When foe becomes a friend: Sequential balloon tamponade, coiling, and autologous fat particle embolization for the successful seal of a refractory distal coronary perforation during a percutaneous coronary intervention

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Coronary artery perforation (CAP) is a potentially severe complication of percutaneous coronary intervention (PCI) with an incidence of 0.71% which is managed conservatively in 73.3% of the cases, followed by the use of covered stents (24%), deployment of coils (0.7%), and fat embolization in 2% of cases [1]. Most large vessel perforations occur due to balloon or stent overinflation while distal vessel perforations are usually caused by the guidewire exit [2]. Furthermore, large vessel perforations are predominantly treated with covered stent implantation while distal and collateral perforations are typically amenable with coils or fat embolization, with both methods having inherent advantages and disadvantages [3–5]. CAP is associated with substantial mortality and morbidity as nearly 50% of patients require pericardiocentesis for tamponade, and up to 13% require emergency cardiac surgery for tamponade treatment [1]. Prompt recognition of CAP and immediate intervention during coronary angiography can significantly minimize the adverse consequences.

A 70-year-old man was admitted for an acute non-ST-segment elevation myocardial infarction. He had a history of arterial hypertension and chronic coronary syndrome as he had previously undergone PCI to the proximal circumflex (Cx) and mid-right coronary arteries seven and six years, respectively, before the current event. Cx stenosis was a culprit for his current presentation. The left main was engaged with a 6F catheter *via* the right radial artery, and the lesion was crossed with a workhorse wire. It was then pretreated with two semi-compliant (SC) balloons upon which delivery of a drug-coated balloon (DCB) was attempted without a success. Another wire was then introduced across the lesion as a "buddy wire" followed by an attempt to deliver DCB and then DES, however, with no success. A proximal Cx segment was again predilated with an SC 2.0 × 20 mm balloon and 2.5 × 18 mm DES was eventually implanted. However, late images showed Ellis type II perforation at the site of distal Cx (Figure 1A), and another occluding SC 2.0 × 20 mm balloon was inflated at 8 atm proximally to the perforation site (Figure 1B). Despite this intervention, the extravasation of the contrast was still active (Figure 1C) so an additional 6F XB 3.5 guiding catheter was introduced adjacent to the existing catheter in the LM *via* right transfemoral access by using the "ping-pong" technique. This allowed for the advancement of the FineCross 1.8 F microcatheter at the perforation site, and its position was securely fixed by the previously deployed and inflated SC balloon — the so-called "block & deploy" technique (Figure 1D). Three coils (2 mm × 4 cm) were then delivered by the microcatheter proximally to the perforation site followed by repeated inflation of the occluding balloon; however, without achieving stoppage of extravasation (Figure 1E). Finally, fat particles were harvested and prepared from subcutaneous tissue at the femoral artery puncture site (Supplementary material, *Video S1*). Then they were delivered through the microcatheter directly at the perfora-

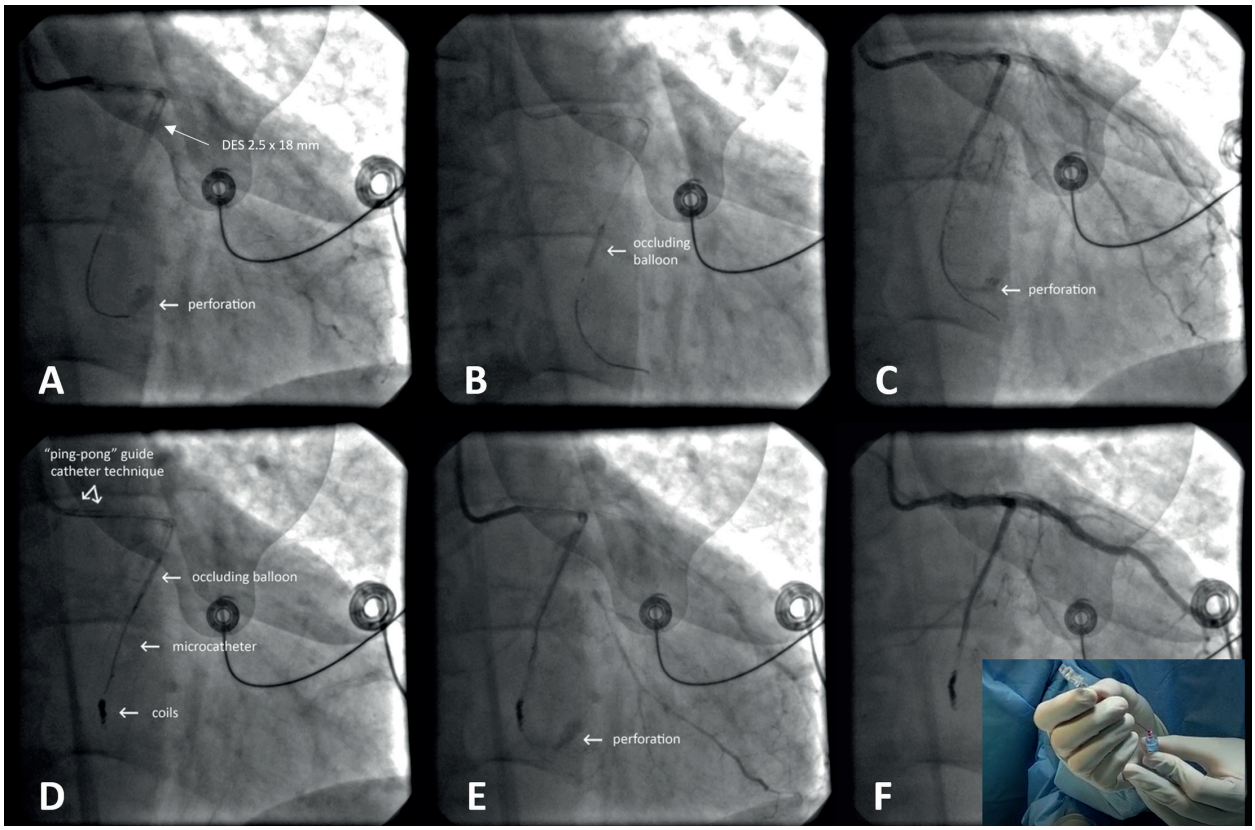

Figure 1. A. After successful drug-eluting stent implantation (2.5 × 18 mm), a perforation of the distal circumflex artery was observed (type II Ellis perforation). **B.** The occluding balloon was inflated twice (2 × 10 min) proximally to limit hemorrhage. **C.** Despite balloon inflations, an active contrast extravasation was still present at the distal vessel. **D.** Second 6 F catheter was inserted *via* femoral access engaging the left main with the previously deployed catheter by using the "ping-pong" technique. Deflation of the occluding balloon on the first catheter allowed for advancement of the microcatheter (1.8 F) to the perforation site and delivery of 3 coils (2 mm × 40 mm) by the modified "block & deliver" technique, which limited hemorrhage by inflating the occluding catheter again; **E.** Contrast extravasation was still observed despite deployment of 3 coils and repeated inflation of the occluding balloon again for 10 minutes. **F.** Fat particles were harvested from subcutaneous tissue near the femoral artery puncture site and were delivered to the perforation site through a previously positioned microcatheter — this intervention finally resulted in the successful closure of the perforation

tion site successfully sealing the perforation (Figure 1F). A post-procedural transthoracic echocardiogram showed small (2 mm) pericardial effusion without right ventricular compression while the patient remained asymptomatic with preserved hemodynamic stability both during and after the procedure.

In conclusion, we feel that the demonstrated technique, while well-known in interventional radiology should be added to the armamentarium of interventional cardiology. It presents a simple and efficient treatment option for refractory coronary artery that might not be amenable to graft stents or protamine infusions.

Supplementary material

Supplementary material is available at https://journals.viamedica.pl/kardiologia_polska.

Article information

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REFERENCES

1. Lemmert ME, van Bommel RJ, Diletti R, et al. Clinical characteristics and management of coronary artery perforations: A single-center 11-year experience and practical overview. J Am Heart Assoc. 2017; 6(9), doi: 10.1161/JAHA.117.007049, indexed in Pubmed: 28939719.
2. Shaukat A, Tajti P, Sandoval Y, et al. Incidence, predictors, management and outcomes of coronary perforations. Catheter Cardiovasc Interv. 2019; 93(1): 48–56, doi: 10.1002/ccd.27706, indexed in Pubmed: 30312992.
3. Abdalwahab A, Farag M, Brilakis ES, et al. Management of coronary artery perforation. Cardiovasc Revasc Med. 2021; 26: 55–60, doi: 10.1016/j.carrev.2020.11.013, indexed in Pubmed: 33203580.
4. Shemisa K, Karatasakis A, Brilakis ES. Management of guidewire-induced distal coronary perforation using autologous fat particles versus coil embolization. Catheter Cardiovasc Interv. 2017; 89(2): 253–258, doi: 10.1002/ccd.26542, indexed in Pubmed: 27143506.
5. Guddeti RR, Kostantinis ST, Karacsonyi J, et al. Distal coronary perforation sealing with combined coil and fat embolization. Cardiovasc Revasc Med. 2022; 40S: 222–224, doi: 10.1016/j.carrev.2021.12.001, indexed in Pubmed: 34903484.