (LAD) and severe calcified stenosis in the proximal to mid-left circumflex artery (LCX). The right coronary artery (RCA) was identified as a dominant vessel, with severe proximal stenosis and severe calcification in the distal segment.

Case 1: Therapeutic Intervention

Following the administration of a 5000 IU bolus of heparin, the patient underwent percutaneous coronary intervention (PCI) of the LCX using a 6Fr 3.0 EBU guiding catheter. Initial attempts to cross the lesion were successful with a workhorse percutaneous transluminal coronary angioplasty (PTCA) wire, and a buddy wire was placed distally in the LCX to confirm wire positioning. However, during stent deployment, extensive calcification impeded optimal positioning of the drug-eluting stent (DES). To facilitate stent placement, the vessel was adequately prepared using semi-compliant and non-compliant balloons. The GuideLiner catheter was then employed to enhance backup support, allowing for successful stent placement and deployment of a DES (3.0 x 38 mm).

Case 1: Follow-Up and Outcomes

An additional dose of heparin was administered as needed, guided by activated clotting time (ACT). Stenting of the RCA was performed in a staged procedure. A final check injection confirmed the absence of residual stenosis or thrombosis, achieving TIMI III flow in the treated arteries.

Case 2: Case Presentation

A 65-year-old man with a history of diabetes and hypertension was admitted due to epigastric discomfort and dyspnea on exertion. An electrocardiogram revealed diffuse ST-T changes, and laboratory tests showed elevated Troponin I levels. Echocardiography indicated moderate left ventricular (LV) systolic dysfunction, with hypokinesia noted in the anterior and anterolateral walls.

Case 2: Diagnostic Assessment

Coronary angiography, performed via a transradial approach, demonstrated a normal bifurcating left main stem. Severe calcified diffuse stenosis was observed from the proximal to mid-segment of the LAD. The LCX was identified as a dominant vessel with significant mid-stenosis, while the RCA displayed severe diffuse proximal stenosis.

Case 2: Therapeutic Intervention

Following the administration of a 5000 IU bolus of heparin, PCI was initiated on the LCX using a 6Fr 3.0 EBU guiding catheter, resulting in successful stent placement. Attention then shifted to the LAD lesion, which was crossed with a workhorse PTCA wire. Despite adequate preparation, attempts to deploy the stent were unsuccessful. The GuideLiner V3 catheter was utilized to provide additional support, allowing for successful placement of two overlapping drug-eluting stents (DES), measuring 2.75 x 28 mm and 3.0 x 33 mm, across the calcified lesion.

Case 2: Follow-Up And Outcomes

An additional dose of heparin was administered as needed, guided by ACT. A final check injection confirmed no residual stenosis or thrombosis, achieving TIMI III flow in the treated arteries.

Discussion

The results of this study demonstrate that the GuideLiner is an effective tool for addressing challenging coronary lesions through radial access. Guide extension catheter devices enable selective deep intubation of the coronary artery, enhancing coaxiality and support, which facilitates the treatment of complex lesions[8]. The primary indication for GuideLiner use is the difficulty or inability to deploy a stent or balloon in intricate coronary lesions, particularly those that are calcified or located in tortuous arteries, as reflected in the lesions treated in our series[9].

In cases involving non-coaxial alignment of the coronary ostium and extreme proximal vessel tortuosity often referred to as the “shepherd’s crook” deep-seating the GuideLiner over the intracoronary wire can be challenging[10]. One effective technique is to inflate a balloon distally, which can "attract" the GuideLiner and aid in the intubation of the coronary artery[11]. Even in less complicated cases where the GuideLiner can be directly inserted, it is advisable to place a balloon sized to match or be slightly undersized relative to the target artery prior to intubation with the GuideLiner. This balloon, even when deflated, provides support and serves as a centering rail, reducing the risk of damaging the ostium and proximal vessel during intubation[10,11].

The recommended sequence of use involves: first inserting the intracoronary guidewire, then passing the GuideLiner up to the distal end of the guiding catheter, followed by a pre-dilatation balloon, after which the GuideLiner can be advanced into the vessel over the balloon[12].

While the use of the GuideLiner has generally been safe, some complications have been documented. For instance, Murphy et al.[13] reported a case of balloon damage at the metallic collar site, while Seto and Kern[14] observed the destruction of two stents during attempts to maneuver them through the proximal GuideLiner collar. The newer GuideLiner V3 design aims to mitigate risks of stent damage and dislodgement. Luna et al.[15] noted a significant number of pressure dampening cases during "6-in-7" Fr GuideLiner engagement.

To optimize the use of the GuideLiner, several recommendations should be followed. It is crucial to take the time to vent the system to reduce the risk of air embolism. The GuideLiner should be inserted using a guiding catheter over a primary guide wire, ensuring the tip protrudes no more than 10 cm. Additionally, the connection to the flexible segment should occur in the straight portion of the guide catheter to facilitate the passage of devices[16]. Finally, operators must ensure that the proximal segment of the target coronary vessel is suitable for intubation; if the lesion extends proximally or if there is a sharp angulation, the use of the extension system is not recommended.

Conclusion

In conclusion, the GuideLiner technique demonstrated significant efficacy and safety in the percutaneous treatment of complex calcified coronary lesions, successfully facilitating stent deployment when conventional methods were insufficient. This approach not only enhanced procedural success but also allowed for the treatment to be performed via the transradial route, minimizing complications associated with transfemoral access. The effective use of the GuideLiner, along with appropriate vessel preparation techniques, underscores its valuable role in managing challenging coronary anatomies.

Learning points

- The GuideLiner technique effectively addresses the challenges of complex calcified coronary lesions, enabling successful stent deployment when other methods encounter difficulties.
- Proper vessel preparation using semi-compliant and non-compliant balloons is essential for enhancing the success rate of interventions in calcified lesions.
- The GuideLiner facilitates procedures via the transradial approach, which is linked to fewer complications compared to the transfemoral route.
- Mastering the use of the GuideLiner can help reduce fluoroscopy time, minimizing the risk of radiation exposure for both patients and operators.
- These case reports demonstrate the adaptability of interventional techniques to meet individual patient needs, underscoring the importance of personalized treatment strategies in cardiology.

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Figure/Video

Case 1

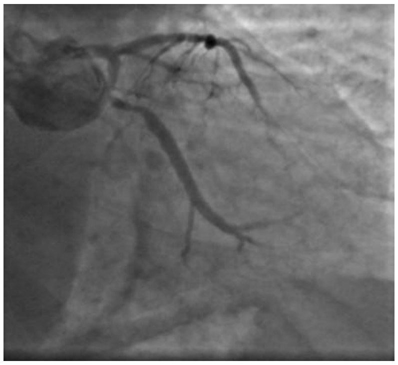

Figure 1: Left Heart catheterization: LCX showing severe calcification.

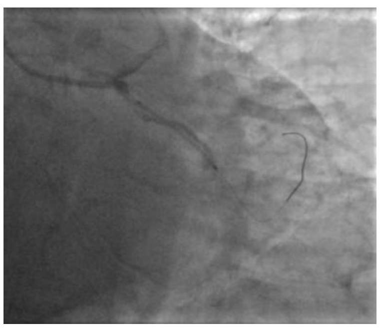

Figure 2: Placement and deployment of stent in proximal LCX.

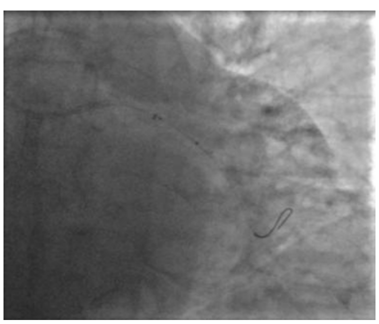

Figure 3: Use of GuideLiner to cross the lesion with the help of balloon.

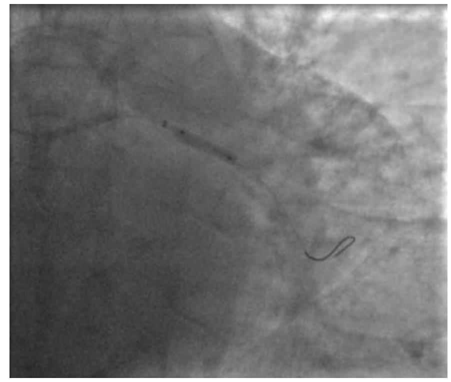

Figure 4: GuideLiner crossed the lesion with the help of inflated balloon.

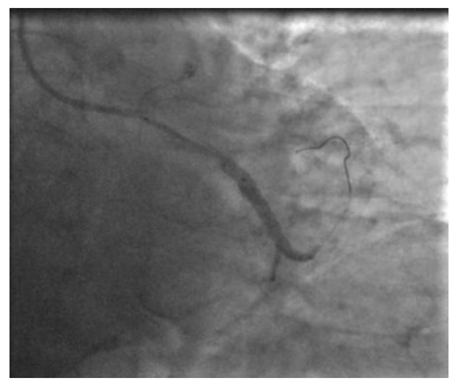

Figure 5: Placement and deployment of stent with the help of GuideLiner.

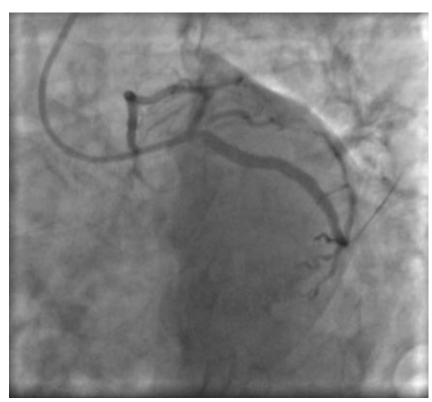

Figure 6: Final check injection after placement of Stent shows TIMI III flow with no residual stenosis.

Case 2

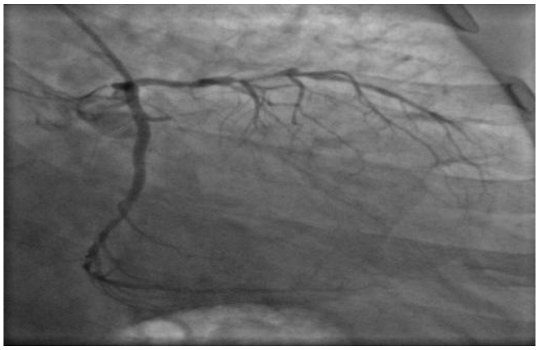

Figure 1: Left Heart Catheterization. LCX is a dominant vessel showing severe mid stenosis. LAD shows severe Calcified stenosis from proximal to mid segment.

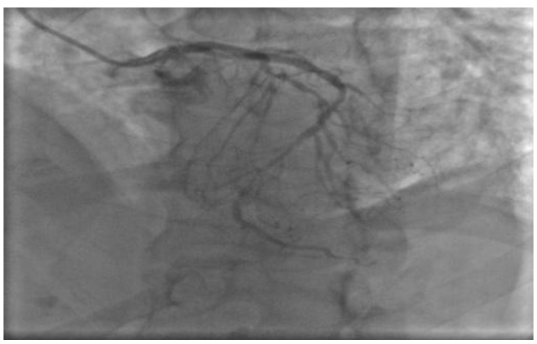

Figure 2: Another view showing severe stenosis in mid LCX.

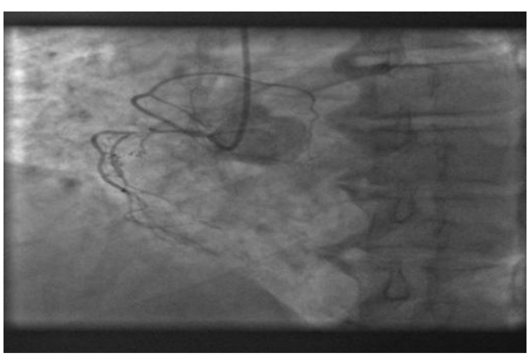

Figure 3: Right heart catheterization: RCA is non dominant vessel showing severe diffuse stenosis.

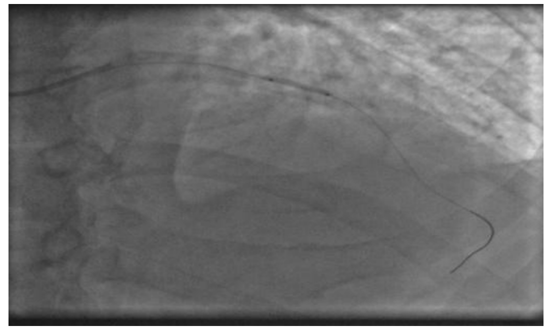

Figure 4: LAD showing severe calcification from proximal to mid segment. Adequate preparation of vessel with semi compliant.

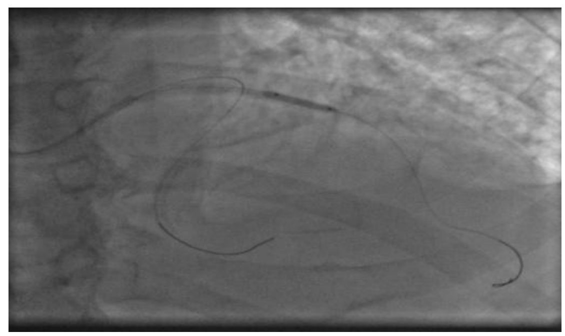

Figure 5: Adequate preparation of vessel with non-complaint balloon and also the use of buddy wire in LCX.

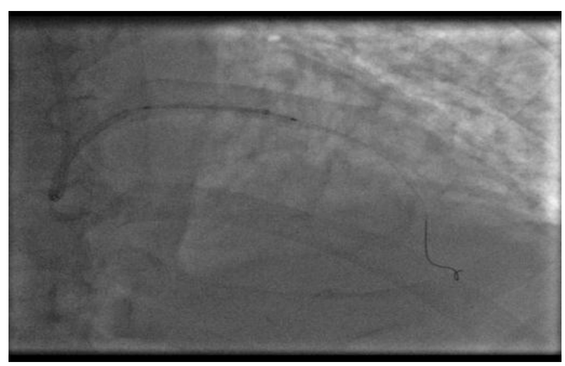

Figure 6: Placement of stent with the help of Guide Liner in mid LAD.

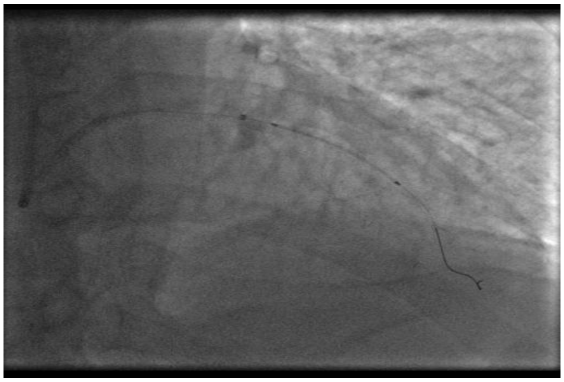

Figure 7: Confirming position of stent with the help of Guide Liner in mid LAD.

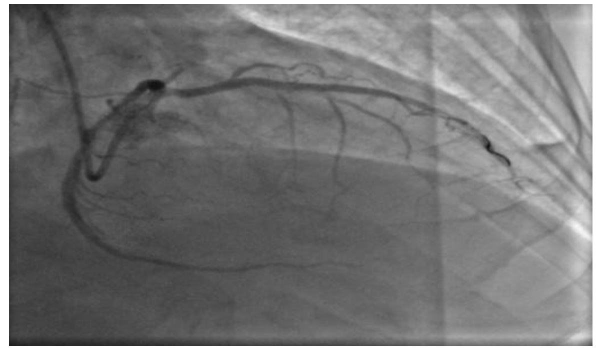

Figure 8: Final view after the placement of stent in LAD showing TIMI III flow.

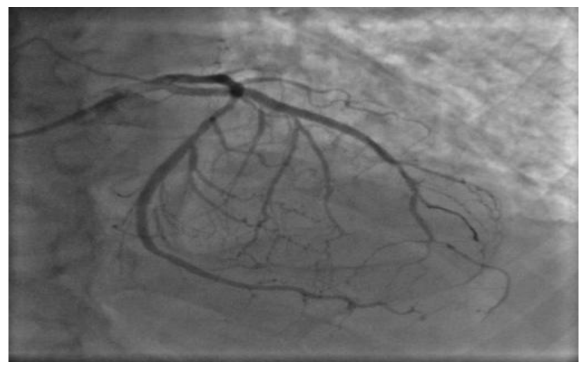

Figure 9: Final view after the placement of stent in LAD showing TIMI III flow.