

# The Miracle of IVUS for Unforeseen Stent Thrombosis: A Case Report

Maryam Mehrpooya<sup>1</sup>, Parisa Koohsari<sup>1</sup>, and Ehsan Moradi Farsani<sup>1</sup>

<sup>1</sup>Tehran University of Medical Sciences

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## Introduction

Stent thrombosis (ST) is a complication of percutaneous coronary intervention (PCI) with catastrophic clinical consequences and an incidence rate of 3% - 20% . Stent underexpansion and malapposition are the major causes of this complication that can be well-diagnosed and prevented by intracoronary imaging like intravascular ultrasound (IVUS) and optical coherence tomography (OCT) .

This report presents a 60-year-old gentleman with a history of recent PCI on RCA (due to inferior NSTEMI). RCA stent thrombosis was diagnosed during staged PCI for LCX-OM which was successfully managed under the guidance of IVUS.

## Case Presentation

The patient, a 60-year-old non-smoker man with a history of hypertension, dyslipidemia, and PCI on the left anterior descending (LAD) artery 3 years ago was admitted to our hospital with severe chest pain, dyspnea, and diaphoresis. In electrocardiography, sinus rhythm and ST depression (4 mm) were seen in inferior leads (II, III, and aVF). Troponin I level was elevated to twenty times of normal reference value.

He was diagnosed with Non-ST-Segment Elevation Myocardial Infarction (NSTEMI) and underwent coronary angiography via the right radial artery, which revealed significant lesions in the LCX and OM arteries, moderate stenosis (50-60%) in the distal edge of the LAD stent (Figure 1, Movie 1), as well as a thrombotic lesion in the proximal to mid part of the RCA (Figure 2, Movie 2). PCI was performed on the RCA using Xience Alpine 3.5\*33 mm stent, followed by sufficient postdilation by NC Saphaire and Vecchio 3.5\*18 mm balloons (Figure 3, Movie 3).

Staged PCI for LCX-OM was scheduled two weeks later regarding borderline renal function (Cr=1.3 mg/dl) and after hydration and renal support. Notably, the patient complied well with treatment and received aspirin and clopidogrel as standard strategy. PCI was successfully performed for LCX by Xience Alpine 3.5\*15 mm stent and OM by Supraflex 2.75\*28 mm stent.

We evaluated the previously implanted stent in RCA, but we were suddenly surprised by the thrombotic lesion in the middle of the stent (Figure 4, Movie 4), and now it was time to seek help from the savior IVUS. IVUS showed a semi-fresh thrombus in the middle of the RCA stent with remarkable stent underexpansion (Figure 5, Movie 5). Therefore, we performed thrombosuction by Capturer thrombus extraction catheter and postdilation by NC TREK 4\*15 mm balloon.

During the final control injection, a mobile clot was detected in the proximal part of RCA (Figure 6, Movie 6), necessitating another round of thrombosuction. However, subsequent angiography and IVUS study revealed TIMI grade 3 flow in the RCA and demonstrated complete expansion and apposition of the stent struts (Figure 7, Movie 7). As a result, the patient was discharged two days later in a stable condition. This case

highlights the importance of IVUS in evaluating procedural success, especially for assessing stent expansion and apposition.

## Discussion

ST is a rare but devastating complication of PCI with up to 50% mortality rate in early cases . ST can be caused by various mechanisms: patient-related, pharmacologic, procedure-related, postprocedural, and lesion-related factors . Acute coronary syndrome (ACS), reduced kidney function (considering GFR), history of previous coronary artery disease (CAD), uncontrolled hypertension, and hyperlipidemia were among the possible patient-related factors causing stent thrombosis in our case. However, a meta-analysis on factors impacting ST questioned the clinical significance of baseline characteristics in terms of predicting ST in patients undergoing PCI due to high heterogeneity in outcomes .

Stent under-expansion, stent under-sizing, geographic miss, edge dissection, in-stent tissue protrusion/prolapse, acute stent malapposition, stent fracture, longitudinal stent deformation, and non-uniform strut distribution are stent-related problems which can cause ST and can be detected by intravascular imaging like IVUS and OCT . We detected stent underexpansion in IVUS imaging of our patient, despite the sufficient postdilation performed 2 weeks ago after stent implantation.

IVUS is an imaging modality used to characterize lesion morphology, quantify plaque burden, guide stent sizing, assess stent expansion, and identify procedural complications by obtaining a 360-degree view of the vessel . IVUS played a key role in the diagnosis of stent thrombosis in our case, which seemed to be the result of procedure-related, as well as patient-related factors.

Randomized trials have demonstrated that an IVUS-guided revascularization strategy compared with angiography-guided PCI can lead to improved clinical outcomes and is associated with a reduction in major adverse cardiovascular events (MACE) . This was explained with more postdilation and larger stent sizes, final larger angiographic minimal lumen diameters, and larger minimal stent areas while using IVUS, which minimized stent underexpansion. Also, more stents were implanted and longer stents were used with IVUS guidance to minimize geographic miss and treat edge dissections .

Stent underexpansion is a major risk factor of stent thrombosis, defined as when the stent doesn't reach nominal stent size but stent struts reach the vessel wall. Post-PCI inadequate minimal stent area (MSA) is consistently the strongest predictor of stent thrombosis .

A meta-analysis of randomized trials of IVUS vs. angiographic guided bare metal stent (BMS) implantation (n=2193 patients) revealed that IVUS guidance was associated with a significantly larger post-procedure angiographic minimum lumen diameter, as well as, a significantly lower rate of angiographic restenosis (22.2% vs. 28.9%, p=0.02), repeated revascularization (12.6% vs. 18.4, p=0.004), and overall MACE (19.1% vs. 23.1%; p=0.03) . Therefore, checking for adequate expansion also good apposition with IVUS can be of great help in preventing the disastrous consequences of stent thrombosis.

## Conclusion

ST is a medical emergency that may be associated with death, myocardial infarction, and significant cardiac morbidity, which mainly requires revascularization.

This case emphasized IVUS as a highly useful modality for investigating the causal mechanisms of ST, as it reveals pathophysiologic factors underestimated by conventional angiography and identifies patients who may benefit from more additional coronary interventions, and it should be at the center of our attention.

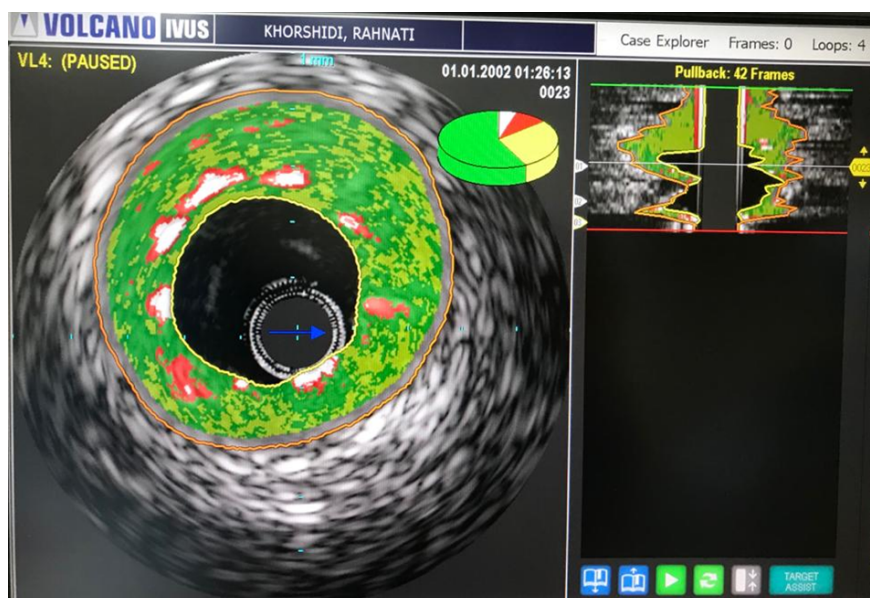
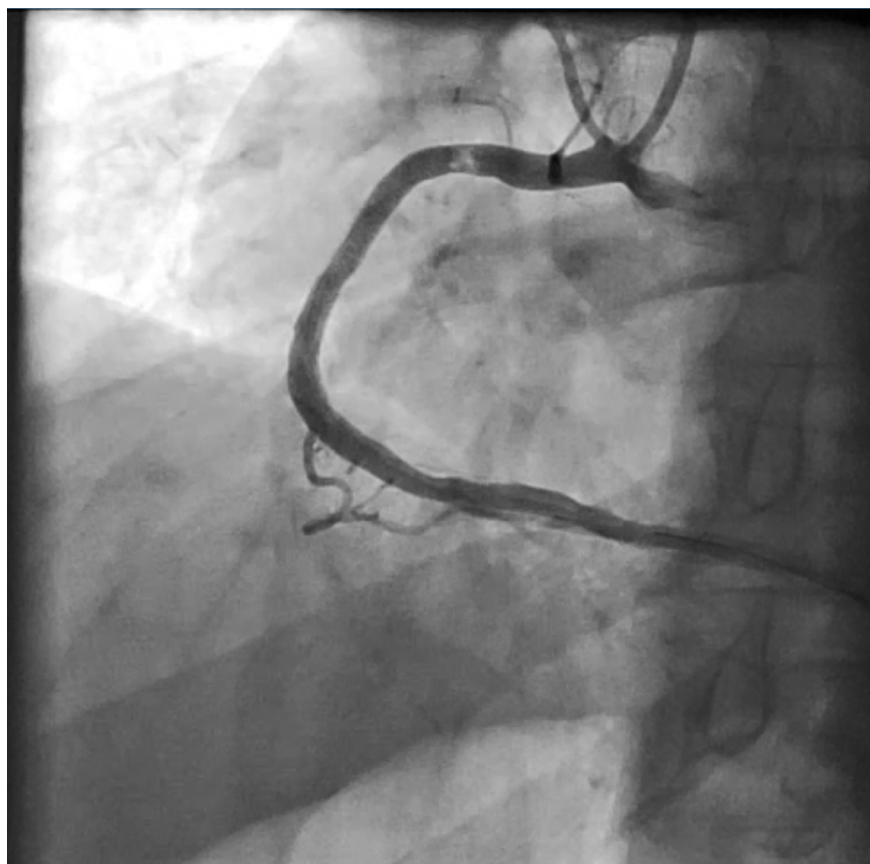
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