

Concurrent inferior stemi with third-degree AV block and acute intracranial haemorrhage: how we overcame this clinical challenge—a case report

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Received 29 December 2024; revised 10 May 2025; accepted 2 August 2025; online publish-ahead-of-print 8 August 2025

Background

The concurrent management of ST-elevation myocardial infarction (STEMI) and acute intracerebral haemorrhage (ICH) poses a significant clinical challenge due to conflicting treatment goals. While the management of STEMI requires coronary reperfusion with antithrombotic agents (anticoagulants and antiplatelets), such treatments are contraindicated in cases of ICH. The coexistence of STEMI and ICH is exceedingly rare in the literature and is associated with high mortality rates. Furthermore, no specific guidelines currently exist for managing such cases.

Case summary

We report a case of a 67-year-old male presenting with acute ICH who subsequently developed inferior STEMI complicated by third-degree atrioventricular block. The patient underwent a deferred percutaneous coronary intervention (PCI) strategy, involving only balloon angioplasty and thrombectomy without stent placement, to restore coronary flow while minimizing the risk of exacerbating the intracranial haemorrhage. Three days later, ischaemia progressed to recurrent myocardial infarction, at which point reassessment revealed stabilization of the ICH, allowing for stent placement in the right coronary artery (RCA) and the administration of antithrombotic therapy.

Discussion

The deferred PCI strategy, involving initial thrombectomy and balloon angioplasty without stent placement, facilitated temporary restoration of coronary flow and provided a critical time window for the stabilization of the ICH. This approach enabled subsequent stent implantation and the reintroduction of antithrombotic therapy (anticoagulants and antiplatelets). This strategy demonstrates its effectiveness in managing patients with concurrent STEMI and ICH by balancing the risks of ischaemia and haemorrhage, thereby improving clinical outcomes.

Keywords

Case report • Acute intracranial Haemorrhage • ST-elevation Myocardial Infarction • Deferred PCI

ESC curriculum

2.1 Imaging modalities • 3.2 Acute coronary syndrome • 3.4 Coronary angiography • 7.3 Critically ill cardiac patient • 7.4 Percutaneous cardiovascular post-procedure

Learning points

- Revascularisation using thrombus aspiration and balloon angioplasty in a deferred PCI strategy, without stenting or antithrombotic drugs, can restore TIMI flow in STEMI complicated by ICH without exacerbating the haemorrhage.
- IVUS-guided sizing and optimization reduce stent mal-apposition and thrombotic risk in STEMI with high-bleeding risk.
- Drug-eluting stents validated for short dual-antiplatelet therapy minimize haemorrhagic risk after re-intervention in ICH.

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Handling Editor: Amir Khalifa

Peer-reviewers: A Shaheer Ahmed; Jonathan Senior

Compliance Editor: Nikesh Jathanna

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Introduction

STEMI and ICH are two critical medical emergencies associated with high mortality rates and requiring urgent management. The incidence of STEMI ranges from 43 to 144 per 100 000 population per year, with in-hospital mortality rates of 4%–12% and 10% within the first year.¹ The incidence of ICH is 29.9 per 100 000 population per year, which is higher in Asian populations,² with a 30-day mortality rate of 40%–50%.³

The coexistence of STEMI and ICH is exceedingly rare, with a reported incidence of 0.27% among STEMI cases.⁴ However, in-hospital mortality rates are alarmingly high, ranging from 41% to 57%.^{4,5} The treatment of STEMI involves coronary reperfusion with anticoagulants and antiplatelet agents,^{1,6} whereas ICH management focuses on blood pressure control and stabilization of consciousness, with antithrombotic therapy being contraindicated.

This report describes a clinical case of concurrent STEMI and ICH managed with a deferred PCI strategy, prioritizing stabilization of the ICH before performing comprehensive coronary intervention.

Summary figure

Date	Event
Day 1 (Admission)	<p>Patient admitted to the hospital for altered consciousness and right-sided weakness.</p> <p>Diagnosis: Acute intracerebral hemorrhage (ICH) (Left basal ganglia, volume 31 mm³).</p> <p>Management: Neurological monitoring and blood pressure control initiated.</p>
Day 1 (Hour 4)	<p>Patient developed chest pain, hypotension (80/50 mmHg), bradycardia (30–45 bpm), and SpO₂ 72%.</p> <p>Diagnosis: Acute inferior STEMI with complete heart block.</p> <p>Management: Temporary transcutaneous pacing initiated. Patient prepared for coronary angiography.</p>
Day 1 (First PCI)	<p>Transfer to Cathlab.</p> <p>Coronary angiography revealed mid-RCA occlusion with heavy thrombus burden. IVUS showed 360° thrombus and plaque burden (61%).</p> <p>Management: Deferred PCI strategy implemented—thrombus aspiration and balloon angioplasty performed. TIMI II flow restored without stent placement or anticoagulation.</p>
Day 2 + 3	<p>Patient reported reduced chest pain, vital signs stabilized, and ST elevation on ECG decreased. Neurological status improved, with better consciousness level.</p>
Day 4 (Recurrence)	<p>Patient experienced recurrent chest pain, difficulty breathing, and worsening AV block. MRI showed ICH stability (reduced volume to 26 mm³).</p> <p>Diagnosis: Recurrent STEMI due to re-occlusion of RCA. ICH stable.</p> <p>Management: Multidisciplinary team decided on definitive coronary intervention given stable ICH. Patient transferred for PCI.</p>
Day 4 (Second PCI)	<p>- Coronary angiography (DSA) revealed re-occlusion of mid-RCA.</p> <p>- Two drug-eluting stents (DES) were deployed: Synergy XD (3.5 × 48 mm) and Megatron (5.0 × 20 mm).</p> <p>- IVUS post-stenting showed incomplete stent apposition (gap 0.57–0.84 mm) and thrombus protrusion into the lumen.</p> <p>- High-pressure balloon dilation was performed to optimize stent apposition.</p> <p>- Final IVUS confirmed good stent apposition with a minimal stent area (MSA) of 10 mm², no thrombus, and TIMI III flow restored.</p>
Day 14	<p>Patient recovered well without chest pain or neurological symptoms. IVUS confirmed well-apposed stents, no thrombus, and TIMI III flow. Patient discharged with dual antiplatelet therapy (short DAPT) and follow-up scheduled.</p>

Case presentation

A 67-year-old male patient with a history of hypertension presented with altered consciousness and right-sided hemiparesis. Brain MRI revealed acute ICH in the left basal ganglia with a volume of 31 mm³. The patient was alert with a Glasgow Coma Scale score of 12 and an ICH score of 2. The initial ECG showed no ST-T abnormalities (Figure 1).

After one hour of treatment in the neurology department, the patient developed sweating, agitation, hypotension (BP: 80/50 mmHg), bradycardia (heart rate: 30–45 bpm), and oxygen saturation of 72%. ECG revealed inferior STEMI (ST elevation in leads II, III, and aVF) complicated by third-degree AV block. A diagnosis of concurrent STEMI and ICH was established.

First intervention

We considered the drop in SpO₂ was caused by reduced cardiac output secondary to an acute myocardial infarction complicated by third-degree atrioventricular (AV) block, resulting in severe hypotension

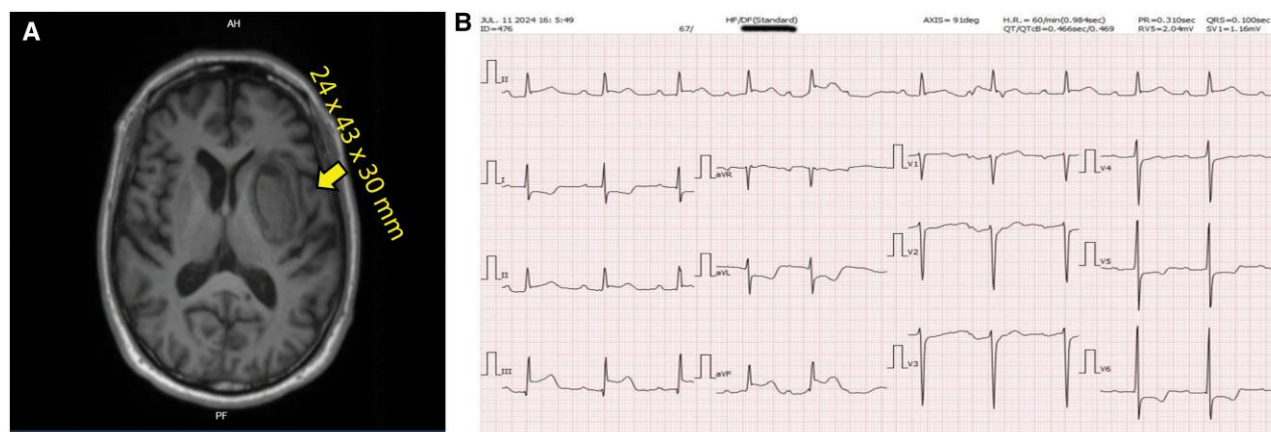


Figure 1 (A) Brain MRI showing acute ICH in the left basal ganglia with a volume of 31 mm³ (dimensions: 24 × 43 × 30 mm). Microbleeds were observed in the left basal ganglia, pons, thalamus, subcortical white matter, and right cerebellar hemisphere, suspected to be hypertension-related. (B): ECG taken at the neurology department 1 h later showed ST elevation in leads II, III, and aVF, with third-degree atrioventricular block and a ventricular rate of 60 beats per minute.

and marked bradycardia. Patient had STEMI together with ICH. Both conditions were severe and carried a high risk of death, especially because of impending cardiogenic shock. Without coronary reperfusion the patient would likely have died from cardiac shock. Temporary transcutaneous pacing was performed to stabilize hemodynamics. Concurrently, after discussing risks and benefits with his family, we chose a reperfusion strategy using thrombus aspiration and balloon angioplasty, avoiding antithrombotic drugs.

Coronary angiography via the femoral artery was subsequently performed (Figure 2). Angiography revealed total occlusion of the mid-right coronary artery (mRCA) with normal LAD and LCx. Intravascular ultrasound (IVUS) showed 360° thrombus extending from the mid to distal RCA (mRCA-dRCA) and atherosclerotic plaque in the proximal RCA (pRCA) with a plaque burden of 61% and a minimal luminal area (MLA) of 7.19 mm².

We opted for a deferred PCI strategy: only thrombus aspiration and balloon angioplasty were performed to achieve temporary reperfusion. We also considered a drug-eluting balloon (DEB); however, after manual aspiration, we removed only part of the clot. Given the large amount of remaining thrombus, a DEB was deemed unsuitable. Specifically, no Heparin was administered during the procedure, and no loading or maintenance antiplatelet agents were given. Despite that, coronary flow improved from TIMI 0 to TIMI II. After emergency transcutaneous pacing and revascularization with manual thrombus aspiration followed by balloon angioplasty, heart rate and arterial pressure improved, and the patient's SpO₂ returned to normal.

Clinical course

On day 3 of post-procedure, the patient experienced recurrent chest pain and dyspnoea. ECG revealed recurrent ST elevation in leads II, III, and aVF, along with advanced second-degree AV block alternating with third-degree AV block (Figure 3). Multidisciplinary consultation confirmed that the ICH had stabilized clinically and radiographically, with the haematoma size reduced from 31 mm³ to 26 mm³. The mechanism of ICH was suspected to be hypertension-related, based on MRI findings, with low suspicion of vascular malformation. A decision was made to proceed with a second coronary intervention.

Second intervention

Repeat coronary angiography revealed re-occlusion of the mRCA. Loading doses of aspirin and clopidogrel plus a single bolus of unfractionated heparin 80 IU/kg were administered immediately before implantation of two drug-eluting stents in the mid-RCA; ACT was not monitored. Post-procedure, TIMI III flow was restored.

IVUS-guided optimization was performed, revealing incomplete stent apposition (gap of 0.57–0.84 mm from the vessel wall). High-pressure balloon post-dilation was conducted to ensure proper stent apposition (Figure 4).

The patient was discharged after 14 days in a stable condition, without chest pain or dyspnoea, and with sinus rhythm restored. Pre-discharge coronary angiography confirmed TIMI III flow, and IVUS showed well-apposed stents without residual thrombus or edge dissection. A short dual-antiplatelet therapy (DAPT) strategy with aspirin and clopidogrel was initiated for 1 month, accompanied by strict blood-pressure control and scheduled brain-CT surveillance; if no intracranial re-bleeding is detected, DAPT will be continued for 3–6 months, but it will be discontinued earlier should haemorrhage recur (Figure 5).

The patient has been followed up monthly, with four visits to date. He remains clinically stable, with no chest pain or dyspnoea, and shows gradual recovery of neurological deficits.

Discussion

Clinical challenges and treatment strategy

Concurrent STEMI and ICH is a rare but highly critical condition, with a high mortality rate,⁵ ranging from 57% to 65%,^{4,7} significantly higher compared with STEMI without ICH (6.1%) or ICH without STEMI (42%).^{5,8} Treating these two conditions requires meticulous consideration due to the opposing treatment strategies, and current literature lacks specific guidelines. A review of similar cases revealed limited reports, most of which resulted in poor outcomes. Obagi's report suggested that temporary coronary revascularization using plain old balloon angioplasty without stent placement during the acute phase could achieve favourable results.⁹

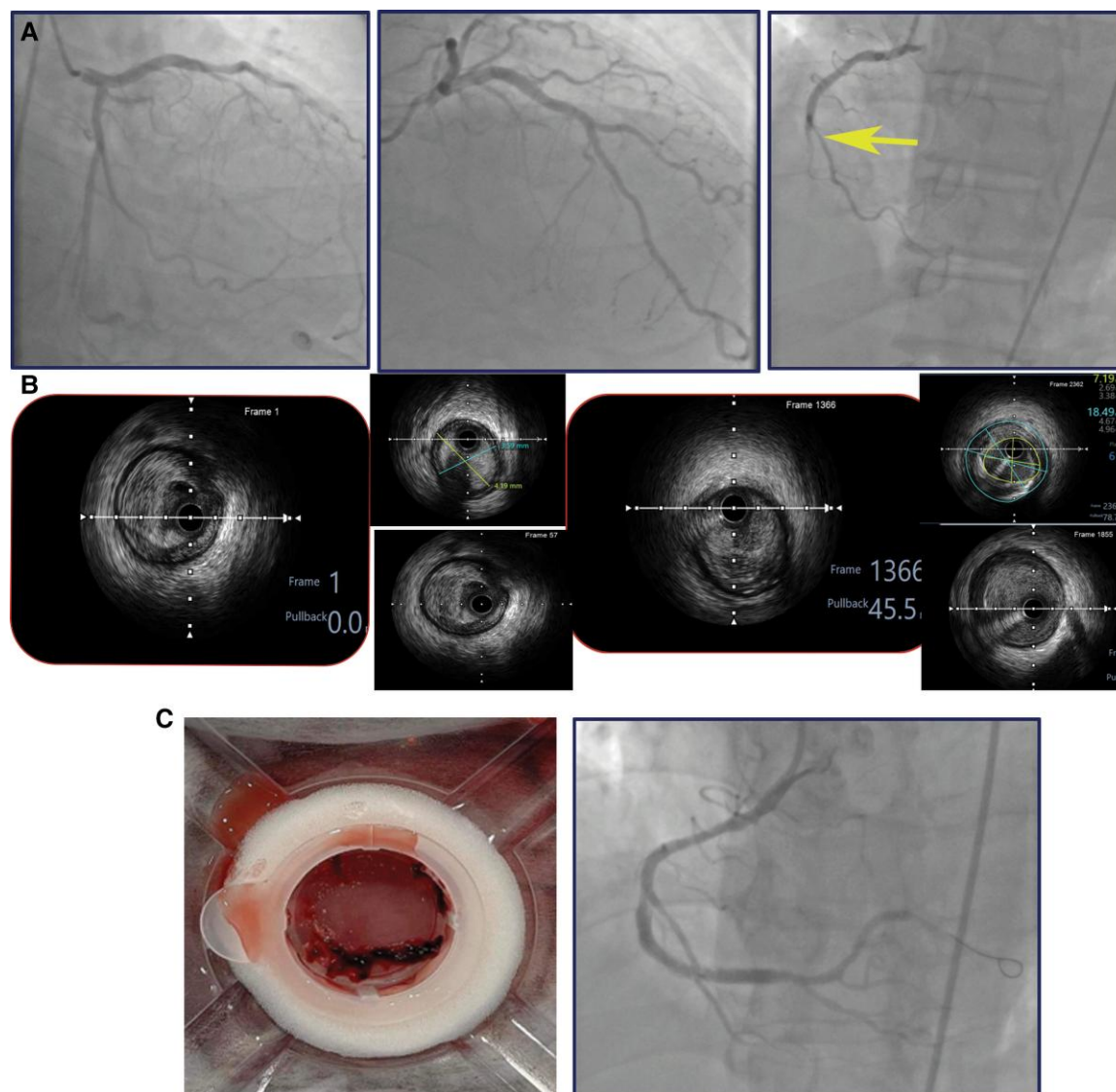


Figure 2 (A) Coronary angiography showing total occlusion of the mRCA (culprit lesion), with normal LAD and LCx. (B): IVUS of the mRCA revealed a 360° thrombus extending from the mid to distal RCA and a pRCA lesion with a plaque burden of 61% and an MLA of 7.19 mm². (C): Extracted thrombus from the RCA (left image). Post-aspiration and balloon angioplasty of the RCA, angiography showed partial thrombus resolution with TIMI II flow (right image).

Deferred PCI strategy during the first intervention

In this case, we implemented a deferred PCI strategy, which involved delaying stent placement and performing only thrombus aspiration through a catheter, combined with temporary pacing and avoidance of antithrombotic agents to minimize the risk of worsening intracranial haemorrhage. This approach, supported by the DANAMI 3-Defer trial¹⁰ and Mahmoud's meta-analysis¹¹ has been shown to neither increase mortality nor long-term major adverse events while reducing the incidence of no-reflow and improving microvascular perfusion.

Decision for the second intervention

On the third day of post-intervention, the patient experienced recurrent chest pain and worsening AV block. Multidisciplinary consultation confirmed that the ICH had stabilized, with a reduced haematoma size and no further progression. After carefully weighing the risks and benefits, a decision was made to proceed with stent placement in the culprit artery.

We selected stents supported by evidence for short-duration dual antiplatelet therapy (short DAPT) to significantly reduce bleeding risks in patients with high haemorrhagic risk.⁶ The procedure was guided by IVUS, a method proven to lower target vessel

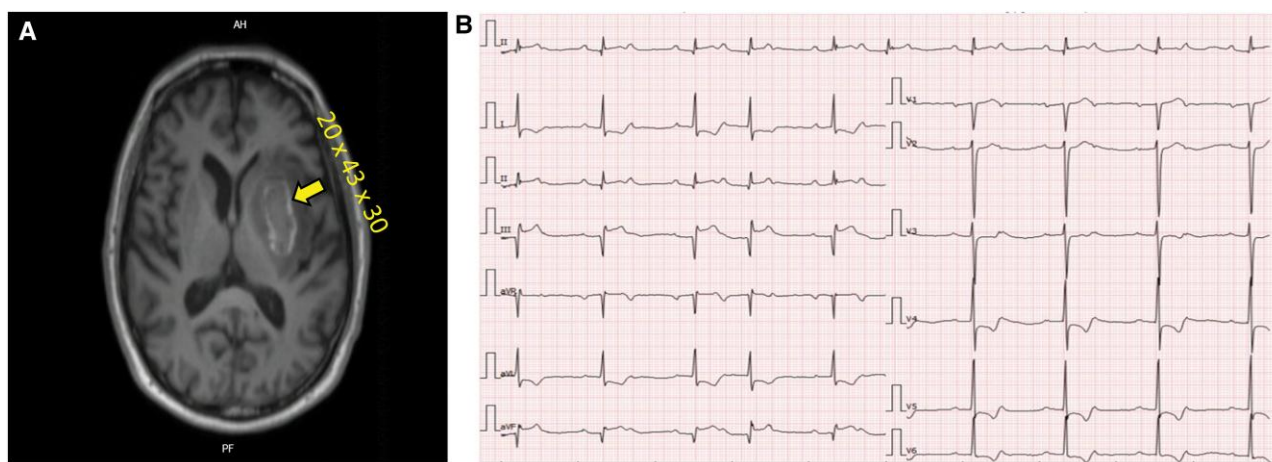


Figure 3 (A) Follow-up MRI on day 3 showing a subacute haematoma in the left basal ganglia, reduced in size to 26 mm³ (dimensions: 20 × 43 × 30 mm). (B): ECG on day 3 showing recurrent ST elevation in leads II, III, and aVF, along with advanced second-degree AV block alternating with third-degree AV block.

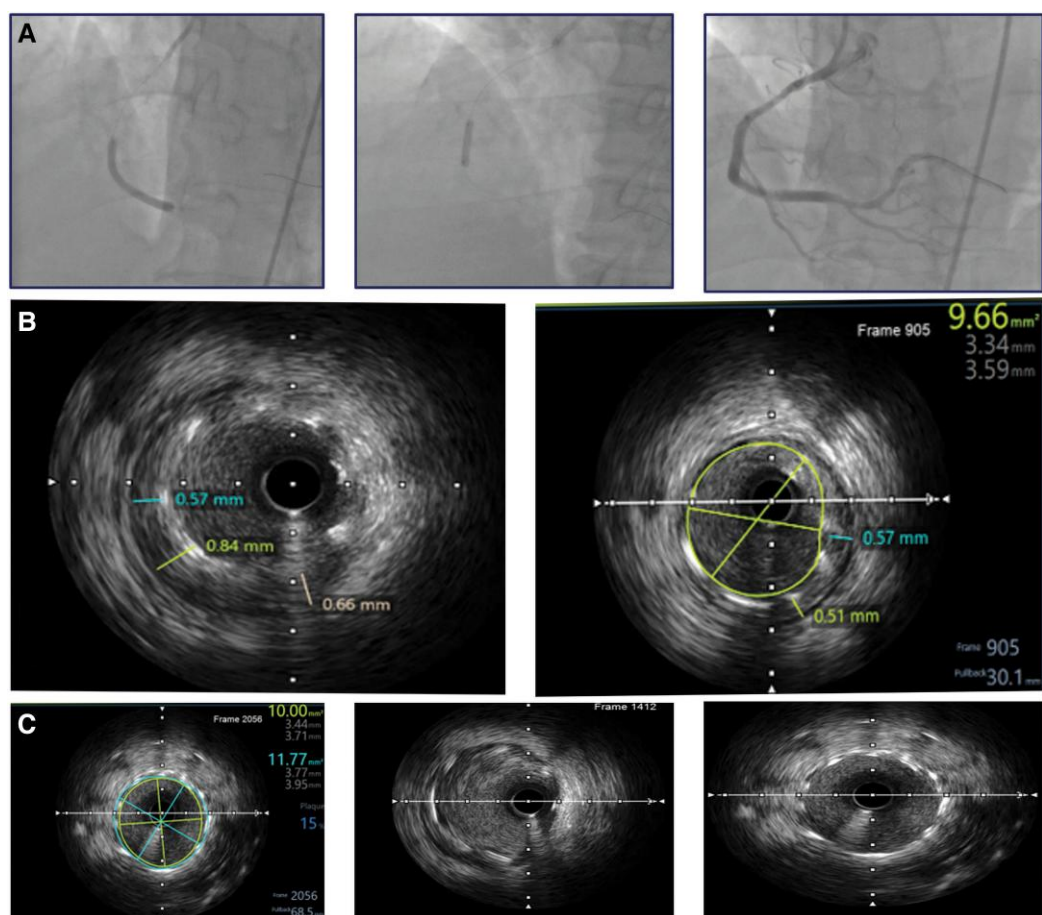


Figure 4 (A) Deployment of an everolimus synergy XD stent (3.5 × 48 mm, 16 atm) in the mid-RCA and an Everolimus Megatron stent (5.0 × 20 mm, 12 atm) in the proximal RCA. (B): IVUS post-stenting revealed incomplete stent apposition with a gap of 0.84 mm between the stent and the vessel wall. (C): Final IVUS check showed complete stent apposition, residual thrombus protrusion, and a minimal stent area of 10.0 mm².

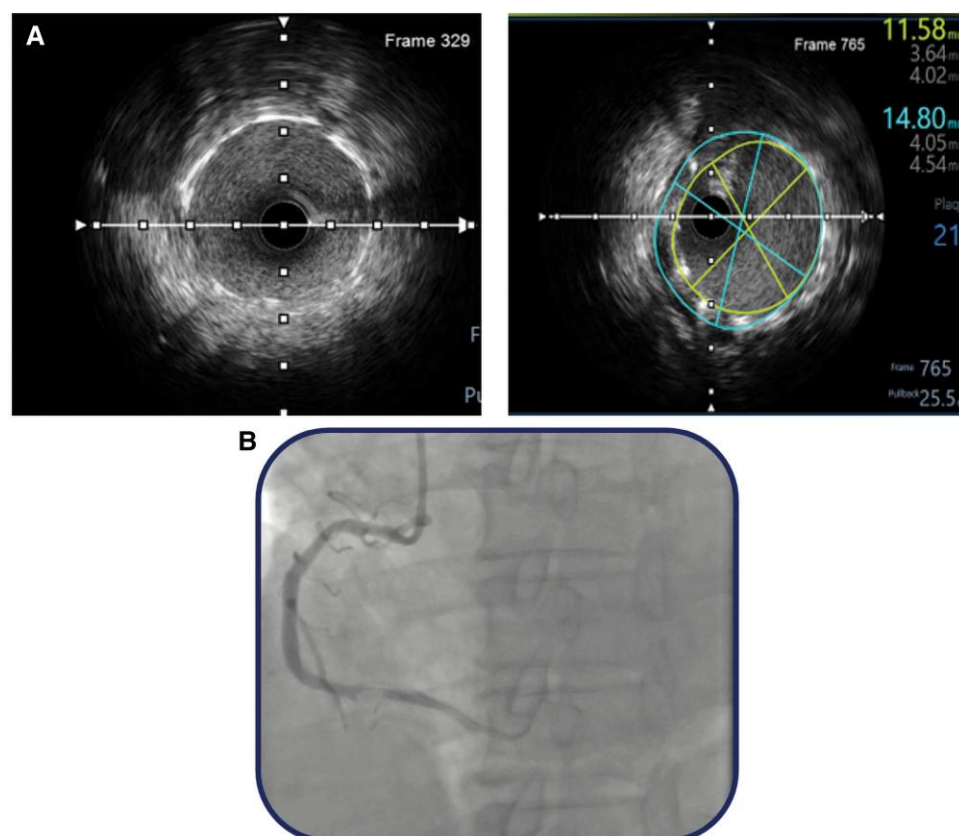


Figure 5 (A) Follow-up IVUS after 14 days showing well-apposed stents with a CSA of 11.58 mm², no edge dissection. (B) Angiography confirmed TIMI III flow without residual thrombus.

failure rates and stent thrombosis compared with angiography alone.¹² Post-stenting, TIMI III flow was restored, but IVUS revealed residual stenosis, thrombus protrusion into the stent lumen, and incomplete stent apposition. High-pressure non-compliant balloon dilation was performed to ensure full stent apposition. An additional stent was placed to cover the remaining thrombus, maintaining stable coronary flow.

At a 2-week follow-up, repeat coronary angiography confirmed restored TIMI III flow, with no residual thrombus in the vessel lumen. The patient showed significant recovery and was discharged in stable condition.

Conclusion

This case highlights the rare concurrence of ICH and STEMI, a critical condition with high mortality and no specific treatment guidelines in current literature. The use of the deferred PCI strategy allowed stabilization of the ICH before comprehensive coronary intervention, supported by IVUS to optimize lesion assessment and procedural outcomes. Given the high risk of recurrent bleeding, we prioritized stents validated for short DAPT¹³ to prepare for potential early antiplatelet discontinuation.

The successful management of this case not only reinforces the validity of this treatment strategy in similar situations but also provides valuable academic contributions to international medical literature.

Lead author biography



Dr Le Duy Lac is Head of the Department of Cardiac Intensive Care at Thu Duc City Hospital, Ho Chi Minh City, with over 14 years of experience in cardiology, particularly in interventional cardiology, specializing in acute coronary syndromes, complex PCI, and structural heart disease. He holds a Specialist Doctoral Degree (Level 2) in Cardiology and has co-authored three research articles in ISI, Scopus, and PubMed-indexed journals.

Dr Lac is recognized for his expertise in managing high-risk cases and ensuring procedural safety in complex interventions. He is an active member of the Vietnam National Heart Association, the Ho Chi Minh City Society of Interventional Cardiology, and the Ho Chi Minh City Heart Rhythm Society.

Consent: The authors confirm that written consent for submission and publication including images and texts has been obtained from the patient in line the Committee on Publication Ethics guidance and under the review board of the hospital administration.

Conflict of interest. None declared.

Funding: None declared.

Data availability

The data underlying this article will be shared on reasonable request to the corresponding author.

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