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CASE REPORT
Coronary intervention

Subacute right coronary artery thrombosis treated by using Excimer Laser Coronary Angioplasty: a case report

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Background Managing high thrombotic burden in the context of myocardial infarction remains a challenging scenario.

Case summary A 51-year-old male was admitted for a subacute inferior myocardial infarction with persistent chest pain. Emergent coronary angiography showed an ostial–proximal thrombotic occlusion of a large ectatic right coronary artery. Several balloon inflations were performed that were not able to improve distal TIMI flow beyond II. With the intent of vaporizing the remaining thrombus, Excimer Laser Coronary Angioplasty was performed with a favourable outcome.

Discussion The present case constitutes an opportunity to revisit percutaneous and non-percutaneous strategies to tackle persistent coronary thrombus showing a contemporary approach to niche technologies such as laser angioplasty.

Keywords Coronary artery disease • Myocardial infarction • Laser therapy • Acute coronary syndrome • ELCA • IVUS • Case report

ESC curriculum 3.2 Acute coronary syndrome • 3.1 Coronary artery disease

Learning point

- Excimer Laser Coronary Angioplasty is highly effective in coronary lesions with severe thrombotic burden and a good alternative to mechanical thrombus aspiration.

Introduction

Thrombotic burden is an established poor prognostic marker in ST-segment elevation myocardial infarction (STEMI),[1,2] and managing patients with intracoronary thrombus remains a therapeutic conundrum for clinicians and interventionalists. The following clinical case describes an example of the utilization of laser coronary angioplasty in subacute thrombotic occlusions with high risk of no-reflow.

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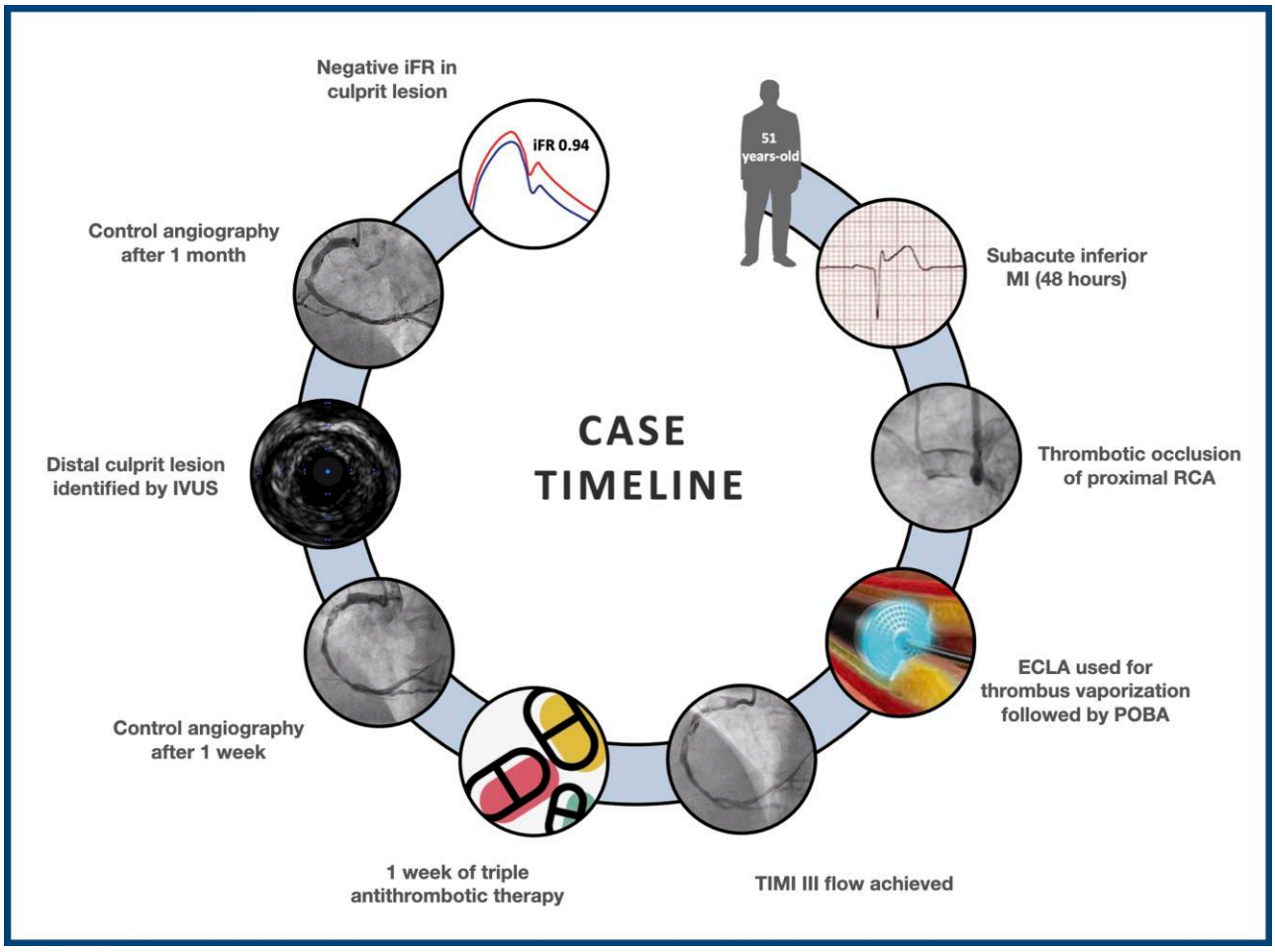
Summary figure



Case report

Our patient is a 51-year-old male without known past medical history or cardiovascular risk factors who presented himself in the emergency department with severe chest pain in the last 48 h. Physical examination revealed normal vital signs (heart rate 89 b.p.m., blood pressure 136/59 mmHg, peripheral O_2 saturation 98% in room air). Cardiopulmonary auscultation was negative for cardiac murmurs or pulmonary rales. The 12-lead electrocardiogram showed pathological Q waves and ST-segment elevation in the inferior leads for which he was brought to the catheterization laboratory for invasive evaluation.

The coronary angiography showed an ostial–proximal thrombotic occlusion of a seemingly large ectatic right coronary artery (RCA) (*Figure 1A*—Supplementary material online, *Video S1*). The left coronary tree was angiographically normal. Due to persistent symptomology, primary percutaneous coronary intervention was decided. The RCA was engaged with a 7 Fr Amplatz Left 1 guide catheter, and numerous attempts were made to cross the occlusion with a standard workhorse guidewire, without success.

Using intravascular ultrasound (IVUS) imaging as a reference and after increasing guide-catheter support utilizing the buddy-wire technique, a second hydrophilic guidewire was advanced to the distal RCA (*Figure 1B*). We then changed this wire for an extra-support guidewire using a microcatheter and advanced a semi-compliant 3.0/8.0 mm balloon that was able to restore distal TIMI I–II flow after several inflations (*Figure 1C*). Subsequent balloon inflations were not able to further improve coronary flow due to the extensive intracoronary thrombotic content. As such, Excimer Laser Coronary Angioplasty (ELCA) was decided with the intent of vaporizing the remaining thrombus. Using a 1.4 mm ELCA catheter, a total of 10 applications were made (40 mJ·mm^{-2}, 35 Hz—Supplementary material online, *Video S2*) with significant reduction of the thrombotic content in the mid-distal RCA and improvement of distal flow to TIMI III (*Figure 1D*—Supplementary material online, *Video S3*).

As some thrombus remained in the proximal segment, several inflations were made with increasing balloon diameters (4.0 mm, 4.5, and 5.0 mm) and mechanical aspiration using a guide-catheter extension was performed with angiographical improvement. Given the clinical and angiographical improvement, we decided to stop the procedure and maintain medical treatment with triple antiplatelet therapy (oral acetylsalicylic acid 150 mg i.d. after a single 250 mg dose, oral ticagrelor 90 mg b.i.d. after a single 180 mg dose, and intravenous tirofiban 0.15 μg/kg/min for 12 h) and anticoagulation (subcutaneous enoxaparin 80 mg b.i.d.).

After one week, a scheduled coronary angiography showed significant improvement in intracoronary thrombus content in the mid-distal RCA (*Figure 1E*). An intermediate stenosis in the distal segment (presumably the original culprit lesion) was also found. Intravascular ultrasound imaging

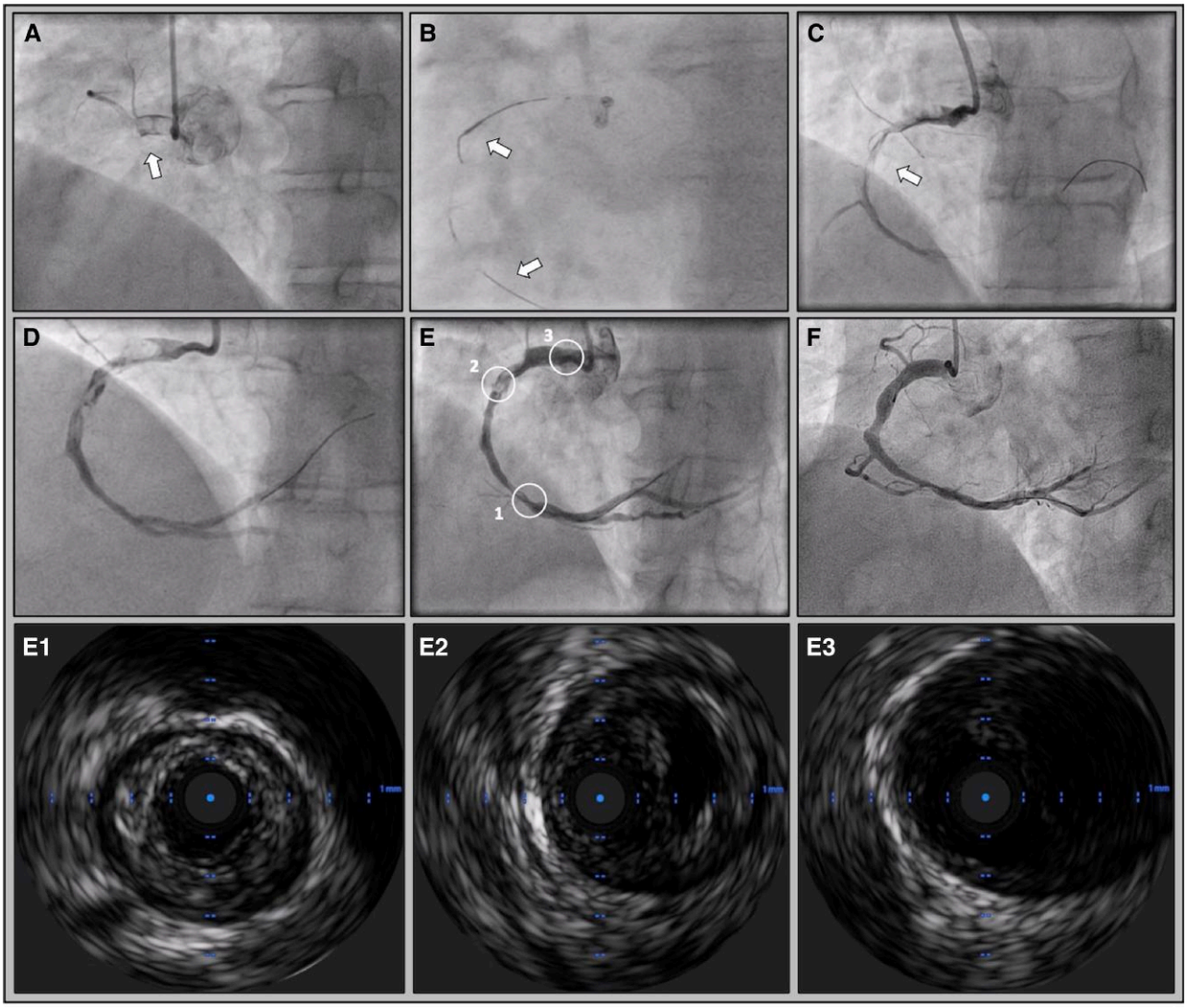


Figure 1 (*A*) Proximal RCA occlusion by an organized thrombus. (*B*) Wiring into distal RCA using buddy-wire technique. (*C*) Distal TIMI I–II flow after balloon dilations. (*D*) Distal TIMI III flow after ECLA and thrombus aspiration. (*E*) One week follow-up coronary angiography showing significant thrombus in the mid and distal RCA. Pullback IVUS showed: (*E1*) a severe concentric lesion in distal RCA; (*E2*) persistence of intraluminal thrombus in proximal RCA; and (*E3*) large proximal RCA lumen diameter. (*F*) One month follow-up after triple antithrombotic therapy showing complete dissolution of the remaining thrombus.

confirmed the presence of a stenotic fibroatheroma in the distal segment (minimal luminal area of 4.2 mm^2—*Figure 1E1*), the persistence of intraluminal thrombus in the middle segment (*Figure 1E2*), and significant ectasia in the proximal segment (mean diameter 6.5 mm—*Figure 1E3*).

The patient's recovery was uneventful as he continued treatment with double antiplatelet therapy plus anticoagulation for one month after which a third coronary angiography was performed depicting total thrombus dissolution and good distal flow (*Figure 1F*—Supplementary material online, *Video S4*). Instantaneous wave-free ratio interrogation of the distal lesion was negative (0.94), and stent implantation was deferred. The follow-up transthoracic echocardiography showed preserved left ventricular systolic function with hypokinesia of the middle and apical inferior wall.

Discussion

Randomized controlled trials have consistently failed to demonstrate the additional benefit of routine mechanical thrombus aspiration in patients with STEMI and high intracoronary thrombotic burden,[3] probably due to insufficient thrombus removal by the current aspiration devices, as shown by optical coherence tomography studies.[4]

In the last decade, laser coronary angioplasty, and particularly ECLA, has regained popularity in specific complex scenarios, such as in-stent restenosis and debulking thrombotic occlusions of saphenous vein grafts due to the high risk of distal embolization and no-reflow.[5]

The ELCA effect is based on three different mechanisms as follows: photochemical, photothermal, and photomechanical. The laser light is absorbed by intraluminal material and disrupts carbon–carbon bounds. Subsequently, the energy released elevates the temperature of intracellular H_2O molecules, resulting in cellular wall rupture and generation of vapour bubbles at the catheter tip. Finally, the expansion and implosion of the vapour bubbles damage the obstructive intravascular material in small fragments. Hence, its thrombus-vaporizing effect surpasses the mechanical effect of aspiration.[6] A continuous saline flush technique is frequently used to control energy delivery and minimize dissection

risk, and the application of laser in blood or contrast media should only be undertaken by experienced ECLA operators.

The present case displays in a practical way, the potential use of contemporary ELCA as complementary tool for the management in cases with severe thrombotic burden even in subacute settings.

Lead author biography

Daniel Faria is a cardiologist finishing his fellowship in Interventional Cardiology.

Supplementary material

Supplementary material is available at *European Heart Journal – Case Reports* online.

Consent: Our patients have given signed consent for the scientific publication of this case. We have complied with the Committee on Publication Ethics (COPE) recommendations.

Conflict of interest: None declared.

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Data availability

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

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