CATHALOGUE

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CASE REPORT

Jailed Semi-Inflated Balloon Technique (JSBT) for Preserving Side Branch Viability During Chronic Total Occlusion (CTO) Intervention

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Citation:
Bilal A, Faisal A. Jailed Semi-Inflated Balloon Technique (JSBT) for Preserving Side Branch Viability During Chronic Total Occlusion (CTO) Intervention. Cathalogue. 2024; 2(2): 50-55.

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

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

Received 18/01/2024
Accepted 20/04/2024
First Published 01/06/2024

Abstract

Background: Chronic total occlusion (CTO) of the coronary arteries poses significant challenges in managing coronary artery disease. Successful intervention is essential for improving patient outcomes, particularly in cases with prior history of coronary interventions. The Jailed Semi-Inflated Balloon Technique (JSBT) has emerged as a valuable strategy to enhance side branch patency during CTO procedures, thereby preserving viable vessels and reducing the risk of ischemia.

Case Presentation: A 58-year-old male with a significant medical history, including diabetes, hypertension, and ischemic heart disease, presented to the outpatient department with persistent retrosternal chest discomfort lasting for six months, despite optimal medical therapy.

Results: The intervention involved a provisional bifurcation stenting strategy, utilizing JSBT in the right ventricular marginal branch to preserve flow in this viable vessel during the CTO recanalization. The procedure was successful, leading to good stent expansion and maintaining patency without complications.

Conclusion: This case underscores the critical importance of preserving as many viable vessels as possible during CTO interventions. The implementation of JSBT not only facilitated successful revascularization but also enhanced overall outcomes, reducing the risk of future ischemic events.

Keywords

Chronic Total Occlusion, Jailed Semi-Inflated Balloon Technique, Percutaneous Coronary Intervention, Side Branch Patency, Revascularization.

Published by Pakistan Society of Interventional Cardiology

Introduction

Chronic total occlusion (CTO) of the coronary arteries represents a complex and challenging scenario in the management of coronary artery disease. CTOs are defined as complete blockages in coronary arteries lasting more than three months, and they can significantly hinder blood flow, leading to ischemic symptoms and adverse cardiac events[1]. The management of CTOs has evolved, with advancements in interventional techniques enabling successful recanalization and restoration of blood flow[2].

The Jailed Semi-Inflated Balloon Technique (JSBT) is an innovative approach that has emerged as a promising strategy for maintaining side branch viability during CTO interventions. This technique involves the strategic placement of a semi-inflated balloon in a side branch while simultaneously treating the main occlusion. By keeping the balloon partially inflated, clinicians can prevent excessive pressure and injury to the side branch, ensuring its patency throughout the procedure[3].

In this case report, we highlight the successful intervention in a 58-year-old male patient with a functional CTO of the right coronary artery (RCA). The application of JSBT not only facilitated the recanalization of the RCA but also preserved the integrity of the collateral circulation, ultimately leading to improved clinical outcomes. Our findings underscore the potential of JSBT as a valuable technique in the realm of interventional cardiology, particularly for complex CTO cases where maintaining side branch viability is critical.

Case Presentation

A 58-year-old male with a significant medical history, including diabetes mellitus, hypertension, and ischemic heart disease, presented to the outpatient department with persistent retrosternal chest discomfort lasting for the past six months. This symptom occurred despite receiving optimal medical therapy. Notably, the patient had a history of a previous percutaneous coronary angioplasty (PCI) of the right coronary artery (RCA) in 2007, indicating a chronic underlying coronary condition.

Upon evaluation, further diagnostic workup revealed a functional chronic total occlusion (CTO) of the RCA, necessitating intervention to alleviate his symptoms and reduce the risk of adverse cardiac events. The patient's ongoing chest discomfort raised concerns about the adequacy of blood flow to the myocardium, prompting the decision to pursue a percutaneous intervention using the Jailed Semi-Inflated Balloon Technique (JSBT) to enhance procedural success and maintain the viability of side branches.

Diagnostic Assessment

Electrocardiogram (ECG): The baseline ECG demonstrated normal sinus rhythm without any evidence of pathological Q waves, indicating no acute ischemic changes.

Echocardiogram: An echocardiogram revealed preserved left ventricular systolic function, with an ejection fraction of 60%. However, inferior wall hypokinesia was noted, suggesting underlying ischemia in that region.

Coronary Angiography: A coronary angiogram was performed via the right radial approach using a 5 French TIG diagnostic catheter. The angiogram revealed:

- Mild to moderate disease in the mid left anterior descending (LAD) artery (Figure 1a).
- Moderate disease in the obtuse marginal 1 (OM-1) of the left circumflex artery.
- Moderate to severe disease in the distal left circumflex (LCX) artery (Figure 1b).
- Diffuse subtotal severe disease in the proximal segment of the right coronary artery (RCA) (Figure 1c).

A fine streak of contrast dye was observed passing antegradely, with distal RCA filling occurring via collaterals from the left coronary system, indicating a complex chronic total occlusion.

Therapeutic Intervention

The patient was thoroughly informed about the necessity of revascularizing the right coronary artery (RCA) through percutaneous coronary intervention (PCI). The procedure was then initiated, engaging the RCA using an Amplatz left-1 (AL-1) guiding catheter via the right radial approach. A Runthrough coronary guidewire was used to cross the lesion using an over-the-balloon technique.

During the intervention, difficulty was encountered in advancing the guidewire into the distal vessel, raising the suspicion that it might be positioned within a dissection flap. To address this, a retrograde contrast injection was performed via a 6 French JL 4.0 catheter through the right femoral approach (Figure 2).

After successful crossing of the lesion, the guidewire was positioned in the right posterior left ventricular (R-PLV) artery. To ensure the preservation of viable vessels during the CTO intervention, another Runthrough coronary guidewire was placed in the right ventricular (RV) marginal branch. The lesion was then predilated with a semi-compliant (SC) balloon sized 2.0 × 15 mm (Figure 3), followed by the deployment of three drug-eluting stents (DES) sized 2.75 × 38 mm, 3.0 × 40 mm, and 3.0 × 15 mm from distal to proximal RCA.

During stent deployment in the mid RCA, which involved the RV marginal branch, a provisional bifurcation stenting strategy was employed in conjunction with the Jailed Semi-Inflated Balloon Technique (JSBT). The SC balloon was simultaneously inflated in the RV marginal branch at a sub-nominal pressure of 3 atm, while the main vessel was stented. This approach helped prevent carina shift, ensured adequate flow preservation, and improved side branch patency (Figure 4).

Post-dilation of the stents was performed using a non-compliant (NC) balloon sized 3.25 × 15 mm (Figure 5). The final assessment of the procedure revealed good stent expansion without any complications (Figure 6). The angioplasty was conducted under heparin cover, and dual antiplatelet therapy was initiated to optimize the patient's post-procedural management.

Follow-Up and Outcomes

The patient was discharged two days post-procedure after completing a cardiac rehabilitation program. Upon discharge, he was placed on a dual antiplatelet therapy regimen, which included Aspirin 75 mg and Ticagrelor 90 mg, along with Atorvastatin 40 mg, Bisoprolol 5 mg, and Losartan 25 mg.

A follow-up appointment after one week revealed that the patient was in stable clinical condition, demonstrating good functional capacity without any episodes of chest pain during exertion or bleeding complications. The patient expressed high satisfaction with the treatment outcomes and exhibited a thorough understanding of the importance of adhering to his medication regimen.

Discussion

Coronary chronic total occlusion (CTO) is characterized by a significant burden of atherosclerotic plaque within the artery, resulting in complete or nearly complete occlusion of the vessel.[1] Recanalization of CTOs via percutaneous intervention is an important consideration for patients experiencing angina that is resistant to medical therapy or for those with a large area of documented ischemia in the territory supplied by the occluded vessel.[2]

The complexities of CTO interventions are associated with several potential complications, including coronary perforation, guide catheter dissection, unintended blockage of collateral circulation, arrhythmias, distal embolism, intramural hematoma, extensive dissection, and loss of side branches[4]. To mitigate the risk of losing side branches during the intervention, a provisional bifurcation stenting strategy combined with the Jailed Semi-Inflated Balloon Technique (JSBT) was employed in this case.

In this approach, the semi-compliant (SC) balloon was inflated simultaneously in the right ventricular marginal branch at a lower pressure, while the main vessel was stented. This strategy effectively prevented carina shift, maintained blood flow, and improved the patency of the side branch. The primary goal of this technique was to preserve as many viable vessels as possible during the CTO procedure, thereby enhancing the overall outcome and reducing the risk of future ischemic events[5].

The successful application of JSBT in this case highlights its potential as a valuable tool in the interventional cardiologist's repertoire, particularly for complex cases involving CTOs where maintaining collateral circulation is crucial for optimal patient outcomes.

Conclusion

In conclusion, complex percutaneous coronary interventions (PCI) necessitate meticulous planning to account for all potential outcomes and complications. Specifically, in chronic total occlusion (CTO) interventions, preserving the patency of as many viable vessels as possible is paramount. This strategy not only optimizes immediate patient outcomes but also significantly reduces the risk of future ischemic events. By employing techniques such as the Jailed Semi-Inflated Balloon Technique (JSBT), interventional cardiologists can enhance procedural effectiveness and improve long-term prognosis for patients with CTO.

Learning points

- Understand the importance of comprehensive planning in complex PCI, particularly in cases of chronic total occlusion (CTO), to anticipate complications and improve procedural success.
- Recognize the critical role of maintaining side branch patency during CTO interventions in ensuring adequate myocardial perfusion and minimizing the risk of future ischemic events.
- Demonstrate knowledge of the Jailed Semi-Inflated Balloon Technique (JSBT) as an effective method for preserving side branch flow during CTO procedures.
- Identify potential complications, such as coronary perforation and side branch occlusion, and develop strategies to safely navigate these challenges during CTO interventions.
- Highlight the significance of post-procedural care, including dual antiplatelet therapy and cardiac rehabilitation, in promoting patient recovery and reducing the likelihood of adverse events following complex PCI.

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Figure/Video

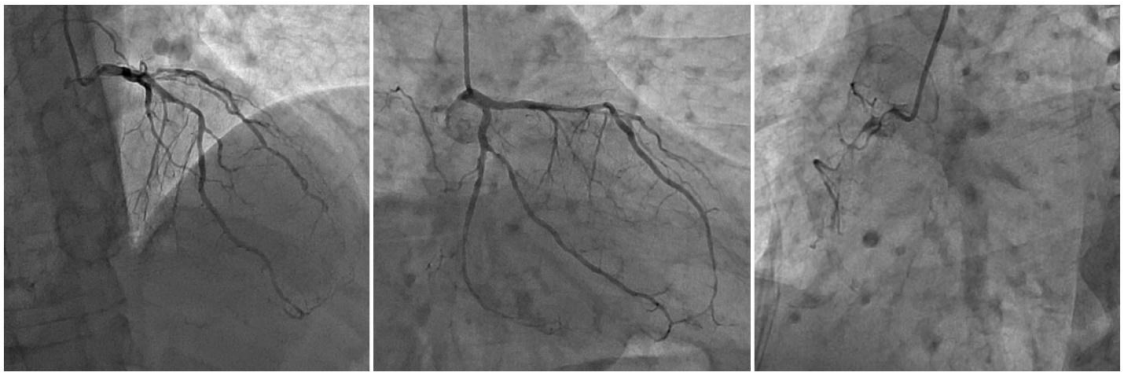

Figure 1a **Figure 1b** **Figure 1c**

Figure 1a: Mild to moderate disease in the mid left anterior descending (LAD) artery
Figure 1b: Moderate to severe disease in the distal LCX artery
Figure 1c: Diffuse subtotal severe disease in the proximal segment of the RCA

Figure 2: A retrograde contrast injection

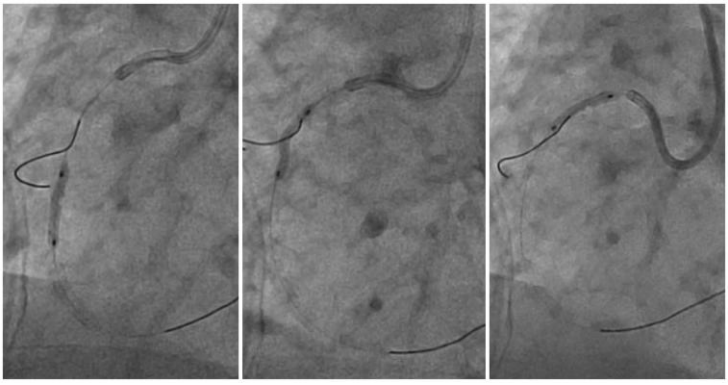

Figure 3: A semi-compliant (SC) balloon sized 2.0 × 15 mm

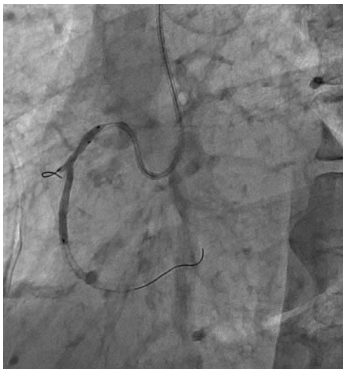

Figure 4: A provisional bifurcation stenting strategy employed in conjunction with the Jailed Semi-Inflated Balloon Technique (JSBT)

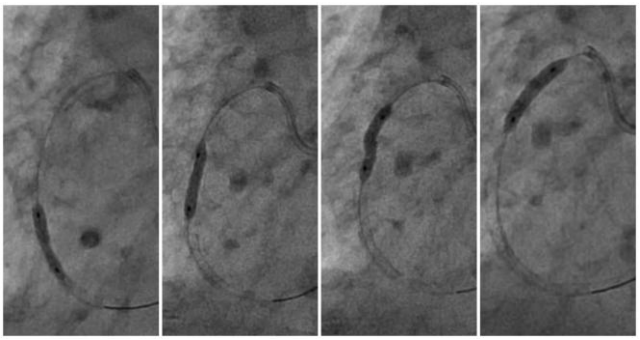

Figure 5: Post-dilation of the stents

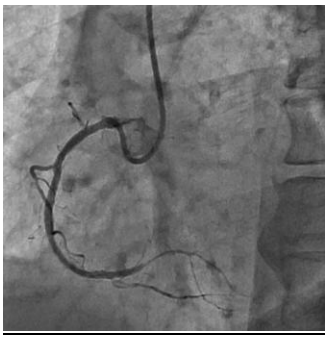

Figure 6: Stent expansion without any complications