

Anupam Bhambhani, Narayan Gadkar,
Stéphane Cook

Department of Cardiology,
University Hospital,
Bern, Switzerland

Intravascular ultrasound guided percutaneous coronary intervention for chronic total occlusion of left anterior descending artery

Abstract

Chronic total occlusions (CTO) remain a technical challenge in interventional cardiology despite remarkable advances in the strategies, expertise, and equipment. The success of percutaneous coronary intervention (PCI) of a chronic total occlusion (CTO) depends in majority of cases whether or not a lesion is crossed by guidewire. This report illustrates successful use of intravascular ultrasound (IVUS) to enter true lumen and to confirm the wire position in an ostial chronic total occlusion without visible stump. It also highlights the importance of simultaneous left and right coronary injections to visualise the distal part of the occluded vessel filling through collaterals.

Introduction

Chronic total occlusions (CTO) is observed in about 10% of all percutaneous coronary intervention (PCI) and remain technical challenging despite remarkable advances in the strategies, expertise, and equipment. Improvement has been observed in procedural success rate but presence of CTO has been one of the commonest indications for referral for surgical revascularisation [1]. Successful percutaneous recanalisation of CTO results in improved survival, as well as enhanced left ventricular function, reduction of angina, and amelioration in exercise tolerance [2–4]. We report successful revascularisation of an ostial CTO of left anterior descending (LAD) artery with invisible stump, where intravascular ultrasound guidance confirmed entry of the stiff wire into the true lumen.

Case description

A 67-year-old white male was admitted with acute coronary syndrome. He complained of having experienced typical chest pain about five days before admission. The only known cardiovascular risk factors were male gender and age. He underwent emergency coronary angiography (fig. 1), which revealed chronic total occlusion (CTO) of the ostium (arrowhead) of the left anterior descending artery (LAD) with distal opacification (light arrow) through ipsilateral (top panels) and controlateral collaterals (lower panels). High grade stenosis of ramus intermedia (IA) and two significant stenoses of the right coronary artery (RCA). Simultaneous bilateral injections were planned to perform

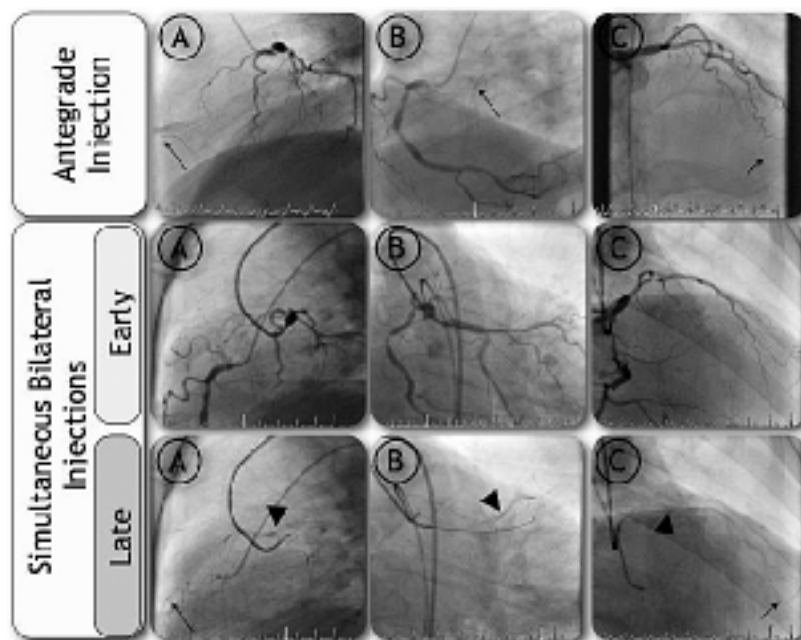


Figure 1
Coronary angiograms before percutaneous coronary intervention. A: LAO 90°, B: caudal 30°/RAO 20°, C: cranial 40°. Chronic total occlusion (CTO) of the ostium (arrowhead) of the left anterior descending artery (LAD) with distal opacification (light arrow) through ipsilateral (top panels) and controlateral collaterals (lower panels). High grade stenosis of ramus intermedia (IA) and two stenoses of the right coronary artery (RCA). Simultaneous bilateral injections were planned to perform PCI (middle and lower panels) and failed to demonstrate a visible LAD stump.

Correspondence:
Stéphane Cook, MD
Invasive Cardiology
University Hospital
CH-3010 Bern
Switzerland
E-Mail: stephan.cook@insel.ch

PCI. A 0.014" 3 G Miracle® guidewire (Abbott Vascular) used initially, which could not cross the CTO; was then placed in the IA. A 0.014" 12 G Miracle® guidewire was advanced

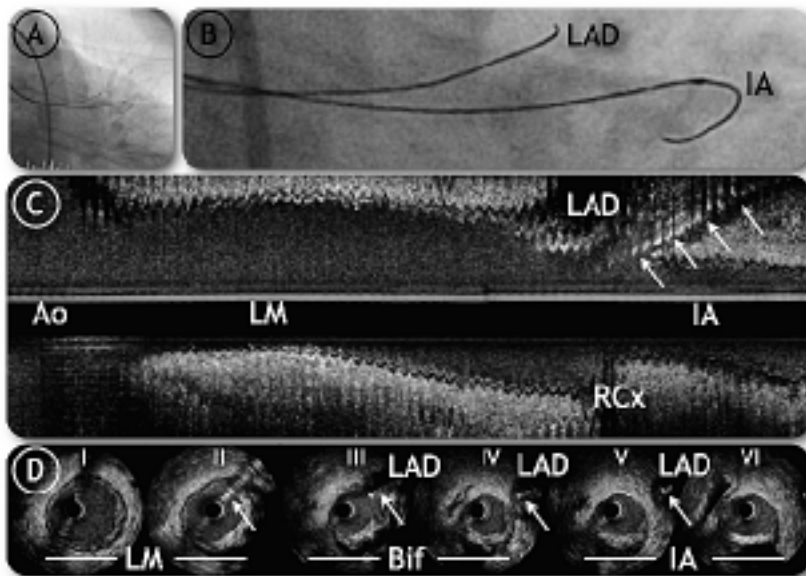


Figure 2
Intravascular findings during percutaneous coronary intervention (PCI).
A: Position of the two Miracle® guidewires during PCI (cranial 40°). B: Magnification of figure A demonstrating the guidewires in CTO and IA. C: (longitudinal reconstruction) and D: (slide view): IVUS confirmation of wire position in LAD true lumen (arrows).

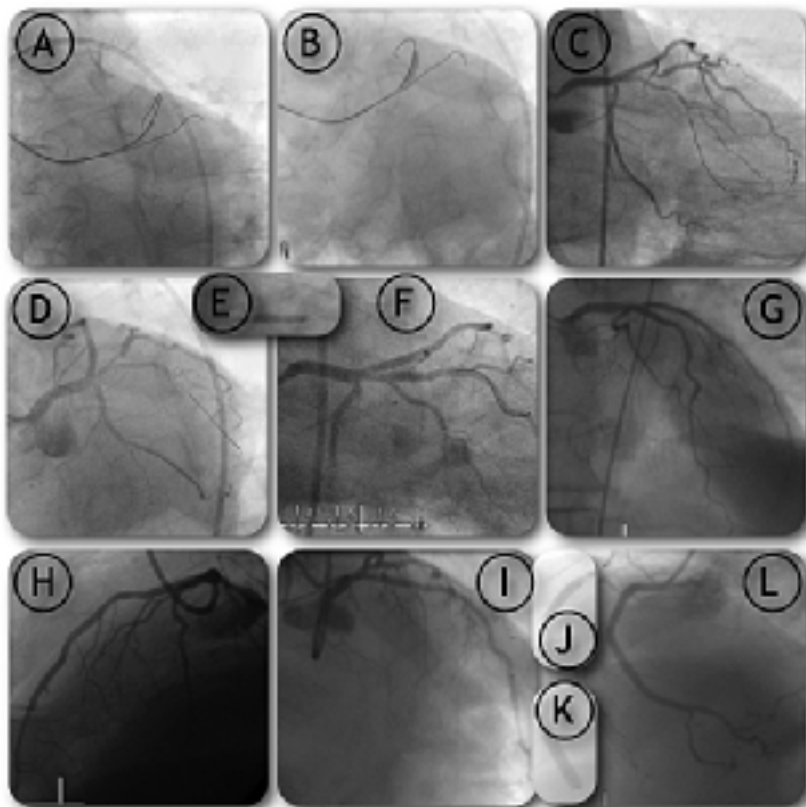


Figure 3
Successful lesion crossing followed by stenting and final results of LAD PCI (A–C), and IA PCI (D–G). LAD and IA angiograms 24 hours later along with result of RCA PCI (H–L).

through the CTO body up to the middle part of the occlusion. Because of unusual friction during crossing of the CTO and in order to check whether the wire reached the true lumen, we decided to perform IVUS study (illustrated in the figure 2). This allowed confirmation of the good position of the wire (fig. 2 – arrow). A 1.1 mm-NIC® balloon (Schwager Medica) was then advanced to the LAD and the guide-wire could be appropriately positioned in the distal LAD. The lesion was then treated by progressive dilatation with 1.1/12 mm-NIC® (Schwager Medica; fig. 3A) and 2.5/15 mm-Maverick® balloons (Boston Scientific) and stent implantation using a 3.0/18 mm-sirolimus-eluting stent (Cypher®, Miami, Florida), which efficiently covered the ostial LAD lesion. The stenosis of the IA was then dilated and treated with implantation of a 2.75/8 mm-sirolimus-eluting stent (Cypher®, Miami, Florida). Later a wire-induced dissection of the distal LAD was treated with implantation of 2.25/8 mm-sirolimus-eluting stent (Cypher®, Miami, Florida). The result was satisfactory. On the next day, the RCA was treated with implantation of two sirolimus-eluting stents (3.5/13 mm and 3.5/18 mm, Cypher®, Miami, Florida). The recovery was uneventful and the patient was discharged after 3 days. Aspirin was prescribed for the remainder of his life and clopidogrel was prescribed for 12 months.

Discussion

The success of PCI for CTO depends usually upon whether the guidewire could cross the lesion and find the true lumen distally. Several advancements have been introduced for CTO revascularisation technique: the most remarkable of these include introduction of stiff, tapered tip guide-wires with or without hydrophilic coating. More sophisticated devices have been also introduced, like laser wire, catheters utilising blunt micro dissection technique, or Safe-cross system [5] with optical coherence tomography guidance coupled with radiofrequency energy source at the distal end of the wire. These techniques improve procedure success but at the cost of safety, since these are plagued by increased chances of dissections and vessel perforation making it essential to visualise the vessel and confirm the position of these stiff catheters or wires into the true lumen before their further advancement. IVUS guidance has been described in successfully redirecting the subintimally placed wires into true lumen [6, 7].

Whereas, the true challenge of this case was to find the orifice of the ostially occluded LAD, without any angiographically visible stump, IVUS provided a very potent tool allowing easy visualisation of the occluded vessel and the safe CTO crossing by stiff guidewire and was complementary to simultaneous left and right coronary injections to visualise distal vessel, filling through collaterals.

References

- 1 King SB, Lembo NJ, Weintraub WS, et al., for The Emory Angioplasty versus Surgery Trial (EAST) Investigators. A randomized trial comparing coronary angioplasty with coronary bypass surgery. *N Engl J Med.* 1994;331:1044–50.
- 2 Olivari Z, Rubartelli P, Piscione F, et al. Immediate results and one-year clinical outcome after percutaneous coronary interventions in chronic total occlusions: data from a multicenter, prospective, observational study (TOASTGISE). *J Am Coll Cardiol.* 2003;41:1672–8.
- 3 Suero JA, Marso SP, Jones PG, et al. Procedural outcomes and long-term survival among patients undergoing percutaneous coronary intervention of a chronic total occlusion in native coronary arteries: a 20-year experience. *J Am Coll Cardiol.* 2001;38:409–14.
- 4 Chung CM, Nakamura S, Tanaka K, et al. Effect of recanalization of chronic total occlusions on global and regional left ventricular function in patients with or without previous myocardial infarction. *Catheter Cardiovasc Interv* 2003;60:368–74.
- 5 Baim DS, Braden G, Heuser R, et al. Utility of the Safe-Cross-guided radiofrequency total occlusion crossing system in chronic coronary total occlusions (results from the Guided Radio Frequency Energy Ablation of Total Occlusions Registry Study). *Am J Cardiol.* 2004;94:853–8.
- 6 Ito S, Suzuki T, Ito T, et al. Novel technique using intravascular ultrasound guided guidewire cross in coronary intervention for uncrossable chronic total occlusions. *Circ J.* 2004;68:1088–92.
- 7 Matsubara T, Murata A, Kanyama H, et al. IVUS-guided wiring technique: promising approach for the chronic total occlusion. *Catheter Cardiovasc Interv* 2004;61:381–6.