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CASE REPORT

Bifurcation Stenting with Internal Crush (Reverse Crush) technique as a bailout in Acute coronary Syndrome

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Abstract

Introduction: Percutaneous coronary intervention (PCI) during acute coronary syndrome (ACS) involving bifurcation stenting presents heightened complications and intricacy. This case report showcases a 66-year-old woman with high-risk ACS and extensive coronary artery disease, featuring a total left anterior descending artery (LAD) occlusion. The case highlights the complexity of PCI in ACS, especially with bifurcation stenting.

Case Presentation: The patient, a 66-year-old woman, exhibited high-risk ACS with triple vessel coronary artery disease and complete LAD occlusion on angiography. The initial strategy aimed to restore LAD flow, followed by Coronary artery bypass grafting (CABG). However, her condition deteriorated due to severe no-reflow unresponsive to intracoronary vasodilators. In response, a left main (LM) to LAD PCI was performed to stabilize the patient. The case further elaborates on the internal crush bifurcation stenting technique and subsequent PCI of the right coronary artery (RCA), all undertaken within the same hospitalization for comprehensive revascularization.

Results: The patient's critical ACS necessitated swift decision-making. Severe no-reflow in the LAD, resistant to vasodilators, prompted a LM-LAD PCI to stabilize the situation. The report discusses the internal crush bifurcation stenting method used, providing insights into its technical aspects and implications. Furthermore, the PCI of the RCA during the index hospitalization for full revascularization is detailed, highlighting the comprehensive approach employed.

Conclusion: This case underscores the dynamic and critical nature of ACS management, requiring prompt decisions and adaptability. The successful execution of internal crush bifurcation stenting as a bailout strategy in this context demonstrates the potential for this technique in specific clinical scenarios. Timely interventions, such as LM-LAD PCI, are crucial to stabilizing patients in high-risk ACS situations, ultimately contributing to improved outcomes. The case emphasizes the importance of considering multifaceted strategies and techniques when managing complex ACS cases with bifurcation stenting challenges.

Keywords

NSTEMI, Bifurcation Stenting, Percutaneous Coronary Intervention, Reverse Crush/Internal Crush, No Reflow.

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Introduction

Coronary bifurcation lesions pose complex challenges in interventional cardiology, and when combined with acute coronary syndrome (ACS), they present an even greater clinical conundrum. The representation of ACS patients with bifurcation lesions in randomized control trials is limited, leading to a lack of consensus on optimal techniques for managing such scenarios. This case report presents a 66-year-old woman's instance, utilizing the internal crush (reverse crush) stenting technique, a less commonly used approach, in the context of ACS.

Case Presentation

A 66-year-old woman with diabetes mellitus and hypertension presented to our institute's emergency department with severe resting chest pain persisting for three hours. Although her physical examination appeared unremarkable, her electrocardiogram (ECG) revealed 2-3 mm ST segment depressions in leads II, III, avF, and V4-V6, along with T wave inversions in III and avF. High-sensitivity troponin levels were significantly elevated. Despite treatment efforts, the patient's chest pain did not completely abate, prompting immediate invasive intervention for non-ST elevation myocardial infarction (NSTEMI). Coronary angiography unveiled diffuse left main disease, an 80% mid-right coronary artery (RCA) lesion, and severe lesions in the proximal left circumflex (LCX) and mid left anterior descending artery (LAD). A plan for plain old balloon angioplasty of the LAD followed by coronary artery bypass grafting (CABG) was initially proposed.

Diagnostic Assessment

The patient's diagnostic assessment encompassed a comprehensive evaluation of vital parameters and laboratory results. Her hemoglobin, platelet count, creatinine, and electrolyte levels fell within the normal range. Notably, high-sensitivity troponin was markedly elevated at 9705 pg/ml, far exceeding the standard threshold of 15.6 pg/ml. Despite implementing effective measures to control heart rate and blood pressure, and the administration of intravenous nalbuphine, her persistent chest pain remained unresolved. Given the urgency of the situation and after obtaining informed consent, the patient was promptly transferred to the cardiac catheterization lab coronary to initiate an immediate invasive strategy for addressing her non-ST elevation myocardial infarction (NSTEMI).

Coronary Angiogram Findings

Upon performing the coronary angiogram, specific details emerged regarding the extent of the patient's coronary artery disease. The angiogram revealed mild to moderate diffuse disease in the left main coronary artery. Additionally, an 80% lesion was detected in the mid right coronary artery (RCA), while the proximal left circumflex (LCX) artery exhibited 70-80% stenosis. Notably, the mid left anterior descending artery (LAD) was entirely occluded, representing a significant challenge. Hemodynamic parameters were assessed, with the patient's left ventricle end diastolic pressure measured at 26 mmHg. Ventriculography indicated an ejection fraction ranging from 35-40%, providing insight into her cardiac function.

Initial Treatment Plan

In light of these findings, an initial therapeutic plan was formulated. The strategy involved performing a plain old balloon angioplasty (POBA) of the occluded mid LAD, with the intention of reestablishing blood flow. Following this intervention, the plan was to subsequently refer the patient for coronary artery bypass grafting (CABG), a surgical procedure that could offer comprehensive revascularization and address the multifaceted nature of her coronary artery disease.

Therapeutic Intervention

For the interventional procedure, a 6 French extra backup 3.5 guiding catheter was employed to engage the left main coronary artery (LMCA). The occluded left anterior descending artery (LAD) was successfully wired using a BMW wire. An initial attempt at percutaneous transluminal coronary angioplasty (POBA) was performed using a semi-compliant 2.5 x 15 mm balloon. However, this resulted in severe no-reflow, which prompted the administration of intracoronary vasodilators,

offering only a marginal improvement in blood flow. Given the presence of a significant dissection in the LAD and the recurrence of the patient's chest pain, the decision was made to stent the lesion from the LMCA.

To ensure optimal outcomes, the patient received a loading dose of 180 mg of Ticagrelor and an intravenous bolus of a Glycoprotein IIb/IIIa inhibitor. A 3.0 x 26 mm Resolute Integrity stent was introduced from the mid LMCA to the mid LAD. A sion wire was utilized to wire the second diagonal branch due to suspected thrombus shift causing poor flow. Intracoronary vasodilators were administered again to address the ongoing no-reflow issue. Post-dilation of the left main part of the stent was performed using a 4.0 x 8 mm non-compliant balloon. Further administration of vasodilators via an export catheter facilitated the achievement of TIMI II-III flow in the LAD.

As the LAD lesion had been successfully treated, the decision was made to proceed with a comprehensive revascularization strategy. After 48 hours of intravenous glycoprotein IIb/IIIa inhibitors, during which the patient remained hemodynamically stable in the coronary care unit, she was returned to the lab. An internal crush bifurcation stenting approach was employed for the left system. Both the LAD and left circumflex artery (LCX) were wired with BMW and sion wires respectively. The proximal LCX was dilated using a 2.5 x 15 mm balloon, while the LAD stent was post-dilated with a non-compliant 3.5 x 15 mm balloon. A 3.5 x 38 mm Resolute Integrity stent was deployed from the LMCA into the LCX. Proximal struts were crushed using a 3.5 x 15 mm balloon already positioned in the LMCA/LAD. Kissing balloon inflation was executed using 3.5 x 15 mm balloons in both the LAD and LCX. Intravascular ultrasound (IVUS) guided LM stent optimization was achieved using a 4.0 x 8 mm balloon. A dissection was identified at the ostium of the left main, necessitating coverage with a 4.0 x 15 mm Resolute Integrity stent and subsequent post-dilation using a 4.5 x 8 mm non-compliant balloon. The final result showed TIMI III flow in all vessels.

Continuing the procedure, a JR4 6French guide catheter was utilized to engage the right coronary artery (RCA), and a sion wire was inserted. Direct stenting was carried out using a 3.5 x 26 mm Resolute Integrity stent in the mid RCA. Post-dilation was performed using a 4.0 x 8 mm non-compliant balloon, followed by IVUS-guided post-dilation with a 4.5 x 8 mm non-compliant balloon. The intervention resulted in TIMI III flow in the RCA.

Follow-Up and Outcomes

Following the intricate and multifaceted interventional procedure, the patient's progress and subsequent outcomes have been closely monitored during regular clinical follow-up over the past 18 months. Encouragingly, her clinical trajectory has been positive, marked by stability and a lack of reported cardiovascular symptoms. The patient has demonstrated commendable adherence to prescribed medication, contributing significantly to her favorable outcomes. This dedication to her medication regimen has likely played a pivotal role in maintaining her well-being and mitigating potential cardiovascular issues.

Discussion

Coronary bifurcation lesions, constituting approximately 20% of all coronary lesions, are particularly susceptible to atheroma development due to factors like endothelial shear stress and turbulent flow. The prevailing consensus recommends a stepwise provisional approach employing techniques like T/TAP or Culotte stenting as a rescue measure, while a more complex upfront two-stent strategy is reserved for intricate anatomies. Patients presenting with ACS coupled with bifurcation lesions are often inadequately represented in clinical trials pertaining to bifurcation PCI. Limited data available for bifurcation PCI in ACS indicates comparable procedural outcomes between single and two-stent strategies, although the latter is associated with increased fluoroscopy time and contrast volume[1-3].

The internal crush bifurcation stenting technique, known as the reverse crush approach, offers an alternative but seldom used bailout strategy in

cases where a transition to a two-stent approach becomes essential[4-9]. Remarkably, our case contributes to the dearth of literature by presenting the internal crush technique's successful utilization for left main (LM) bifurcation stenting within the context of ACS.

This case underscores the critical importance of dynamic and judicious decision-making in managing complex clinical scenarios. It elucidates how the evolving clinical condition can prompt a deviation from the initial treatment strategy. In our case, the planned strategy of coronary artery bypass grafting (CABG) post-POBA for LAD was dynamically altered due to the patient's clinical deterioration, necessitating immediate stenting from the LM into the LAD. This timely intervention averted an emergent situation and created an opportunity for a staged procedure during the index hospitalization period. This staged approach proved advantageous by offering a controlled environment for comprehensive revascularization, ultimately yielding exceptional clinical outcomes.

Conclusion

In conclusion, this case demonstrates the successful application of the internal crush (reverse crush) technique as a bailout strategy for bifurcation stenting in the setting of acute coronary syndrome. The study emphasizes the importance of being adaptable in treatment strategies and highlights the feasibility and safety of employing the internal crush technique for LM bifurcation stenting in emergent scenarios.

Learning Points

- Coronary Bifurcation lesions can be encountered in the setting of ACS increasing the overall procedural complexity.
- Clinical situation in ACS is dynamic which can lead to changes in the initially planned treatment strategy.
- An interventional cardiologist must be versatile to adapt to the changing clinical demands and act accordingly.
- Internal Crush (reverse crush) bifurcation stenting can be safely performed in acute coronary syndrome is the need arises.

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Figure/Video

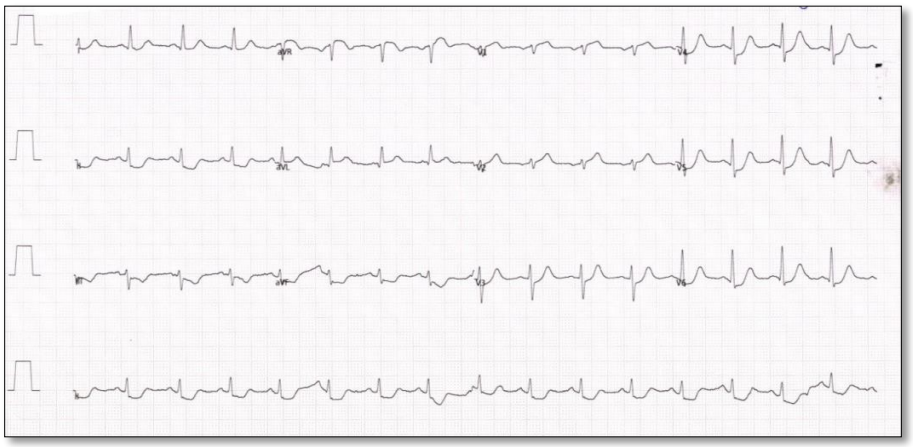

Figure 1: ECG, Diffuse ST segment changes in leads II, III, aVF, V3-V6

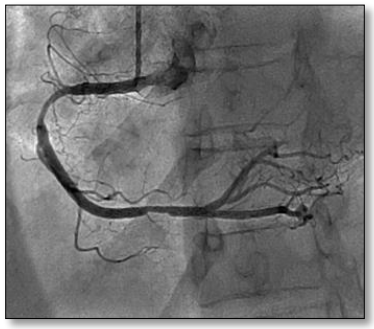

Figure 2: Severe Mid RCA disease

Figure 3a: Severe proximal LCX disease

Figure 3b: Total proximal LAD Occlusion

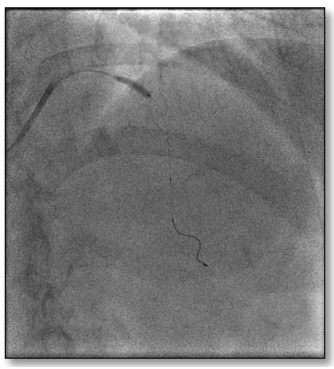

Figure 4: LAD pre-dilation with a semi-complaint 2.5 x15 mm balloon

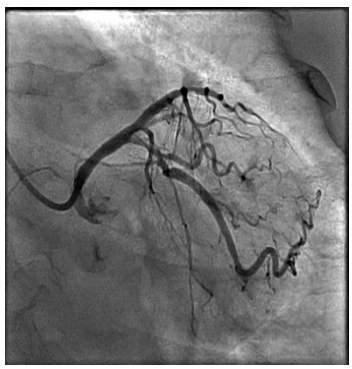

Figure 5 a,b: Final result after LM-LAD stenting and Intracoronary vasodilators

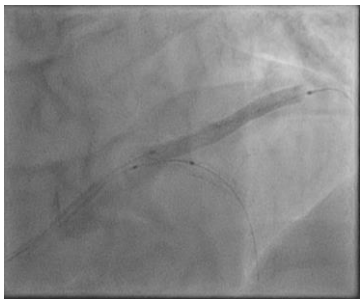

Figure 6: 3.5x38 mm stent from left main into LCX and crushed with NC 3.5 x15 balloon in LAD

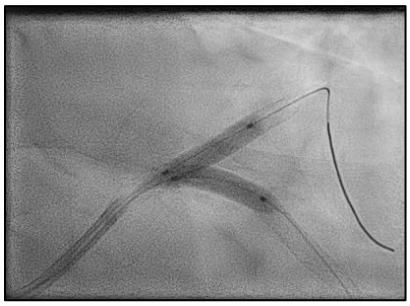

Figure 7: Kissing Balloon Inflation with 3.5 x15 mm balloons in both LAD and LCX

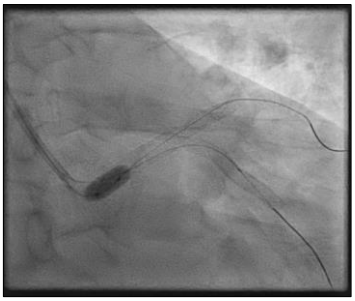

Figure 8: POT with NC 4.5x8

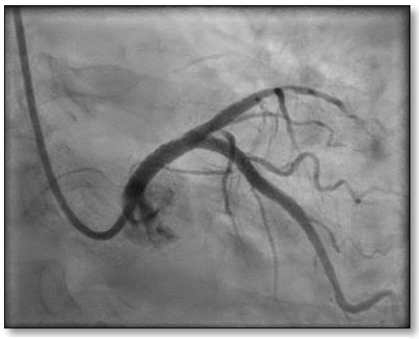

Figure 9: Final result caudal view

Figure 10: Final result cranial view

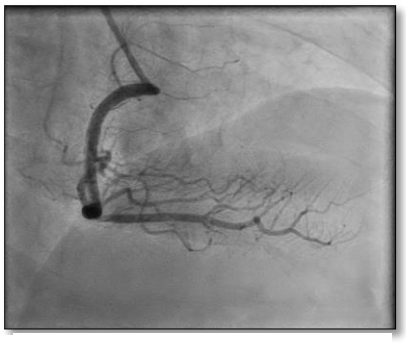

Figure 11: Final result after RCA PCI