



# Management of Intra-Stent Restenosis with an Oversized Stent: A Case Report and Review of Percutaneous Coronary Intervention Strategies

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## Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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**Case Report**

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## ABSTRACT

**Aims:** Percutaneous coronary intervention (PCI) is one of the important management options for intra-stent restenosis (ISR) following PCI. Undersized stents may lead to suboptimal results. Hence, adequate stent size relative to the vessel of the target is crucial. In this case, we have placed an oversized stent inside a smaller stent with ISR and followed up.

**Case Presentation:** A 48-year-old male came with complaints of exertional angina for 2 months. We proceeded with a coronary angiogram, which revealed ISR in the RCA and a patent stent in the

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LCX. Initial suboptimal predilatation and the non-availability of a cutting balloon were challenging. RCA stenting was done with a larger sized stent. He is doing well at the 22-month follow-up, asymptomatic, and on regular medications.

**Discussion:** The drug-eluting stent technology at present offers an effective antiproliferative effect. Hence, the demerit of vessel injury was counterbalanced by the merits of bigger final stent dimensions due to oversized stents. Similar to our case, this positive effect of stent oversizing was documented in procedural as well as clinical outcomes.

**Conclusion:** Selection of larger-size stents (preferably alternative DES) with appropriate attention to the edge effects can be considered an effective strategy for ISR while also optimizing long-term outcomes. Drug-coated balloons (DCB) may be taken into account for broadened use if they are proven to be non inferior to DES in randomized control trials.

*Keywords: In-stent Restenosis (ISR); drug eluting stent; oversized stent; PCI complications.*

## ABBREVIATIONS

ISR	-	Intrastent Restenosis
RCA	-	Right Coronary Artery
LCX	-	Left circumflex coronary artery
dES	-	Drug Eluting Stent
CAG	-	Coronary angiogram
PCI	-	Percutaneous coronary intervention
DCB	-	Drug coated balloon.

## 1. INTRODUCTION

Percutaneous coronary intervention (PCI) is one of the important management options for patients with coronary artery disease and intra-stent restenosis (ISR) following PCI [1]. Intrastent restenosis (ISR) is characterized by the presence of plaque within 5 mm of the stent edge, accompanied by a stenosis greater than 50% [2]. There is a 15%–30% incidence of ISR for stents [3]. The problem of ISR was tried to overcome with drug-eluting stents (DES) by making use of antiproliferative drugs like paclitaxel and sirolimus, which decrease proliferation of smooth muscles, delay re-endothelialization, and reduce neointimal formation [4,5]. In comparison with bare metal stents, the first-generation drug-eluting stents decreased the rate of ISR but increased the development of subacute, late, and very late stent thrombosis. These were associated with major adverse cardiac events, including myocardial infarction and death [5–7]. There is literature evidence that undersized stents lead to suboptimal results, mainly underexpansion of stents that result in ISR and stent thrombosis [8–10]. Hence, adequate stent size relative to the vessel of the target is crucial. In this case, we have placed an oversized stent inside a smaller stent with ISR and followed up.

## 2. CASE PRESENTATION

48-year-old male who is known to be diabetic and hypertensive has been on treatment for the past 12 years. History of an old inferior wall myocardial infarction (IWMI) in 2020, for which he was thrombolized with streptokinase and proceeded with a coronary angiogram (CAG) elsewhere. CAG showed 70% stenosis in the distal left circumflex (LCX) and 80% stenosis in the mid-RCA. Percutaneous coronary intervention (PCI) was done, and 3.0 x 28 mm sirolimus DES was deployed in the right coronary artery (RCA), and 2.75 x 16 mm sirolimus DES was deployed. 2 years later (2022), he came with a history of a 2-month duration of exertional angina. Electrocardiography revealed old IWMI, and echocardiography showed left ventricular (48%) mild left ventricular systolic dysfunction. We proceeded with a coronary angiogram, which showed 90% ISR in the RCA with a patent stent in the LCX. We proceeded from PCI to RCA. A 3.5 EBU guiding catheter was used to engage the RCA, and a blue wire was passed. Optimal predilatation couldn't be achieved with a 2.75 x 12 mm balloon even after multiple times at 16 atm for 20 sec. Due to the non-availability of cutting balloons, multiple predilatations are done by changing the position of the cougar XT wire, assuming it as the atherotome of cutting balloons at different angles. Predilatation was done with a 2.75 x 12 mm balloon. RCA stenting was done with a 3.5 x 44 mm everolimus drug-eluting stent into the old 3.0 x 28 mm sirolimus DES. Multiple post-dilatations were done with 3x8mm and 3.5x8mm balloons. Ostial flaring was done with a 4x8-mm balloon. The patient was followed up regularly in cardiology OPD after the procedure. In spite of initial suboptimal predilatation, the non-availability of cutting balloons, and intracoronary imaging, the procedure was successful, and he is doing well at the 22-month

follow-up. He is now asymptomatic on regular medications.

### 3. DISCUSSION

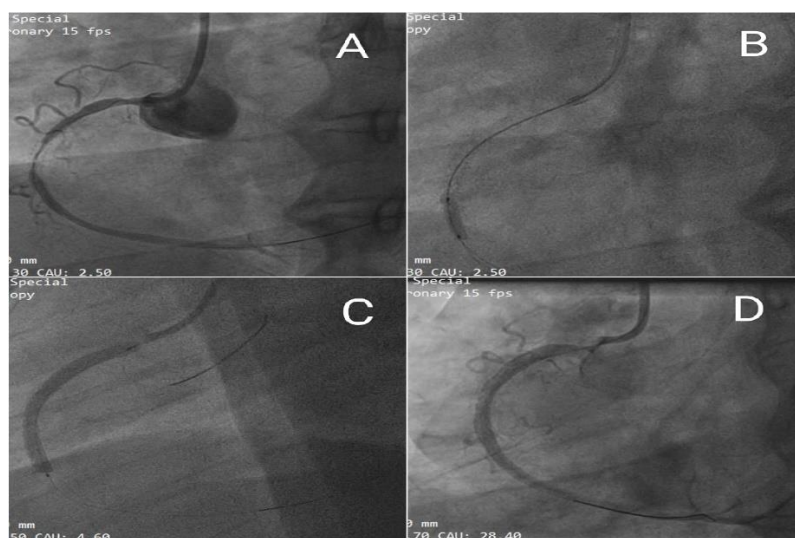
In-stent restenosis is characterized by the development of hyperplasia of the endothelium due to mechanical, biological, technical, and complex factors related to the patient that cause the destruction of target blood vessels and a spike in adverse cardiac events [11]. Hence, anticipation, early detection, and prevention of ISR are vital. It has been found that systemic hypertension, diabetes mellitus, greater than 1 lesion in coronary arteries, unstable angina, left anterior descending artery involvement, stent diameter greater than or equal to 3 mm, stent length more than 20 mm, and LDL cholesterol more than or equal to 1.9 mmol/L were the independent risk factors following PCI for ISR. Preventing these factors is essential to preventing ISR [12].

In terms of what causes restenosis, the three main mechanisms that happen are early elastic recoil, vascular remodeling, and neointimal hyperplasia. The first two mechanisms were mainly found before the stent era. Metallic struts present in the stent lead to neointimal hyperplasia. PCI causes intimal trauma, which alters the natural atherosclerotic process and triggers a severe local response to treatment. Atherosclerosis is a sequence of processes that

causes vasoconstriction and endothelial dysfunction, leading to elastic recoil mechanisms and vascular remodeling. These are increased by inflammatory pathways caused by vessel injury, as evidenced by the spike in C-reactive protein, or MCP-1, in patients at increased risk of restenosis [13].

One of the main risk factors for coronary artery disease (CAD) is hypertension. The blood increases the shear force on the vessel wall and damages the endothelial cells if there is a fluctuation in the blood pressure (BP) levels or a persistent increase in BP, which increases the incidence of ISR [14]. Therefore, patients with hypertension must strictly control their blood pressure after surgery.

Even though the strategy of bigger stents was previously accepted in the baremetal stent era, it has also been mentioned that implantation of oversized stents may result in neointimal proliferation [15, 16], which is probably caused by vessel injury due to overstretching [16–18]. The drug-eluting stent technology at present offers an effective antiproliferative effect. Hence, the demerit of vessel injury was counterbalanced by the merits of bigger final stent dimensions due to oversized stents [19]. Similar to our case, this positive effect of stent oversizing was documented in procedural as well as clinical outcomes.



**Fig. 1. A- RCA angiogram showing in-stent restenosis  
B- Predilatation during PCI to RCA using 2.75x 12 mm balloon.  
C- Stenting of RCA with 3.5 X 44 mm everolimus drug eluting stent into the old 3.0 X 28 mm sirolimus DES.  
D- RCA angiogram after post dilatation.**

Even in DES deployment, aggressive selection of bigger stents with good attention to the edge effects can optimize long-term outcomes. [18] POBA alone has a high recurrence rate; selecting another layer of stent (preferably an alternative DES) is most commonly used but not desired. This leaves drug-coated balloons as a potential treatment, but they are subjected to effective randomized control trials for their future utilization [20, 21]. DES provides the advantages of both a vascular scaffold and drug delivery. This is particularly beneficial in diffusely diseased and heavily calcified vessels, as well as in dissection. However, DES may have disadvantages, such as triggering stent thrombosis, if adequate antiplatelet treatment is not provided. Bioresorbable DES offers the benefit of both DES and drug-coated balloons and also has supporting early data. However, we will need to conduct long-term follow-up [22].

#### 4. CONCLUSION

The selection of larger-size stents (preferably alternative DES) with appropriate attention to the edge effects can be considered an effective strategy for ISR while also optimizing long-term outcomes. Drug-coated balloons (DCB) and Bioresorbable DES may be taken into account for broadened use if they are proven to be non inferior to DES in randomized control trials.

#### DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

#### ETHICAL APPROVAL

As per international standards or university standards written ethical approval has been collected and preserved by the author(s).

#### CONSENT

All authors declare that 'written informed consent was obtained from the patient/attender for publication of this case report and accompanying images.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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