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# **Effective use of the cutting balloon technique for treatment of intramural haematoma complicating a complex percutaneous intervention in a patient with multivessel disease and severely decreased left ventricular ejection fraction**

**Short title:** Cutting balloon technique for treatment of intramural haematoma

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An 80-year-old man with multivessel coronary artery disease was admitted to our department of cardiology for an elective multivessel high-risk percutaneous coronary intervention (PCI) with left ventricle assist device support — Impella CP (ABIOMED Inc., Danvers, MA, US). The patient had a prior history of myocardial infarction and atherosclerotic risk factors which included hypertension, type 2 diabetes mellitus and dyslipidemia. Transthoracic echocardiogram (TTE) revealed a left ventricular ejection fraction (LVEF) of 20%. The procedure was preceded by “Heart Team” qualification.

The Impella CP was placed in the left ventricle (LV) via right femoral arterial access. In the first part of the procedure, the right coronary artery (RCA) was treated, rotational atherectomy was used and 3 drug-eluting stents (DES) were implanted (XienceProS, Abbott Vascular, Chicago, IL, US). The second part of the procedure covered PCI of the left main coronary artery (LMCA) and left anterior descending artery (LAD). After initial predilatation, the intravascular lithotripsy (IVL) technique was used with a shockwave balloon (Shockwave Medical, Inc, Santa Clara, CA, US). Subsequently, DES (XienceProS 3.5 × 38 mm) was

implanted in the LMCA and proximal-mid-LAD at a 16 atm pressure. The post-stenting angiogram revealed distal stent edge stenosis (Figure 1A). The intravascular ultrasound (IVUS) demonstrated an intramural haematoma (IMH) compressing the vessel lumen (Figure 1B). Hence, it was decided to fenestrate the haematoma with a cutting balloon — dimensions: 2.5 × 10 mm (Flextome, Boston Scientific, MA, US) was inflated to 8 atm (Figure 1C). Afterwards, the fenestrated area was stented (XiencePro 3.0 × 38 mm, 12 atm). Angiography showed that the haematoma distally shifted to the second stent (Figure 1D). Further inflation of the cutting balloon to 6 atm was performed with awaited effect. The IVUS control showed an optimal outcome (Figure 1E). The final angiogram demonstrated patency of LAD — TIMI (thrombolysis in myocardial infarction) flow grade 3 (Figure 1F). During the hospital stay, the patient was rehabilitated and mobilised without any signs or symptoms of cardiac ischaemia, and was finally discharged within the next 3 days. Phone call follow-up confirmed satisfactory post-PCI rehabilitation.

In the available literature on the subject, there are case reports on using the cutting balloon (CB) method in the treatment of spontaneous and post-stenting IMHs [1–3]. Coronary artery intramural haematoma after stenting is an uncommon complication of PCI, but its occurrence can lead to significant ischaemia, thrombosis and final occlusion of the culprit artery [4]. IVUS is a tool useful for detecting IMH, and it offers complete vessel visualisation in terms of both circumferential and longitudinal haematoma extent. Furthermore, the use of IVUS can guide PCI and minimise the incidence of PCI-related complications [1, 5]. There are currently no guidelines on the treatment of intramural haematomas therefore, treatment should be individualised on the basis of patient characteristics and clinical scenario. In the presented case, we have demonstrated that cutting balloons can be an effective management strategy for post-stenting intramural haematomas.

### **Article information**

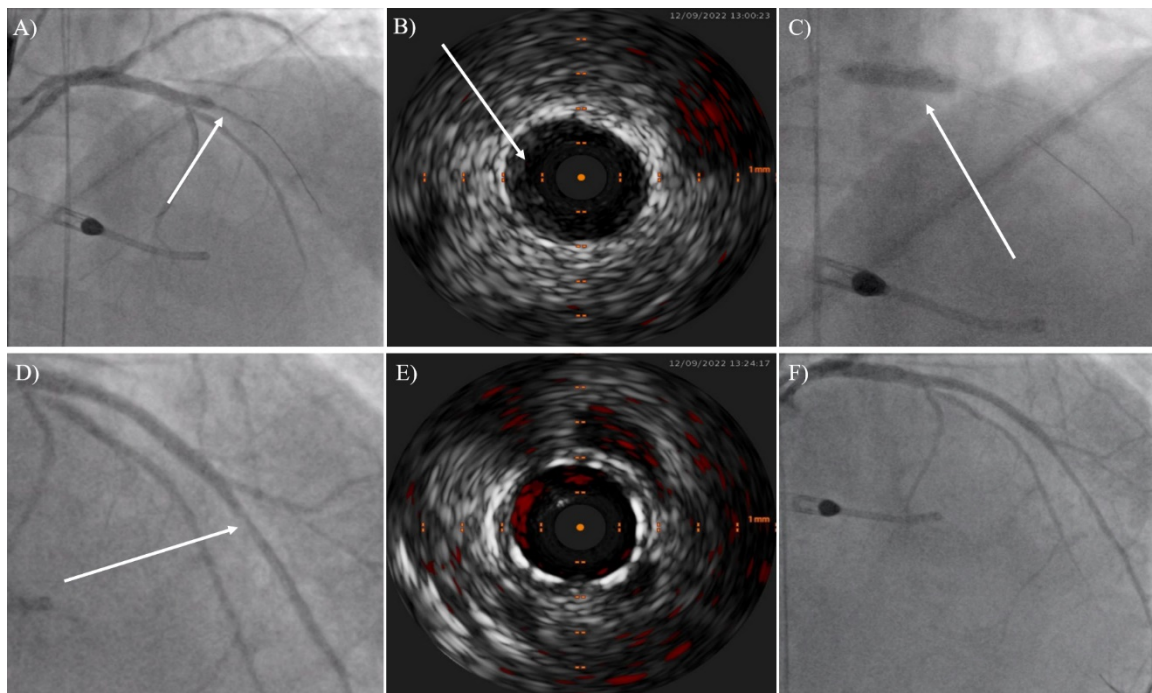
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**Figure 1.** **A.** Left coronary artery angiography showing distal stent edge stenosis (the white arrow). **B.** Intravascular ultrasound demonstrating intramural haematoma compressing vessel lumen (the white arrow). **C.** Angiogram showing cutting balloon inflation ( $2.5 \times 10$  mm, Flextome, Boston Scientific, MA, US; the white arrow). **D.** Angiography exhibiting propagation of compressive intramural haematoma (the white arrow). **E.** Intravascular ultrasound control showing optimal procedure outcome. **F.** Final angiography of left coronary artery