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CASE REPORT

An upfront two-stent strategy for bifurcation stenting of left anterior descending artery in acute coronary syndrome

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Abstract

Introduction: This case report presents a unique and noteworthy instance of bifurcation stenting in the left anterior descending coronary artery (LAD) during acute coronary syndrome (ACS). Bifurcation lesions are complex and challenging to treat, and this case contributes valuable insights to the scientific literature by showcasing successful management of LAD bifurcation in the context of ACS.

Case Presentation: The patient, a 50-year-old male with a history of hypertension and hyperlipidemia, presented to the emergency department with severe chest pain and electrocardiogram (ECG) changes indicative of ACS, with raised cardiac troponins. Urgent coronary angiography was planned, which revealed a significant stenosis at the bifurcation of the LAD.

Results: Given the complexity of the lesion and the high-risk presentation, the patient underwent percutaneous coronary intervention (PCI) with a bifurcation stenting approach. A drug-eluting stent was deployed at the LAD bifurcation site using a DK crush technique. The procedure was successful, with restoration of blood flow and resolution of chest pain. The patient was closely monitored and received dual antiplatelet therapy post-PCI.

Conclusion: This case underscores the importance of a tailored approach to treat bifurcation lesions in ACS patients. It highlights the feasibility and efficacy of a two-stent technique for bifurcation stenting in the LAD during ACS. The successful outcome demonstrates that careful planning, expertise, and appropriate stenting strategies can lead to favorable results in complex scenarios. Nevertheless, more research and clinical studies are warranted to establish the best management strategies for such cases, contributing further to the advancement of interventional cardiology.

Keywords

Acute Coronary Syndrome, Left Anterior Descending Artery, Bifurcation Stenting, DK Crush, Post Stenotic Dilatation.

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Introduction

This case report focuses on the utilization of an upfront two-stent strategy for bifurcation stenting in the left anterior descending artery (LAD) during acute coronary syndrome (ACS). Bifurcation lesions in the LAD are challenging to manage, especially in the context of ACS, and the choice of stenting strategy plays a crucial role in determining the procedural success and long-term outcomes. This report contributes to the scientific literature by showcasing a successful and innovative approach for treating LAD bifurcation in the acute setting, thereby offering insights and potential benefits to interventional cardiologists facing similar challenging scenarios.

What sets this case apart is the adoption of an upfront two-stent strategy for bifurcation stenting in the LAD during ACS. Unlike traditional single-stent approaches, where provisional stenting is preferred, the interventional team opted for a more proactive approach due to the complexity of the lesion and the high-risk presentation of unstable angina. By choosing the upfront two-stent strategy (crush stenting), the team aimed to achieve optimal stent placement and ensure adequate coverage of both the main vessel and side branch, effectively restoring blood flow and alleviating myocardial ischemia. This innovative approach in the acute setting presents a unique case that adds to the existing body of knowledge in interventional cardiology, potentially expanding the treatment options available for similar bifurcation lesions in ACS patients. The successful outcome of this case demonstrates the feasibility and efficacy of the upfront two-stent strategy, emphasizing the importance of individualized and aggressive approaches when managing complex bifurcation lesions during acute coronary events.

Case Presentation

The patient is a 50-year-old male with a medical history of hypertension and hyperlipidemia. He presented to the emergency department with severe chest pain of sudden onset, radiating to his left arm and neck. The pain was associated with shortness of breath and diaphoresis. The patient had no significant family history of coronary artery disease. He was a non-smoker. The patient was independent in his activities of daily living and had no known drug allergies.

Relevant Past Interventions: The patient had no previous interventions for coronary artery disease or other significant cardiac procedures.

Significant Physical Examination & Clinical Findings: On physical examination, the patient appeared anxious and in moderate distress due to chest pain. Vital signs revealed a blood pressure of 160/90 mmHg, heart rate of 110 beats per minute, respiratory rate of 22 breaths per minute, and oxygen saturation of 95% on room air. Cardiac auscultation revealed normal heart sounds without any murmurs, gallops, or rubs. There were no signs of heart failure, peripheral edema, or cyanosis

Timeline of emergency management

- T0: Patient arrives at the emergency department with severe chest pain, suggestive of acute coronary syndrome.
- T0 + 30 minutes: Initial assessment, ECG performed, showing ST-segment elevation in the anterior leads.
- T0 + 35 minutes: The patient receives aspirin and sublingual nitroglycerin for immediate relief of symptoms.
- T0 + 60 minutes: Cardiac biomarkers (troponin) measured and found elevated, confirming the diagnosis of ACS.
- T0 + 90 minutes: Urgent coronary angiography performed, revealing a significant stenosis at the bifurcation of the left anterior descending artery (LAD).
- T0 + 100 minutes: The decision is made to proceed with percutaneous coronary intervention (PCI) using a bifurcation stenting approach.

The patient presented with classic symptoms of ACS, including severe chest pain, diaphoresis, and shortness of breath. Given his medical history of hypertension and hyperlipidemia, he had multiple risk factors for coronary artery disease. The absence of significant family history of coronary artery disease and his non-smoking status were positive factors. The timely diagnosis and

management of ACS were crucial to prevent potential complications and reduce mortality.

Informed Consent

The patient provided informed consent for the medical procedures and interventions involved in his care, including percutaneous coronary intervention (PCI) with bifurcation stenting.

Diagnostic Assessment

The patient's clinical presentation, ECG changes, and elevated cardiac biomarkers confirmed the diagnosis of ACS. Coronary angiography showed critical stenosis in proximal LAD with post-stenotic dilatation and critical stenosis at ostium of large diagonal artery with post-stenotic dilatation, which makes it a Medina 1:1:1 case (figure 2B). The significant stenosis at the LAD bifurcation on coronary angiography highlighted the complexity of the lesion, warranting careful consideration of the most appropriate stenting strategy. The interventional team opted for an upfront two-stent approach (crush stenting) to ensure complete lesion coverage and maintain adequate blood flow in both the main vessel and side branch. This decision was influenced by the high-risk presentation of Non-ST elevation myocardial infarction and the goal of achieving optimal revascularization.

Therapeutic Intervention

DK crush technique was adopted considering the angle of bifurcation of LAD and diagonal artery and significant size of diagonal artery. This technique was chosen over other bifurcation techniques as it is known to have improved lesion coverage[4], reduced risk of stent malapposition[5], lower rates of target lesion revascularization[6], enhanced side branch protection[7] and better feasibility in complex lesions[8]. 6Fr radial sheath was secured. 6Fr, EBU guide catheter was engaged in left main stem. To begin, advance two workhorse wires into the distal left anterior descending artery (LAD) and Diagonal artery. Predilation of the diagonal and LAD was done using a 2.5- X 15-mm semi compliant balloon. Then, after intracoronary administration of nitroglycerin (100-200 µg), the stent sizes of main branch and side branch were estimated.

Step 1: Side branch Stenting

Positioned a 2.5- X 18-mm DES in the diagonal artery, with a protrusion of 2 to 3 mm into the LAD. Simultaneously position a 3.5- X 12-mm noncompliant balloon in the LM-LAD. Deployed a Diagonal stent at > 12 atm, then removed the stent balloon and diagonal wire after confirming there were no angiographic complications.

Step 2: Balloon Crushing

Sized the LAD balloon according to proximal LAD diameter (1:1 ratio) and inflated it to crush the Diagonal stent by using 3.5 into 12mm non complaint balloon.

Step 3: First kissing balloon inflation

After successfully rewiring the diagonal from the proximal stent cell, inflated a 3.5- X 12-mm noncompliant balloon in the LAD and a 2.5- X 12-mm noncompliant balloon in the Diagonal and performed the first Kissing balloon inflation. (figure 3)

Step 4: Main vessel Stenting

Deployed a 3.5- X 24-mm DES in the LAD to further crush the LCX stent, followed by post-dilatation using a 3.5- X 12-mm noncompliant balloon and the proximal optimal technique (POT) using a 3.75- X 15-mm

Step 5: Final Kissing balloon inflation

Once the diagonal rewiring was confirmed, inflated a 3.5- X 12-mm noncompliant balloon in the LAD and another 2.5- X 12-mm noncompliant balloon in the Diagonal at 12 atm and performed the final Kissing balloon inflation. (figure 4)

Step 6: Final Proximal optimization

Completed the final proximal optimization and post-dilatation with a 3.75- X 15-mm noncompliant balloon.

Follow-Up and Outcomes

Assessed the immediate success of the bifurcation stenting procedure based on angiographic findings, confirming proper stent deployment, apposition, and resolution of the stenosis, the

restoration of blood flow in the LAD and side branch after the stent placement, as evidenced by the absence of residual stenosis and restored coronary flow. Patient reported chest pain relief after the procedure; he was kept under cardiac monitoring. He was discharged 48 hours post procedure on dual antiplatelet, statins, beta-blockers and angiotensin receptor blockers. He was advised follow after 2 weeks for assessment of his physical activity, ischemic symptoms and compliance to medication.

Discussion

The use of an upfront two-stent strategy (DK crush technique) in bifurcation stenting of the LAD during acute coronary syndrome is a less commonly used as provisional stenting is preferred because of simplicity of procedure. This case report highlights the feasibility and success of this technique especially when complex coronary anatomy calls for a complex PCI in high-risk patient with acute ischemia and providing valuable insights into its potential benefits in challenging scenarios. The case report includes a detailed account of the patient's medical and social history, presenting symptoms, diagnostic tests, interventional procedure, and follow-up outcomes. This comprehensive assessment enhances the understanding of the case and its management.

As a single case report, this study may lack generalizability and cannot establish causality or definitive treatment recommendations. The findings are limited to this specific patient, and broader conclusions require validation in larger studies. Since this is not a comparative study, there is no control group to compare the outcomes of the two-stent strategy with other bifurcation stenting approaches. A controlled trial would be necessary to draw conclusions that are more robust.

The decision to use the two-stent strategy may have been influenced by the clinician's expertise and experience, potentially introducing selection bias. It is essential to acknowledge the potential impact of clinician preference on the outcomes.

The medical literature on bifurcation stenting in acute coronary syndrome is rich with studies exploring various stenting strategies and techniques[1-3]. One commonly studied technique is the "DK crush technique," which has shown promising results in some clinical trials. Chen et al. (2019) demonstrated that the DK crush technique was associated with lower rates of target lesion revascularization compared to provisional stenting in patients with bifurcation lesions. However, not all studies have consistently shown superior outcomes with the two-stent approach. For example, the DKCRUSH-VI trial by Chen et al. (2021) reported no significant difference in major adverse cardiac events between DK crush and provisional stenting at one year. The DK crush technique was chosen over other bifurcation techniques as it is known to have improved lesion coverage[4], reduced risk of stent malapposition[5], lower rates of target lesion revascularization[6], enhanced side branch protection[7] and better feasibility in complex lesions[8].

The scientific rationale for the conclusions drawn in this case report lies in the successful management of the patient's complex bifurcation lesion using the two-stent strategy, resulting in complete lesion coverage, restored blood flow, and resolution of angina symptoms. The outcomes align with previous studies suggesting the potential benefits of the DK crush technique in certain scenarios.

Conclusion

Overall, this case report contributes valuable insights to the management of bifurcation lesions in the LAD during acute coronary syndrome. It encourages interventional cardiologists to consider an individualized approach and the use of an upfront two-stent strategy in carefully selected cases. The successful outcome in this case warrants further investigation and highlights the importance of ongoing research to optimize treatment strategies for such challenging scenarios.

Learning points

- **Individualized Approach:** Bifurcation lesions in the LAD during acute coronary syndrome are complex and require individualized treatment

strategies. This case report highlights the importance of tailoring the approach based on the patient's clinical presentation, lesion characteristics, and the expertise of the interventional team.

- **Upfront Two-Stent Strategy:** The successful use of an upfront two-stent strategy (DK crush technique) in this case demonstrates the potential benefits of this approach in achieving complete lesion coverage and maintaining blood flow in both the main vessel and side branch. Interventional cardiologists should consider this technique in carefully selected cases, especially in high-risk presentations.
- **Timely Revascularization:** Prompt and timely revascularization in acute coronary syndrome is crucial for reducing myocardial damage and improving patient outcomes. This case highlights the significance of early coronary angiography and intervention in such high-risk presentations.

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Figure/Video

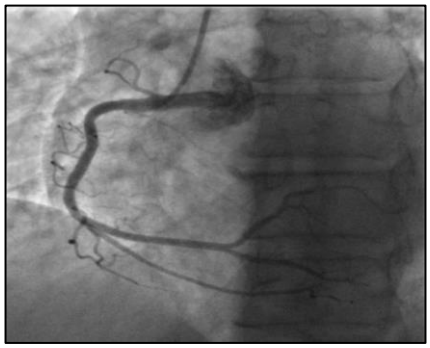

Figure 1: Right coronary artery (dominant and normal)

Figure 2 A-C: Left circumflex is free of any angiographic disease; there is critical stenosis in proximal LAD and diagonal artery with post stenotic dilatation. (Medina 1:1:1 classification)

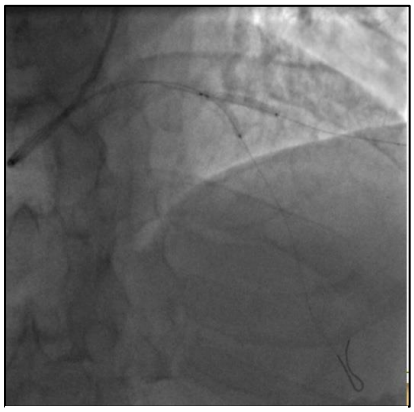

Figure 3: First simultaneous kissing inflation

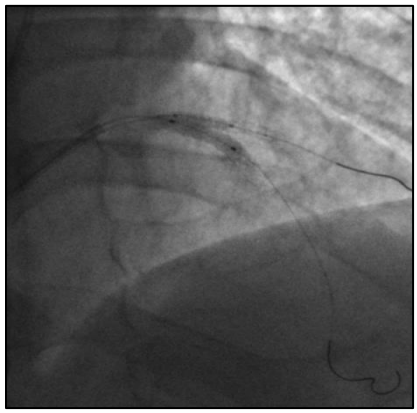

Figure 4: Final simultaneous kissing inflation

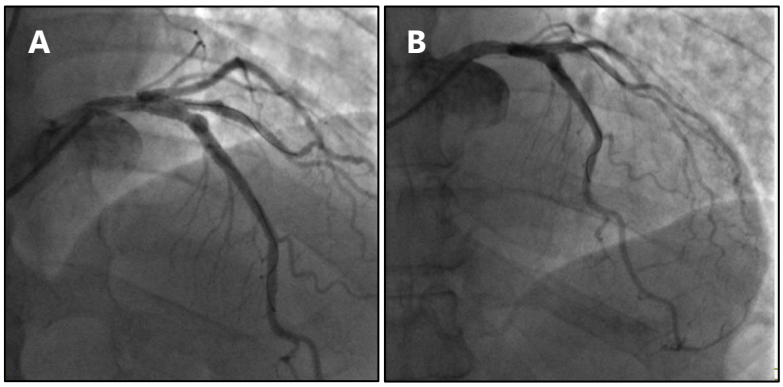

Figure 5 A and B: Final Results