# CLINICAL BULLETIN

## Chronic total occlusions — Current techniques and future directions

IJC Heart & Vasculature 2015;7:28–39 George Touma et al.

Chronic total occlusion (CTO) lesions are often challenging to treat, and guidance on the use of percutaneous coronary intervention (PCI) in this scenario has been lacking. However, recent advances in procedures and equipment in specialist centres have resulted in success rates exceeding 80%, which should encourage uptake of PCI for CTO lesions.

The review by Dr Touma et al. provides a useful summary of the developments and technologies that are helping to revolutionise CTO treatment, including use of the parallel wire technique in order to maximise success rates with an antegrade approach.

#### What were the key findings?

Traditional strategies for CTO PCI usually begin with an antegrade approach. Multiple strategies have been developed for attempting to cross the CTO in an antegrade fashion (Panel 1).

The aim of these strategies is to achieve a luminal cross of the CTO; if the subintimal space is entered, the distance of antegrade dissection is limited by attempting re-entry quickly or switching to a retrograde strategy.

#### What did the authors conclude?

The authors noted that specialised equipment, sharing of expertise, and appropriate patient selection are improving success rates of PCI for CTO lesions. Experience from expert centres is also adding considerable expertise to CTO management.

Panel 1. Techniques for an antegrade approach	
Single wire manipulation with wire escalation	<ul> <li>A soft hydrophilic wire is used to seek out microchannels to traverse the CTO in the intimal space.</li> <li>Gradual escalation of wire tip load is used as needed to cross the CTO with the safest wire to minimise the risk of perforation.</li> </ul>
Parallel wiring technique	<ul> <li>If a wire enters the subintimal space it is left in position to seal that tract and act as a marker.</li> <li>Continued advancement of the wire towards the distal cap is avoided as it can collapse the distal true lumen and make re-entry difficult.</li> <li>A second penetrating wire is introduced using a microcatheter, and an attempt made at redirection into the true lumen.</li> <li>A dual lumen microcatheter with both a monorail and an over-the-wire (OTW) port is ideally suited to parallel wiring, as it allows introduction of multiple wires without removal of the catheter from an optimal position.</li> </ul>
Seesaw wiring	<ul> <li>Uses two microcatheters and wires.</li> <li>Avoids the need for complex exchange of OTW microcatheters: allows wires to be reshaped and their roles switched quickly.</li> </ul>
Balloon anchoring	<ul> <li>An appropriately-sized balloon is inflated in a side branch to stabilise the guidewire and increase support.</li> <li>Carries a risk of side branch injury or ischaemia if the branch supplies a large area of myocardium.</li> </ul>
IVUS guided wiring	<ul> <li>IVUS can be used to guide penetration of the CTO proximal cap in cases where the occlusion is flush with a large side branch.</li> <li>IVUS can also be used to assess a re-entry location in cases where the wire enters a false lumen after the distal cap.</li> </ul>



### FOR THE MOST COMPLEX ENGINE IN THE WORLD



# Revascularisation of a chronic total occlusion of the right coronary artery close to a bifurcation using the FineDuo® dual lumen microcatheter

#### Case provided by:

#### Dr Stefan Kralev, Cardiologist

Percutaneous coronary intervention (PCI) for complex lesions such as chronic total occlusion (CTO) can be difficult in practice, and can result in poor success rates;<sup>1,2</sup> however, advances in techniques and equipment have the potential to improve outcomes, and change the use of PCI for these lesions.<sup>3</sup>

CTO in a vessel with bifurcation anatomy can be particularly challenging, making it especially important to choose the correct tools for this complex procedure. Using dual lumen microcatheters rather than a single lumen microcatheter, interventional cardiologists can cross CTOs in bifurcation regions with potentially less effort and, depending on vessel morphology, often quicker, because a second wire in the open side branch can effectively block the path of least resistance.

The following case discusses the successful revascularisation of a heavily calcified CTO in a bifurcation region of the right coronary artery (RCA) using the FineDuo® dual lumen microcatheter, highlighting the potential benefits of using a two-wire technique.

#### Introducing the patient

A 37-year-old man was referred to the clinic with intermittent chest pain (Text Box 1). Initial coronary angiography revealed heavy calcifications and a CTO in the mid RCA. Inducible ischaemia was identified in the lower third of the posterior wall of the left ventricle, along with a reduction in left-ventricular ejection fraction (accompanied by reduced myocardial wall thickening of the posterior wall). Given these observations, revascularisation was recommended.

#### Text Box 1: Summary of case details

Risk factors for coronary artery disease:

- Severe hyperlipoproteinaemia
- Heavy smoker (~20 pack years)
- Family history (father died of myocardial infarction aged 31 years)
- Two prior episodes of extreme chest pain (5 years, and 6 months ago)

#### Current presentation:

• Intermittent chest pain

## How was the procedure performed?

An initial coronary angiography was performed via transfemoral access using a 6Fr sheath, and showed left coronary artery and retrograde filling of the distal RCA territory located behind the CTO (Figure 1). A 6Fr guiding catheter was advanced to the RCA.

A stiff wire was placed in front of the CTO, and the FineDuo<sup>®</sup> dual lumen microcatheter was advanced over this wire to reach the proximal segment of the RCA. A soft guidewire was delivered via the second FineDuo® lumen, and advanced into the open interventricular branch proximal to the occlusion (Figure 2). This second wire was anchored in the interventricular branch of the RCA to provide stability. The positioning of FineDuo<sup>®</sup> prevented tangling of the guidewires, and facilitated crossing the main vessel CTO with the stiff wire. After crossing the CTO, the FineDuo<sup>®</sup> was removed; the stiff wire remained in the main vessel to deliver devices.

To prepare the vessel for drug-eluting stent (DES) deployment, a Tazuna<sup>®</sup> 1.5x15 mm balloon was used to initially open the CTO (Figure 3a), followed by dilation of the highly calcified vessel with a larger 2.0x15 mm balloon. Despite repeated predilations, full opening of the balloon was not possible at rated burst pressure (Figure 3b).



Initial angiography shows the left coronary artery



Both wires in their final position



Self-Employed, procedure performed at the Hospital for Internal Medicine Ebersbach, Germany



**3** The reopened occlusion, with a clearly identifiable right coronary artery (a) despite incomplete balloon opening (b)



4 Small dissection in the dilated segment of the right coronary artery



5 Final angiographic result after placement of three drug-eluting stents

To continue opening the stenosis, repositioning of the wire was necessary. After another series of dilations with a 2.5x15 mm balloon, good revascularisation was achieved. A small dissection was identified (Figure 4), which was covered with a 2.5x23 mm DES. After stent deployment, proper antegrade filling of the RCA was observed.

A second, 2.5x18 mm, DES was deployed overlapping the first stent. Another stenosis was observed at the distal end of the first stent, although initially interpreted as a coronary spasm. After intracoronary glyceryl trinitrate, a 75% stenosis remained visible at the distal end of the stent, so a third, 2.25x12 mm, DES was deployed in the overlap region. This produced a good angiographic result for the whole RCA (Figure 5). The catheter, wire, and sheath were removed, and the puncture site was closed with a vascular closure device.

Even in this highly complex intervention with a duration of 1 hour 25 minutes, including triple DES deployment, fluoroscopy was used for only 12.3 minutes, and no more than 230 ml of contrast agent was needed. Consequently, total radiation exposure was low for an intervention of this complexity (3645.80 cGy/cm<sup>2</sup>).

#### What happened to the patient?

The patient recovered well from the procedure, and is regularly seen by a cardiologist in an outpatient clinic. Treatment with an antiplatelet agent was recommended for 1 year because of the nature of the lesion, and the relatively long distance covered by the DES.

#### What have we learnt?

This case highlights the benefits of a dual lumen microcatheter for complex cases such as crossing CTOs using a two-wire technique. As demonstrated here, having two lumens gives physicians the flexibility to adapt their interventions to challenging cases without resulting in long procedure times, thereby minimising radiation exposure.

#### **Terumo tool checklist**

- FineDuo<sup>®</sup> dual lumen microcatheter
- Tazuna<sup>®</sup> semi-compliant PTCA balloon catheter
- Angio-Seal<sup>™</sup> VIP vascular closure device

References: 1. Werner GS et al. J Am Coll Cardiol 2003;42:219-25; 2. Colmenarez HJ et al. J Am Coll Cardiol 2010;55:1854-66; 3. Touma G et al. IJC Heart & Vasculature 2015;7:28-39.

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**Terumo Corporation** +81 3 3374 8111

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Terumo Interventional Systems EMEA +33 147 16 09 30

EMEA Sales Offices

Terumo Europe NV Africa Business Division +3216381308 **Terumo Europe NV Benelux Sales Division** Belgium: +32 16 39 25 80 The Netherlands: 0800 0220396

Terumo Europe NV Emerging Market Division +32 16 38 12 11

**Terumo Deutschland GmbH** +49 6196 80 230

**Terumo Deutschland GmbH** Österreich +43 2236 378020 **Terumo Deutschland GmbH Switzerland** +41 56 419 10 10

**Terumo Europe España SL** +34 902 10 12 98

**Terumo France S.A.S.** +33 130 96 13 00

**Terumo Italia S.r.l.** +39 0651 96 14 20

**Terumo Russia LLC** +7 495 988 4740

**Terumo Sweden AB** +46 3174 85 880 **Terumo Middle East FZE** +971 4 292 0200

**Terumo UK Ltd** +44 1276 480 440

Terumo BCT Tıbbi Cihazlar Dağıtım ve Hizmetleri A.Ş. +90 216 590 0074



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