

Role of IVUS/OCT in the Management of NSTEMI with Concomitant Supraventricular Tachycardia: A Case-Based Analysis**Ritesh Kheemanee¹, Sanjeev Bhatia², Vivek Nanda³**¹DNB Resident, Department of Emergency Medicine, KD Hospital, Ahmedabad, Gujarat, India.²Consultant, Department of Cardiology, KD Hospital, Ahmedabad, Gujarat, India.³Consultant, Department of Emergency Medicine, KD Hospital, Ahmedabad, Gujarat, India.

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Abstract

Background: Non–ST-segment elevation myocardial infarction (NSTEMI) complicated by supraventricular tachycardia (SVT) presents unique diagnostic and therapeutic challenges. Advanced intracoronary imaging modalities—such as intravascular ultrasound (IVUS) and optical coherence tomography (OCT)—enable precise lesion characterization, optimized stent deployment, and improved procedural outcomes in percutaneous coronary intervention (PCI).

Case Summary: We report a case series of three male patients, presenting with NSTEMI and documented SVT. The first patient, with single-vessel disease involving a 95% concentric stenosis of the left anterior descending artery, underwent IVUS-guided PCI with drug-eluting stent implantation, achieving optimal TIMI III flow. The second patient, with complex triple-vessel disease and prior PCI to the right coronary artery, underwent staged OCT-guided PCI to the obtuse marginal branch (OM1) and drug-eluting balloon angioplasty to OM2, with confirmation of stent expansion and apposition on post-procedural OCT. Both had preserved left ventricular systolic function, uneventful recoveries, and were discharged in stable condition on optimal medical therapy.

Conclusion: This case series underscores the value of IVUS and OCT in guiding PCI for NSTEMI complicated by SVT. Advanced imaging facilitates tailored revascularization strategies, ensures optimal device deployment, and supports favourable short-term outcomes, while coordinated arrhythmia management is essential for maintaining hemodynamic stability during intervention.

Keywords: Non–ST-Elevation Myocardial Infarction, Supraventricular Tachycardia, Percutaneous Coronary Intervention, Intravascular Ultrasound, Optical Coherence Tomography.

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Introduction

Non-ST-elevation myocardial infarction (NSTEMI) represents a major subset of acute coronary syndromes, often presenting with heterogeneous clinical manifestations.[1] Among its various complications, supraventricular tachycardia (SVT) can pose a diagnostic and therapeutic challenge, as it may both mimic ischemic symptoms and exacerbate myocardial oxygen demand.

When promptly recognized, SVT can often be terminated by maneuvers that increase vagal tone, intravenous adenosine administration, or synchronized cardioversion, depending on hemodynamic stability. [2] Early identification and treatment of SVT, together with recognition of underlying myocardial ischemia, are essential, as timely revascularization significantly improves outcomes. The co-occurrence of NSTEMI with SVT is relatively uncommon but clinically

significant, necessitating prompt recognition and tailored management. Advances in intracoronary imaging modalities, particularly intravascular ultrasound (IVUS) and optical coherence tomography (OCT), have enhanced lesion assessment, stent optimization, and procedural outcomes in percutaneous coronary intervention (PCI). These technologies enable high-resolution visualization of plaque morphology, accurate measurement of vessel dimensions, and detailed assessment of stent expansion and apposition. [3]

We report case series of three male patients in their fourth and fifth decades presenting with NSTEMI and documented SVT, who underwent successful PCI with the aid of intracoronary imaging guidance. This case series highlights the clinical presentation, angiographic findings, and procedural strategies in NSTEMI patients with coexisting

SVT, emphasizing the role of intracoronary imaging in achieving optimal PCI outcomes.

Case Description

Case 1

A 47-year-old male with a history of hypertension and hypothyroidism, and no history of diabetes mellitus, presented with acute-onset palpitations, excessive perspiration, exertional dyspnea, and a sense of impending doom since the morning of admission. On arrival, he was hemodynamically stable. A 2D transthoracic echocardiogram revealed no regional wall motion abnormalities at rest and

preserved left ventricular systolic function with an ejection fraction of 60%. Electrocardiographic monitoring during admission showed supraventricular tachycardia (SVT), correlating with the patient's presenting symptoms. Coronary angiography was performed via right radial artery access. The left main coronary artery was angiographically normal. The left anterior descending (LAD) artery was found to be a Type III vessel with 95% concentric stenosis accompanied by ectasia. The left circumflex artery was non-dominant, exhibiting 50% proximal eccentric stenosis (Figure 1).

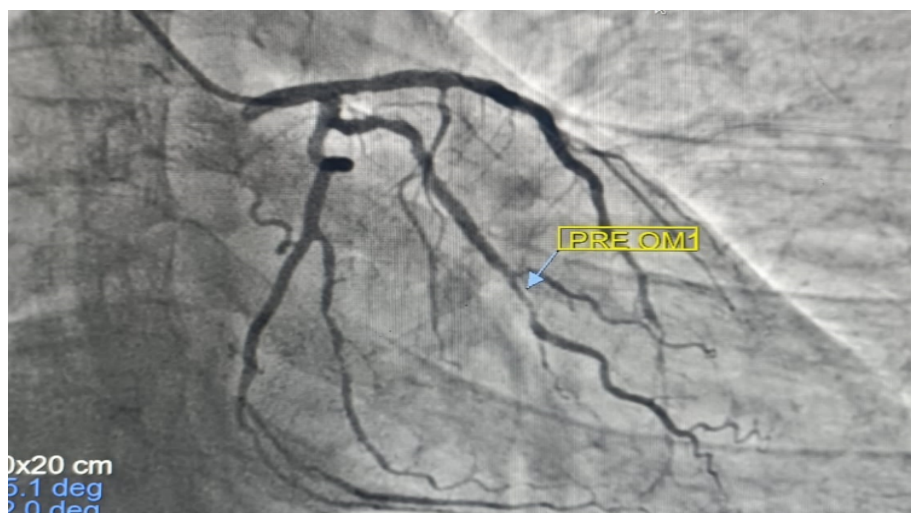


Figure 1: LAD artery (Type III vessel) with 95% concentric stenosis.

The right coronary artery was dominant with minor distal stenosis (30%) before the crux.

Based on these findings, the diagnosis of single-vessel coronary artery disease involving the LAD, non-ST elevation myocardial infarction (NSTEMI), and supraventricular tachycardia was established. The patient underwent successful percutaneous transluminal coronary angioplasty (PTCA) to the LAD using intravascular ultrasound (IVUS)

guidance and drug-eluting stent (DES) implantation, achieving optimal TIMI III flow (Figure 2).

The patient's post-procedure course was uneventful. He was monitored in the ICU before transfer to the ward, remained hemodynamically stable, and was discharged on dual antiplatelet therapy, statin, ezetimibe, thyroxine, and supportive medications, with follow-up scheduled.

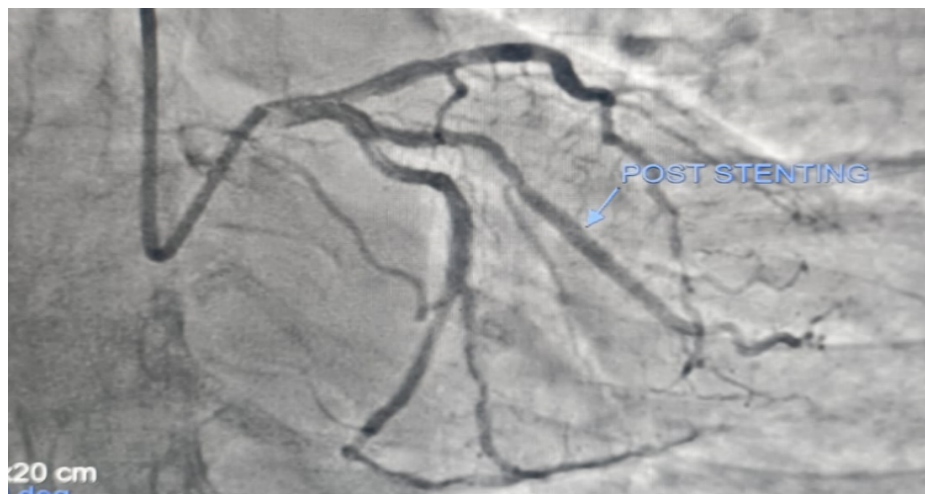


Figure 2: PTCA to the LAD resulting in optimal TIMI III flow.

Case 2

A 41-year-old normotensive, non-diabetic male with a known history of ischemic heart disease and previously documented triple-vessel coronary artery disease presented with new-onset palpitations, chest discomfort, and diaphoresis lasting one hour prior to arrival. He had a history of NSTEMI one month earlier, during which he underwent OCT-guided PTCA with DES implantation to a totally occluded mid-RCA. He was scheduled for a staged intervention to the LCX/OM system. On admission, he was found to be in supraventricular tachycardia at 164 bpm, associated with mild hypotension. The arrhythmia reverted to sinus rhythm following administration of intravenous adenosine. Post-conversion ECG showed non-specific ST-T changes, and serial high-sensitivity troponin assays demonstrated a rising trend, consistent with NSTEMI. A repeat transthoracic echocardiogram revealed preserved left ventricular systolic function (EF 55%) with no new regional wall motion abnormalities. After initial stabilization, coronary angiography was performed. Findings were consistent with previously documented triple-vessel disease, including 80% fibro-calcific stenosis of OM1 and a significant lesion in OM2. The patient underwent OCT-guided PTCA to OM1, followed by drug-eluting balloon (DEB) angioplasty to OM2. OCT imaging confirmed adequate stent expansion, optimal apposition, and absence of edge dissection or thrombus. The patient's ICU and ward courses were uneventful. He was discharged in stable condition on dual antiplatelet therapy, anticoagulation, antibiotics, and supportive care, with advice on lifestyle modification and regular follow-up for rhythm and restenosis surveillance.

Case 3

A 50-year-old male, with a history of hypertension and smoking, presented with acute-onset palpitations, profuse sweating, and central chest discomfort of 3 hours duration. On admission, he was hemodynamically stable but in supraventricular tachycardia, which reverted to sinus rhythm after intravenous adenosine. Transthoracic echocardiogram revealed preserved left ventricular systolic function (EF: 60%) with no wall motion abnormality. Serial cardiac biomarkers were elevated, consistent with NSTEMI. Coronary angiography via radial access demonstrated a critical (95%) mid-LAD lesion. The left main was normal; LCX was small and non-dominant; RCA was dominant with mild irregularities. IVUS confirmed a concentric plaque with heavy lipid burden and minimal luminal area (3.2 mm²), guiding stent sizing and deployment. The patient underwent IVUS-guided PCI with DES implantation to the LAD. IVUS confirmed adequate stent expansion and apposition with

restored TIMI III flow. He remained stable, with no recurrence of SVT during monitoring and was discharged at day 3 on dual antiplatelet therapy, beta-blocker, statin, and supportive medications.

Discussion

Arrhythmias are well-recognized complications of ACS, though SVT is less commonly encountered than ventricular arrhythmias.⁴ Nevertheless, its occurrence in NSTEMI is clinically significant, as SVT can exacerbate myocardial ischemia by increasing oxygen demand and reducing diastolic filling time, thereby worsening the ischemic burden. [5] In our case series, all patients presented with symptomatic SVT in the context of NSTEMI, underscoring the importance of a high index of suspicion and early diagnostic evaluation. The management of NSTEMI complicated by SVT requires a dual approach: immediate rhythm stabilization and definitive treatment of the culprit coronary lesion. Acute rhythm control may be achieved pharmacologically with adenosine or beta-blockers, or with electrical cardioversion in refractory cases. [6,7] Once stabilized, urgent coronary angiography remains the cornerstone for diagnosis and revascularization. However, conventional angiography may underestimate lesion severity, particularly in eccentric, ostial, or diffuse plaques.[8]

Intravascular ultrasound (IVUS) provides high-resolution cross-sectional imaging of the vessel wall and lumen, allowing detailed assessment of plaque morphology, lesion length, and minimal luminal area. [9] Importantly, IVUS guidance during percutaneous coronary intervention (PCI) has been shown to optimize stent sizing, ensure complete expansion and apposition, and reduce the risks of restenosis and stent thrombosis. [10] Several randomized trials and meta-analyses have confirmed the superiority of IVUS-guided PCI over angiography-guided PCI in terms of procedural and long-term outcomes, particularly in complex lesions such as left main and proximal LAD disease. [11,12] Case 1 represents a classic example of an atypical NSTEMI presentation. The patient's primary symptoms of palpitations, dyspnea, and autonomic distress were driven by SVT, which can both be triggered by and exacerbate myocardial ischemia. Further complicating the scenario was the presence of coronary ectasia in the LAD artery, a challenging anatomy where angiography alone can misrepresent vessel dimensions. IVUS provided precise cross-sectional imaging that allowed accurate vessel sizing and confirmed optimal stent expansion and apposition, ultimately guiding a successful intervention. A potential drawback of IVUS, however, is prolonged procedure time, which must be balanced against its diagnostic and therapeutic benefits.

The role of staged PCI in managing complex multivessel disease is also well recognized, with clinical and nonclinical factors often influencing the decision to perform revascularization in multiple sessions rather than a single procedure. Case 2 demonstrates such a staged strategy in a patient with complex triple-vessel CAD. While completing PCI in a single session may reduce overall cost and procedural repetition, staging can be clinically prudent to enhance patient safety, especially in high-burden disease. Optical coherence tomography was central to the planned intervention, offering high-resolution visualization that enabled detailed characterization of fibro-calcific plaque morphology in the obtuse marginal branches. These OCT insights facilitated a tailored hybrid approach—drug-eluting stent (DES) implantation for the more severe OM1 lesion and drug-eluting balloon (DEB) angioplasty for OM2—thereby achieving optimal revascularization while minimizing the long-term foreign body burden. In conclusion, these cases reinforce several key principles of contemporary interventional cardiology. First, the use of advanced intracoronary imaging with both IVUS and OCT provides critical information beyond conventional angiography. Second, the management of a concomitant arrhythmia requires careful peri-procedural monitoring to maintain hemodynamic stability and prevent ischemic exacerbation. Third, the ability to tailor revascularization strategies—such as choosing between a staged versus a single-session approach and selecting between a DES or a DEB based on lesion characteristics—is essential for maximizing procedural success and long-term vessel patency. These cases serve as a compelling illustration of how imaging-guided, personalized interventions enhance patient safety and contribute to favorable clinical outcomes in challenging scenarios.

Patient Consent: A voluntarily written informed consent was obtained from the patients for the use of their clinical data and images.

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