

# Intravascular ultrasound-guided retrograde percutaneous coronary intervention of a chronic total occlusion

Przezskórna rekanalizacja przewlekłego zamknięcia naczynia wieńcowego z zastosowaniem ultrasonografii wewnątrznaczyniowej

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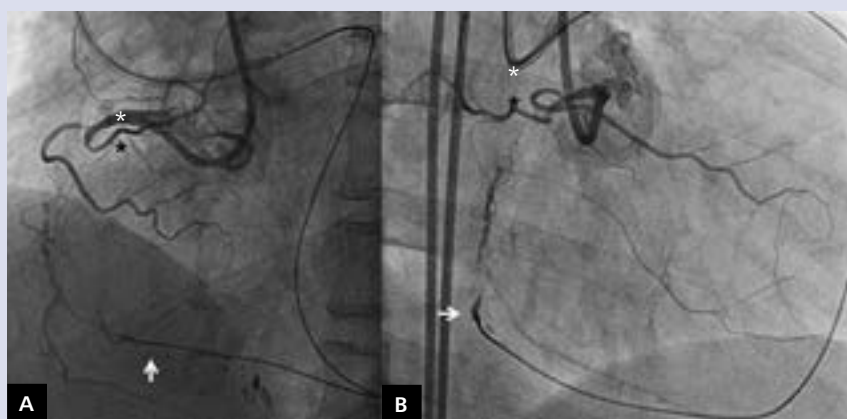
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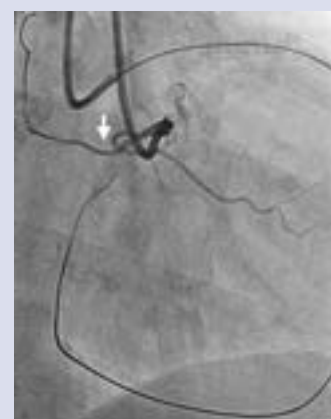
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A 56-year-old male patient with history of diabetes mellitus, hypertension, smoking, and previous stent implantation in the left anterior descending artery (LAD) and left circumflex artery 10 years previously consulted for exertional angina (CCS II). The echocardiogram showed a left ventricular ejection fraction of 47%, with severe hypokinesia in the inferior and septal inferior walls. A treadmill test was clinically and electrically positive from the beginning of stage 4, showing ST-depression in leads II, III, aVF, V5, and V6. The coronary angiography revealed a chronic total occlusion (CTO) of the proximal right coronary artery (RCA), with collaterals Rentrop 3 supplied by septal branches from the LAD (Fig. 1). No clear stump was visible and an atrial branch took off directly from the blunt ending (Fig. 1,\*). A first antegrade attempt failed to cross the occlusion. J-CTO score = 4 (blunt ending, bending > 45°, occlusion length ≥ 20 mm, re-try). A retrograde approach was preferred for the second attempt to recanalise the CTO, and a Corsair catheter (Asahi Intecc Co., Seto, Aichi, Japan) was placed into the distal RCA through a septal branch (Fig. 1, arrow). The occluded segment was successfully negotiated with a steerable Gaia-2 wire (Asahi Intecc Co., Seto, Aichi, Japan). The navigation in the most proximal segment of the occlusion and the re-entry into the proximal true lumen were guided by means of a mechanical intravascular ultrasound (IVUS) (Atlantis SR Pro, Boston Scientific, Marlborough, MA, USA) placed into the atrial branch (Fig. 2, arrow). In the



**Figure 1.** Chronic total occlusion of the proximal right coronary artery (RCA). **A, B.** Oblique anterior projections in biplane angiography, with double antegrade + retrograde injection. Notice the blunt ending, the lack of a stump, and the atrial branch (\*) taking off from the occlusion point, almost precluding an antegrade approach. A retrograde microcatheter (arrow) was placed into the distal RCA through septal collaterals



**Figure 2.** Intravascular ultrasound catheter in the atrial branch (arrow) to guide the lumen re-entry of the retrograde wire

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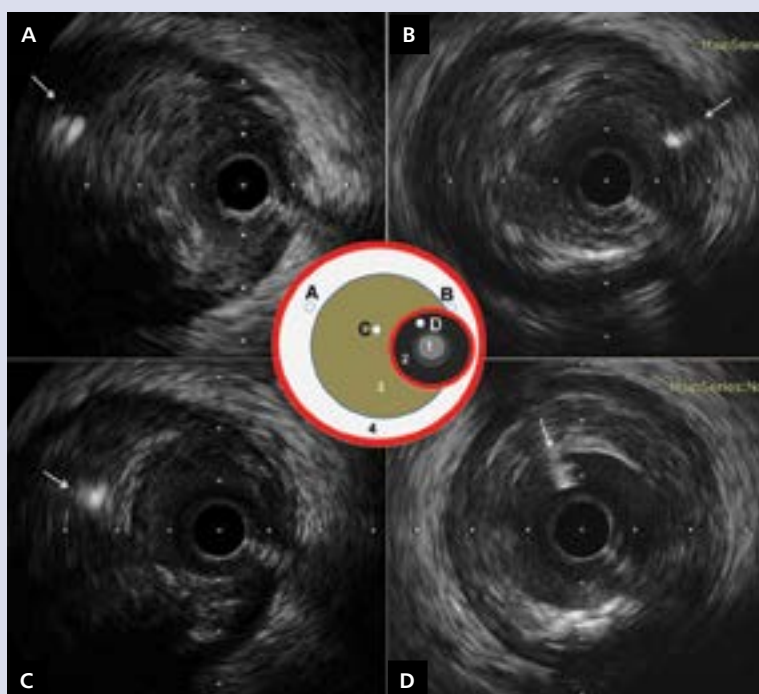
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**Conflict of interest:** none declared

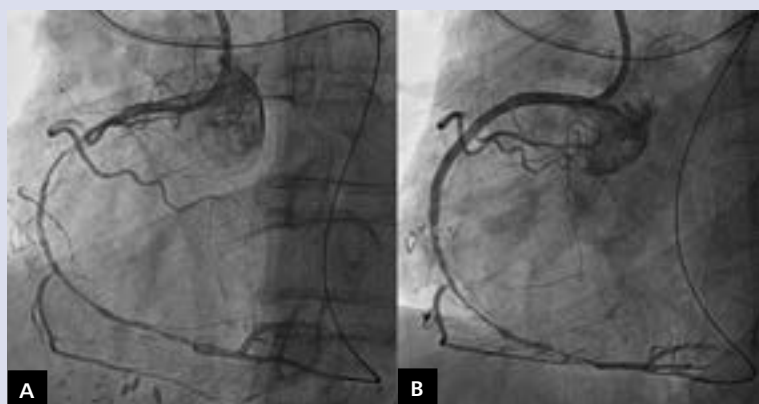
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first attempt of proximal lumen re-entry the IVUS showed clearly that the wire had progressed into the subintimal space (Fig. 3A, arrow), thus reducing the chances of re-entering the true lumen, since the wire remained subintimal (Fig. 3B, arrow; **Suppl. Video 1 — see journal website**). The wire was then partially withdrawn and redirected towards the intimal plaque, assisted by the IVUS imaging (Fig. 3C, arrow). IVUS-guided intimal tracking resulted in successful re-entry into the true lumen of the proximal RCA (Fig. 3D, arrow; **Suppl. Video 2 — see journal website**). After externalisation of the retrograde wire and exchange for a RG3 wire (Asahi Intecc Co., Seto, Aichi, Japan), the occluded segment was dilated with balloons of escalating size (Fig. 4A) and finally a 3.0 × 33 mm everolimus-eluting stent was implanted, thus restoring antegrade normal flow (Fig. 4B). This didactic case illustrates the usefulness of IVUS imaging to guide critical steps in the percutaneous coronary intervention of a chronic total occlusion: the re-entry into the true lumen. When the coronary anatomy allows for IVUS-guided lumen re-entry, this technique can result in reduced interventional times, lower radiation, and minimised vascular damage as compared with conventional angiographic guidance and other re-entry techniques (reverse CART).



**Figure 3.** Intravascular ultrasound (IVUS)-guided intimal plaque tracking and lumen re-entry. **Panels A and B** show the difficulty of lumen re-entry when the wire follows a subintimal trajectory: if the wire progresses through the subintimal space of the occluded segment (**A**, arrow), it will probably remain subintimal in the segments proximal to the occlusion, like in the proximal right coronary artery (RCA) of our case (**B**, arrow). **Panels C and D** show a second re-entry attempt: the wire was partially withdrawn and redirected into the intimal plaque (**C**, arrow) under IVUS guidance, thus achieving a successful and uncomplicated re-entry into the true lumen of the proximal RCA (**D**, arrow); 1 — IVUS catheter; 2 — true lumen; 3 — intimal plaque; 4 — subintimal space



**Figure 4.** Final restoration of the antegrade flow in the occluded segment after balloon predilation (**A**) and stent implantation (**B**)