

When Slow Reflow Turns Dangerous: Balloon Embolization as a Bailout Strategy for Wire-Induced Coronary Perforation During Primary PCI

Muhammad Imran Hanif, MBBS, FCPS (Cardiology), FRCP (Edin), FSCAI;
Ahmad Usama Wali, MBBS; Murad Ali Khan, MBBS

Patient Presentation & Evaluation

A 75-year-old man with 30 pack-year smoking history presented with chest pain for 6 hours associated with palpitations and two episodes of syncope occurring during the same symptomatic period prior to hospital presentation. He also reported anorexia with unintentional weight loss for 6 months. On presentation, heart rate was 40 beats/min and blood pressure was 100/70 mmHg. Electrocardiogram demonstrated inferior wall myocardial infarction with complete heart block. Echocardiography revealed left ventricular systolic dysfunction with ejection

fraction of 35%. A temporary pacemaker was inserted, and the patient was shifted to the cardiac catheterization laboratory for primary percutaneous coronary intervention (PCI).

Procedure

Coronary angiography showed dominant right coronary artery (RCA) with distal occlusion. An anomalous left circumflex artery arising separately from the RCA was also noted (Figure 1, Video 1).

The culprit RCA lesion was crossed using a Pilot 50 guidewire (Abbott Vascular). Following predilatation and deployment of two

drug-eluting stents, check angiography demonstrated slow reflow (Figure 2). Slow reflow is a recognized complication of primary PCI and is commonly attributed to distal thrombus embolization, microvascular dysfunction, vasospasm, and reperfusion injury. In the presence of slow reflow, reduced antegrade contrast flow may obscure distal contrast extravasation, rendering a wire-induced perforation angiographically inapparent.

In our case, intracoronary nitroglycerin was administered in 200 µg boluses (total dose 1000 µg) for treatment of slow reflow. Following improvement in distal coronary flow, repeat angiography revealed contrast extravasation from a perforated side branch, consistent with an Ellis type III cavity-spilling perforation. This sequence is clinically important because delayed recognition of perforation may occur after administration of anticoagulation and dual antiplatelet therapy, increasing the risk of hemorrhagic complications (Figure 3, Video 1).

The patient remained hemodynamically stable with no pericardial effusion. However, persistent contrast extravasation was present in a patient who had received anticoagulation and dual antiplatelet therapy during primary PCI. Considering the distal location and small caliber of the perforated side branch, covered stent implantation was not technically feasible. Although coil embolization is a recognized treatment option for distal coronary perforations, coils were not readily available. Therefore, balloon embolization was selected as a readily available bailout strategy to achieve prompt vessel sealing.

XXXXX

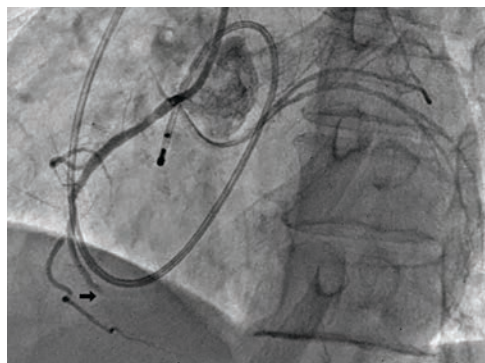


Figure 1. Coronary angiography demonstrating a totally occluded RCA.

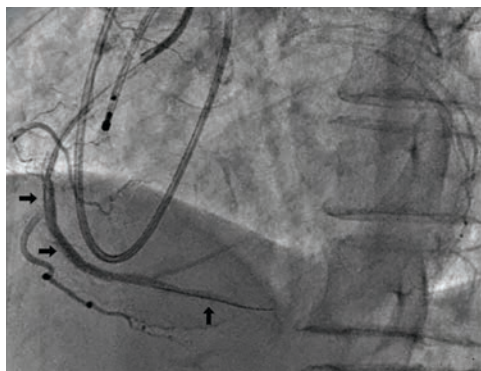


Figure 2. Both DES deployed and distal slow reflow.



Figure 3. Post-intracoronary nitrates; side branch perforation.

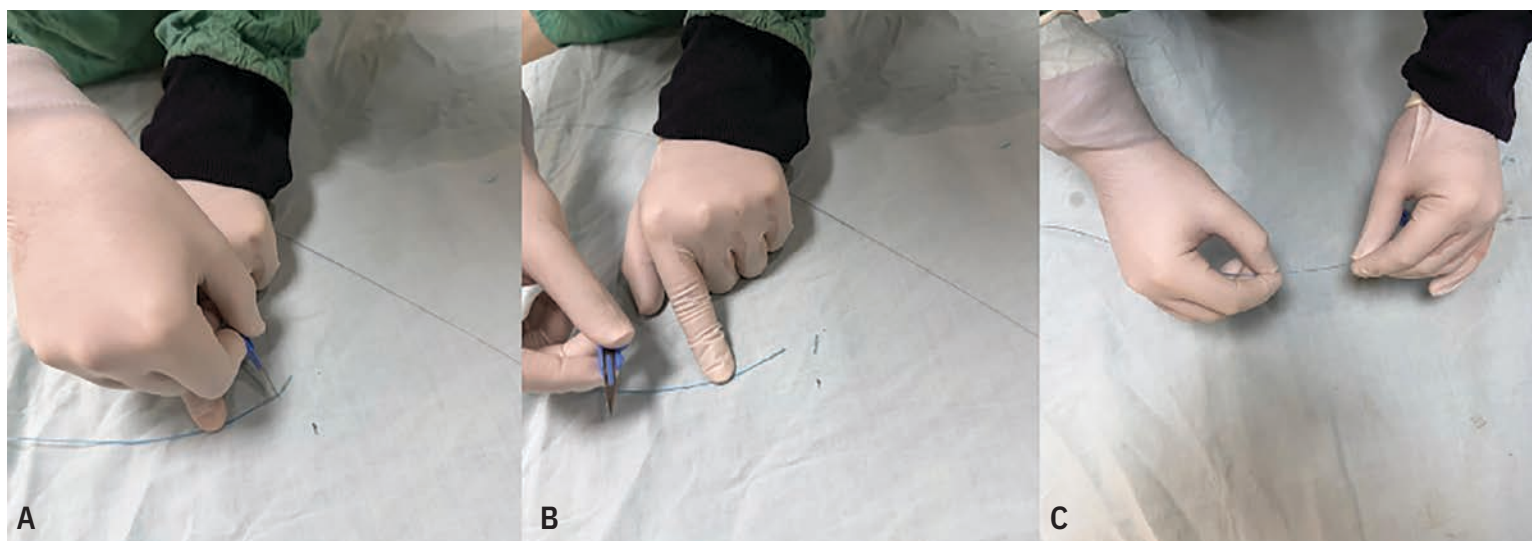


Figure 3. The cut balloon technique (CBT). (A) A 2.0 mm × 15 mm semi-compliant VexPander balloon (TT Medical, Inc.) cut transversely using a sterile surgical blade. (B) Distal balloon fragment prepared for embolization. (C) Distal balloon fragment mounted on the coronary guidewire prior to advancement to the site of perforation.

A 2.0 × 15 mm semi-compliant VexPander balloon (TT Medical, Inc.) was cut transversely using a sterile surgical blade. The sequential steps of the cut balloon technique are illustrated in **Figure 4**.

The distal balloon fragment was retained on the guidewire and advanced to the site of perforation. A second balloon segment was subsequently advanced over the same guidewire and used as a pusher to deliver the embolizing fragment distally (**Figure 5**). The pusher segment was not inflated and served solely as a mechanical support to facilitate distal delivery of the embolizing fragment. No additional delivery devices or microcatheter were required. Prolonged balloon tamponade was then performed proximal to the perforation using a 2.0 mm × 14 mm balloon inflated for 10 minutes. The guidewire was subsequently withdrawn, leaving the balloon fragment permanently implanted within the vessel.

Repeat angiography demonstrated complete cessation of contrast extravasation (**Figure 5**, **Video 2**). Final angiography demonstrated complete resolution of contrast extravasation with restoration of distal flow (**Figure 6**, **Video 2**).

Discussion

Slow reflow during primary PCI can mask distal coronary perforation. Typical management



Figure 5. Balloon embolization: embolized part in the distal vessel and pusher in proximal vessel.

principles include stopping further distal wire manipulation, instituting prolonged balloon inflation/tamponade, assessing for pericardial effusion, maintaining hemodynamic monitoring, considering anticoagulation reversal when appropriate, and selecting covered stent implantation or distal embolization based on perforation location. Balloon embolization may be considered a simple, readily available, and cost-effective bailout strategy for selected distal small-vessel perforations when standard embolization materials are unavailable. However, it should be performed with careful attention to the risks of distal vessel occlusion, embolic migration, thrombosis, and loss of side-branch territory. ■

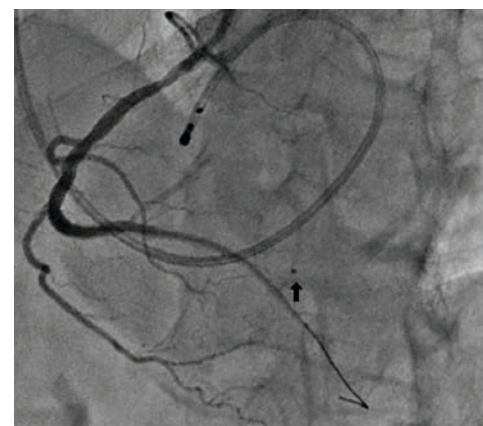


Figure 6. Final angiogram: embolized balloon and sealing of perforation.

Find Hanif et al,
including accompanying
videos, online:



Muhammad Imran Hanif, MBBS, FCPS (Cardiology), FRCP (Edin), FSCAI¹; Ahmad Usama Wali, MBBS²; Murad Ali Khan, MBBS²

¹Professor of Cardiology, Department of Cardiology, Gulab Devi Teaching Hospital Lahore, Pakistan; ²Post-graduate Resident, Cardiology; Department of Cardiology, Gulab Devi Teaching Hospital Lahore, Pakistan

The authors can be contacted via Ahmad Usama Wali, MBBS, at ahmadusama49@gmail.com.