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Successful Recanalization of a Left Anterior Descending Chronic Total Occlusion Via an Ipsilateral Intraseptal Collateral Using Reverse CART Technique

Sharad Chandra, MD, DM, Sudarshan Kumar Vijay, MD, DM, Sudhanshu Kumar Dwivedi, MD, DM

ABSTRACT: The retrograde approach using collaterals has been introduced for percutaneous dilatation and opening of chronic total occlusion of the coronary arteries. The controlled antegrade and retrograde tracking (CART) strategy has been developed to improve guidewire crossing and successful recanalization. We herein describe a case of left anterior descending chronic total occlusion that was successfully recanalized using ipsilateral intraseptal collateral by reverse CART technique.

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Key words: chronic total occlusion, intraseptal collateral, left anterior descending coronary artery, reverse CART

A successful chronic total occlusion (CTO) percutaneous coronary intervention (PCI) is one of the challenges in interventional cardiology.€Despite improvements in hardwares, operator expertise, and novel CTO-PCI strategies, results of antegrade recanalization remain suboptimal in many cases.€With the introduction of the retrograde technique, the success rate of recanalization of CTOs has improved significantly. There are various limitations and difficulties in selecting the route for the retrograde approach, such as the extreme tortuosity of the epicardial collateral, narrow septal collaterals, or collateral arising from around the stenosed donor artery. We describe a case of the successful use of a retrograde approach through an ipsilateral intraseptal collateral vessel connecting proximal and distal segments of the LAD with a CTO in the mid-left anterior descending artery (LAD).

Case Description

A 60-year-old male smoker with a history of Canadian Cardiovascular Society (CCS) class II exertional angina of 5 years duration despite maximal optimal medical therapy and a positive treadmill test with moderate risk (Duke score = -10) was referred to us for coronary angiography and possible revascularization. His electrocardiogram was unremarkable and an echocardiogram showed normal left ventricular function. Coronary angiography revealed left dominant coronary circulation and a long CTO segment in the mid-LAD (Figure 1 and Video 1). The distal segment of the LAD was supplied via an ipsilateral intraseptal collateral channel (Figure 1). The CTO segment was very long and the entrance to the occlusion had an unusual configuration. After a lengthy struggle using the antegrade approach, a Conquest Pro guidewire (Asahi Intecc) successfully penetrated through the proximal segment. Consequently, a large false lumen was created, but the distal true lumen could not be negotiated (Figure 2). The procedure was eventually abandoned. An ipsilateral intraseptal collateral channel was comparatively straight for better accommodation of the retrograde wiring. A second attempt using retrograde approach was thus made after 2 months. A 7 Fr Launcher 3.5 guide catheter (Medtronic, Inc) was engaged in the left coronary artery and a Fielder FC 300 cm guidewire (Asahi Intecc) was introduced in the proximal septal branch and navigated into the distal LAD through the distal septal branch via intraseptal collateral (Figure 3). Because of its favorable angulation and low

tortuosity, wire manipulation in the distal LAD was relatively smooth. The retrograde guide catheter was cut short for longer distance to the lesion. After advancing the wire through the distal septal branch, the wire was navigated into the CTO retrogradely. A 180 cm Corsair hybrid catheter (Asahi Intecc) was loaded over the 300 cm Fielder FC wire in order to make an attempt to advance it retrogradely over the CTO segment (Figure 4 and Video 2). However, because of the hard proximal cap of the CTO segment, the retrograde corsair device had difficulty in getting into the true lumen proximal to the CTO. We then introduced another Fielder XT wire with a 1.2 mm over-the-wire balloon antegradely (Figure 5). The antegrade wire was advanced into the proximal cap subintimally and balloon dilatation at nominal pressure was performed in the subintima. After this, the retrograde wire was then advanced through the subintimal dissection into the proximal LAD (Figure 6) and then the Corsair was advanced over this wire proximal to the CTO segment. As a result, the true lumen of the distal LAD was then successfully negotiated with a Fielder XT guidewire in an antegrade fashion (Figure 7). The retrograde wire with Corsair was removed. After successful balloon dilatation, two Yukon stents (Translumina) of 2.5 x 32 mm and 2.5 x 28 mm were deployed (Figures 8 and 9), with an optimal angiographic result (Figure 10 and Video 3). The patient is free of symptoms after 6 months of follow-up.

Discussion

In addition to the classical retrograde technique, newly developed retrograde techniques like controlled antegrade and retrograde subintimal tracking (CART) technique, reverse CART, and the intravascular ultrasound (IVUS)-guided technique favorably contribute to the technical success rates of CTO-PCI.[1-4] At present, the primary reason for failure of CTO-PCI is the inability to successfully cross the proximal cap of the lesion with the guidewires into the distal true lumen. The histology of the CTO segments is suggestive of thinner and softer distal fibrous cap than the proximal cap. Therefore, the distal cap is more amenable to penetration with a guidewire than the proximal one,[5] thereby increasing the chances of crossing the lesion retrogradely. Determining the exact entrance of the CTO using multiple orthogonal view angiograms is crucial for wire manipulations.[3] A particular angiographic configuration around the entry of the CTO such as the side branch and bridging collaterals, makes it difficult to navigate the guidewire along the correct route. The retrograde approach with various modifications has been applied in CTO PCI with encouraging results.[6] In the CART technique, a connection between the subintimal space of the CTO lesion and the distal true lumen is created by retrograde ballooning,[7] while in the reverse CART technique, a connection between the subintimal space of the CTO lesion and proximal true lumen is created by antegrade ballooning.[8] The reverse CART technique has potential limitations, such as difficult retrograde wire handling due to the long course and many angulations.

The Corsair, a hybrid catheter, is an excellent channel dilator and has dramatically improved the success of the retrograde approach. It also manages to cross the difficult lesions by its shrink shaft mechanism.

Retrograde PCI can be attempted either via intraseptal or interseptal collaterals.[9] The most important difference between the intraseptal and the interseptal channel is in their anatomical course. Interseptal collaterals lie intramuscularly, allowing easy initial passage of the device. In contrast, the intraseptal collaterals have a relatively sharp angle compared to the interseptal collaterals; thus, it is imperative for the devices to pass through and make a U-turn at the angled point of the end of its course, which requires meticulous care while advancing devices to this site.

The second attempt of balloon dilatation in our patient was therefore performed on the antegrade wire in the subintimal space of the proximal cap, as described in the reverse controlled antegrade and retrograde subintimal tracking (reverse CART) method. Our case was slightly different from the classical demonstrated cases of reverse CART, in which the initial plan was to externalize the retrograde wire through the same guide catheter and to perform the stenting using externalized wire, but the Corsair channel dilator managed to dilate the CTO segment adequately so that we were able to cross through the CTO with the antegrade wire. This case describes the successful

retrograde PCI of a CTO via the ipsilateral intraseptal collateral in a mid-LAD CTO, using the reverse CART technique. Use of this technique must be carefully evaluated, as damaging a donor channel might compromise the distal flow with detrimental consequences.

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Department of Cardiology, CSM Medical University (King George Medical College), Lucknow, UP, India.
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Address for correspondence: Sudarshan Kumar Vijay, MD, DM, Department of Cardiology, CSM Medical University (King George Medical College), Chowk, Lucknow, UP, India, PO-226003. Email: skvijay1980@rediffmail.com

Figure 1. Left coronary angiogram (left anterior oblique cranial view) showing mid left anterior descending (LAD) artery chronic total occlusion (CTO) and the presence of a tortuous intraseptal collateral.

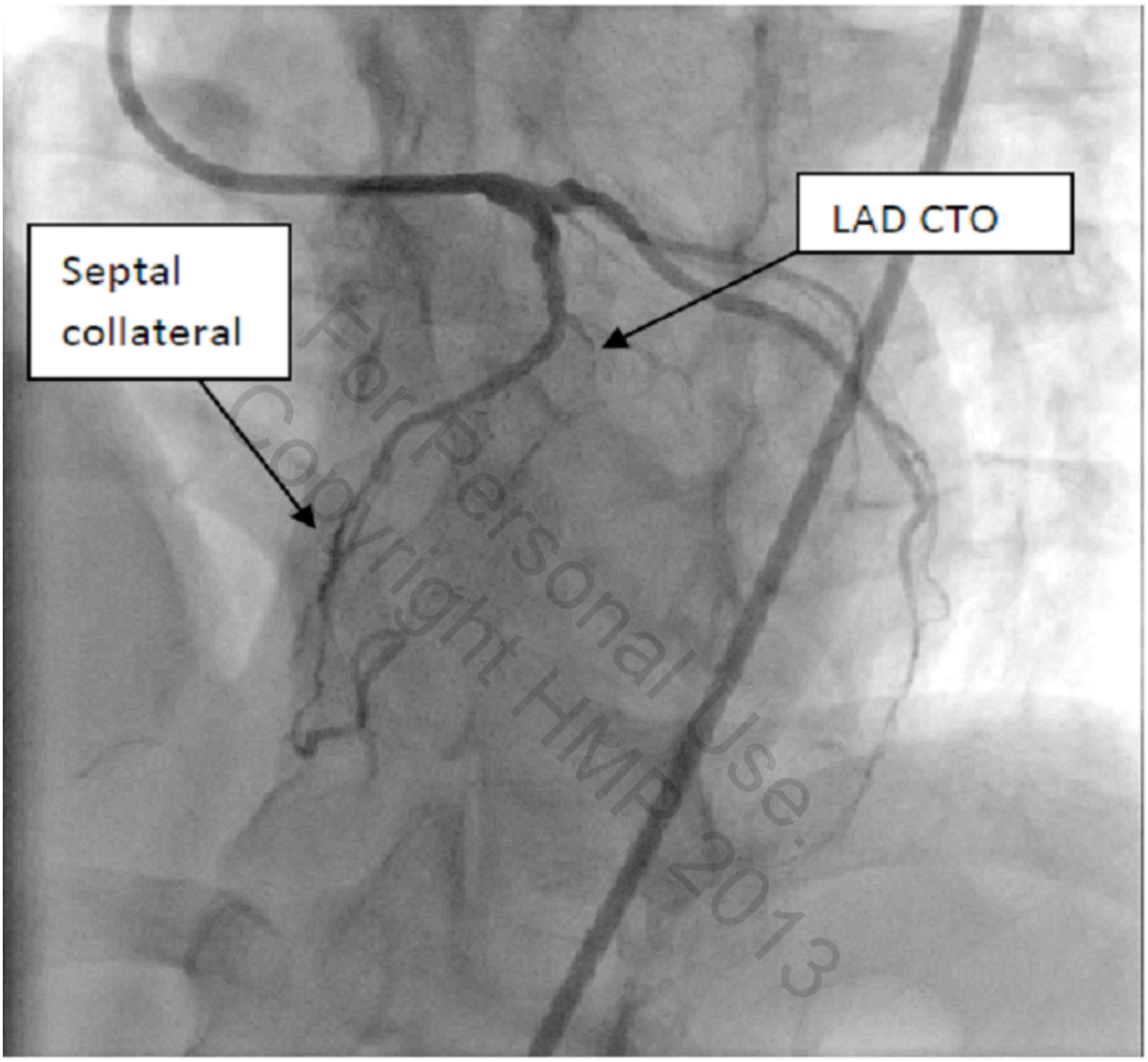

Figure 2. Antegrade attempt to open the chronic total occlusion, resulting in wire entry into false lumen and coronary dissection. D1 = first diagonal; LAD = left anterior descending coronary artery.

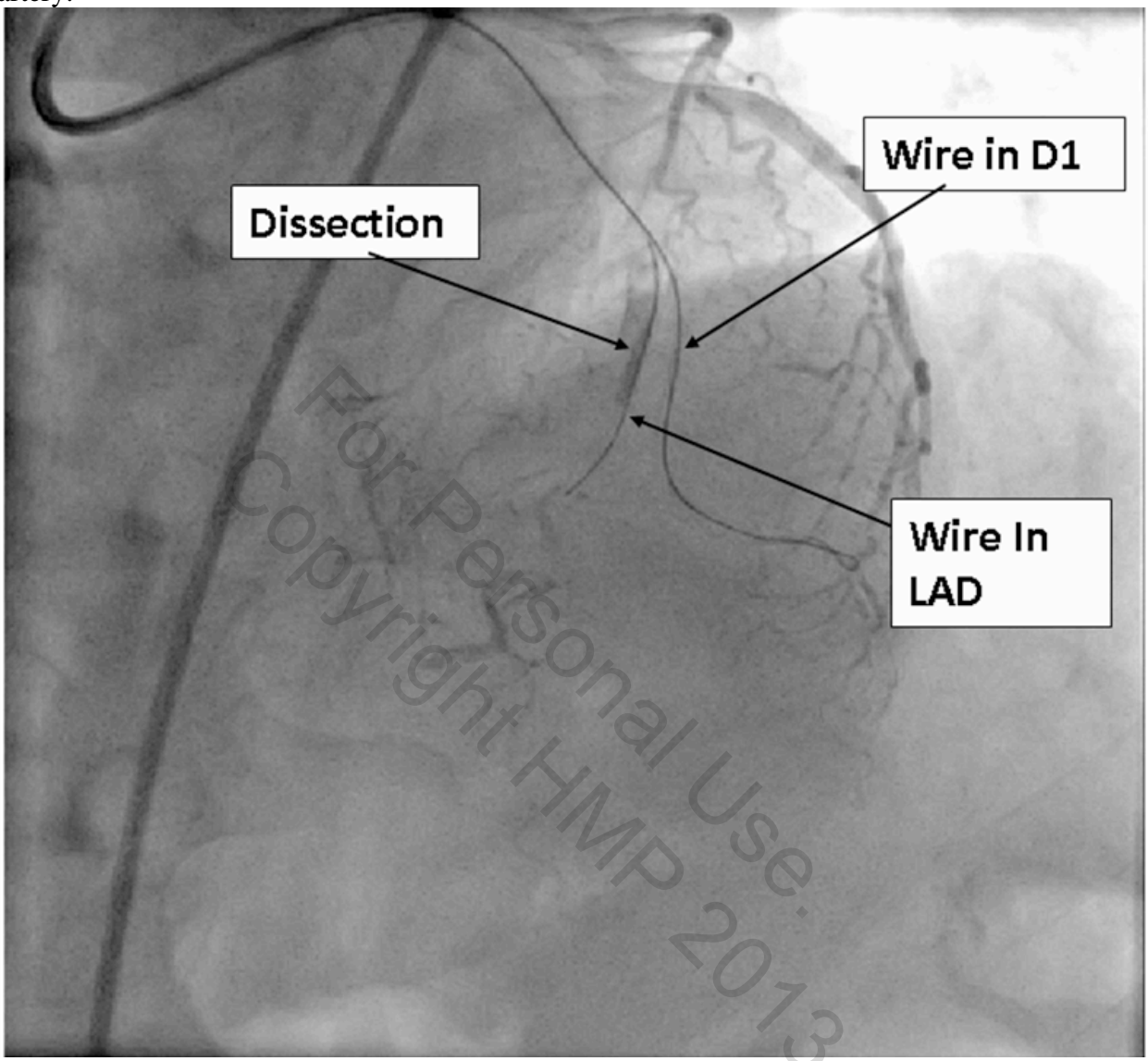

Figure 3. Fielder FC (300 cm) guidewire passed through the ipsilateral intraseptal collateral into the distal chronic total occlusion segment and antegrade wire in the diagonal branch.

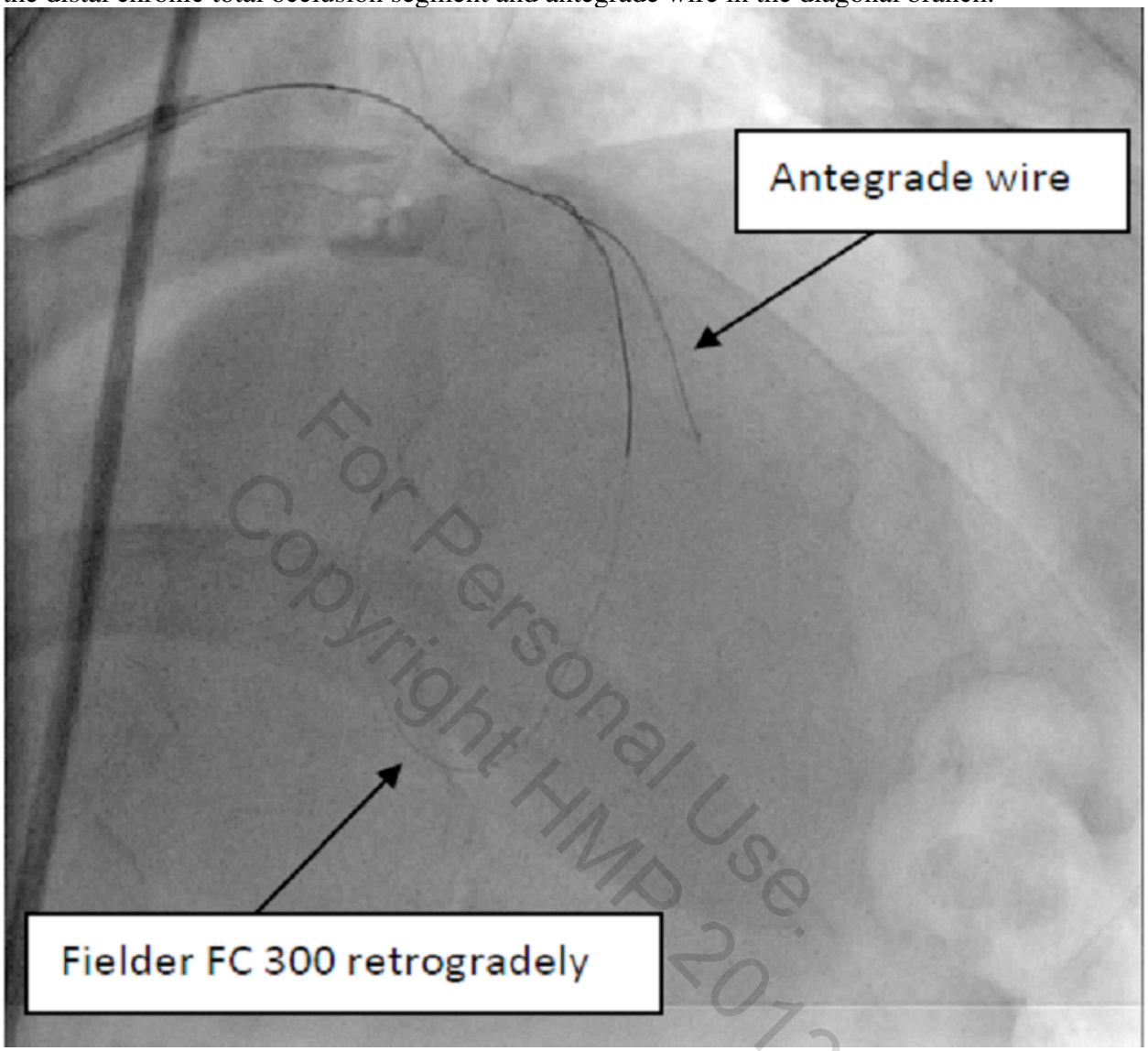

Figure 4. Corsair device loaded on the retrograde wire and an attempt was made to pass it through the distal chronic total occlusion segment.

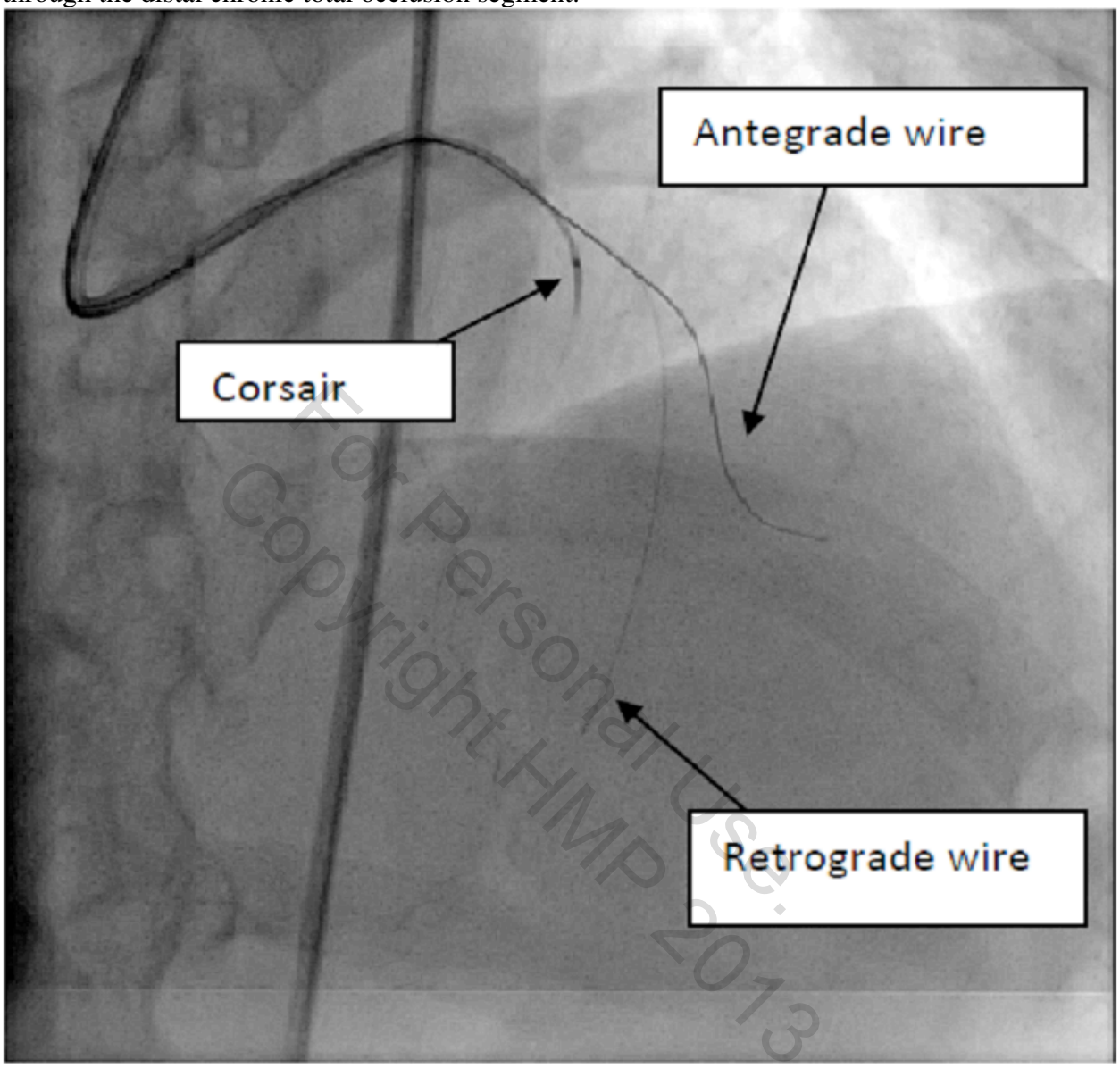

Figure 5. Fielder XT guidewire passed antegradely into false lumen and the false lumen was dilated using 1.2 mm over-the-wire balloon. D1 = first diagonal; LAD = left anterior descending coronary artery.

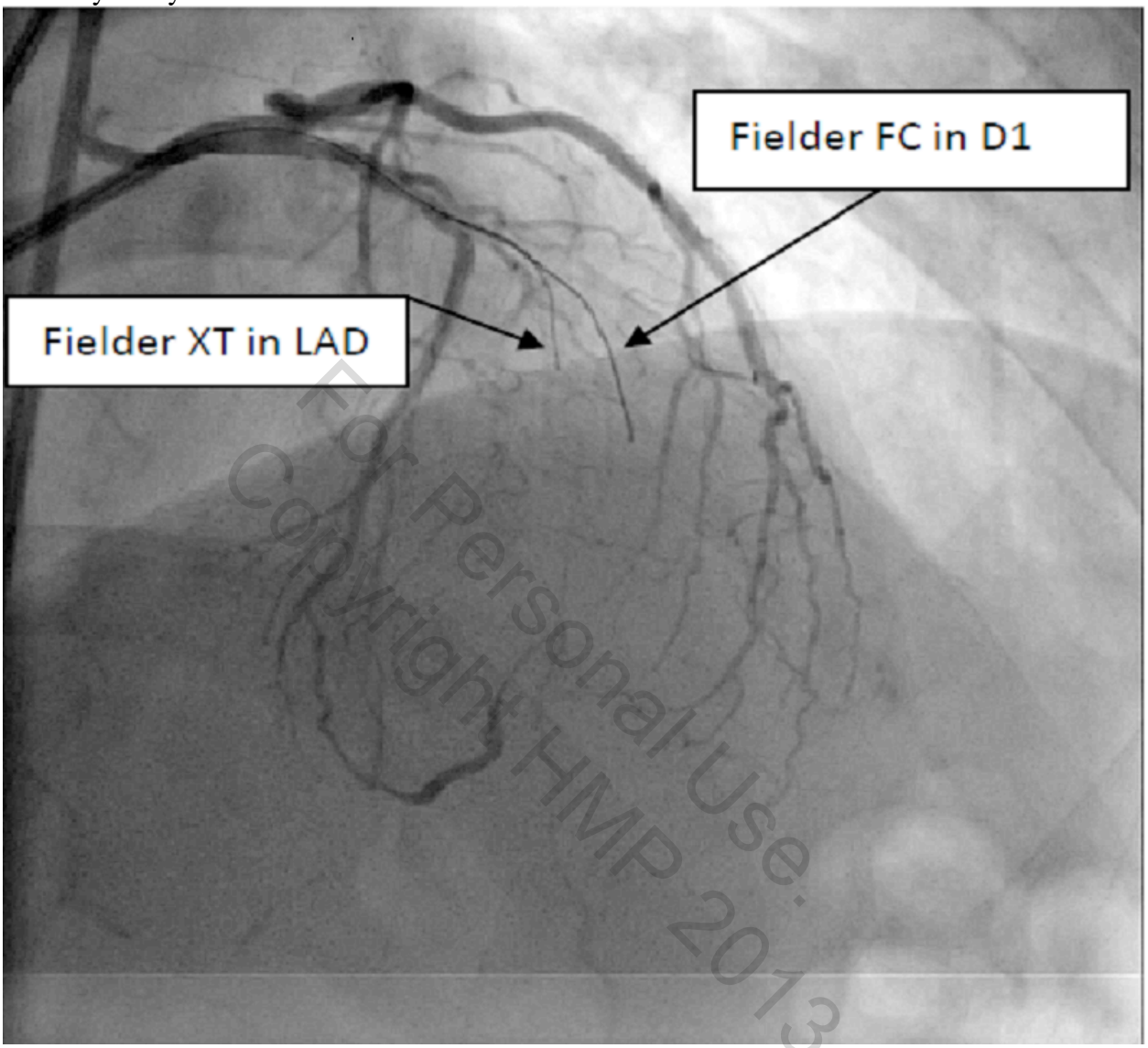

Figure 6. After crossing the retrograde wire into the proximal false lumen corsair device was passed over the wire into the proximal chronic total occlusion segment.

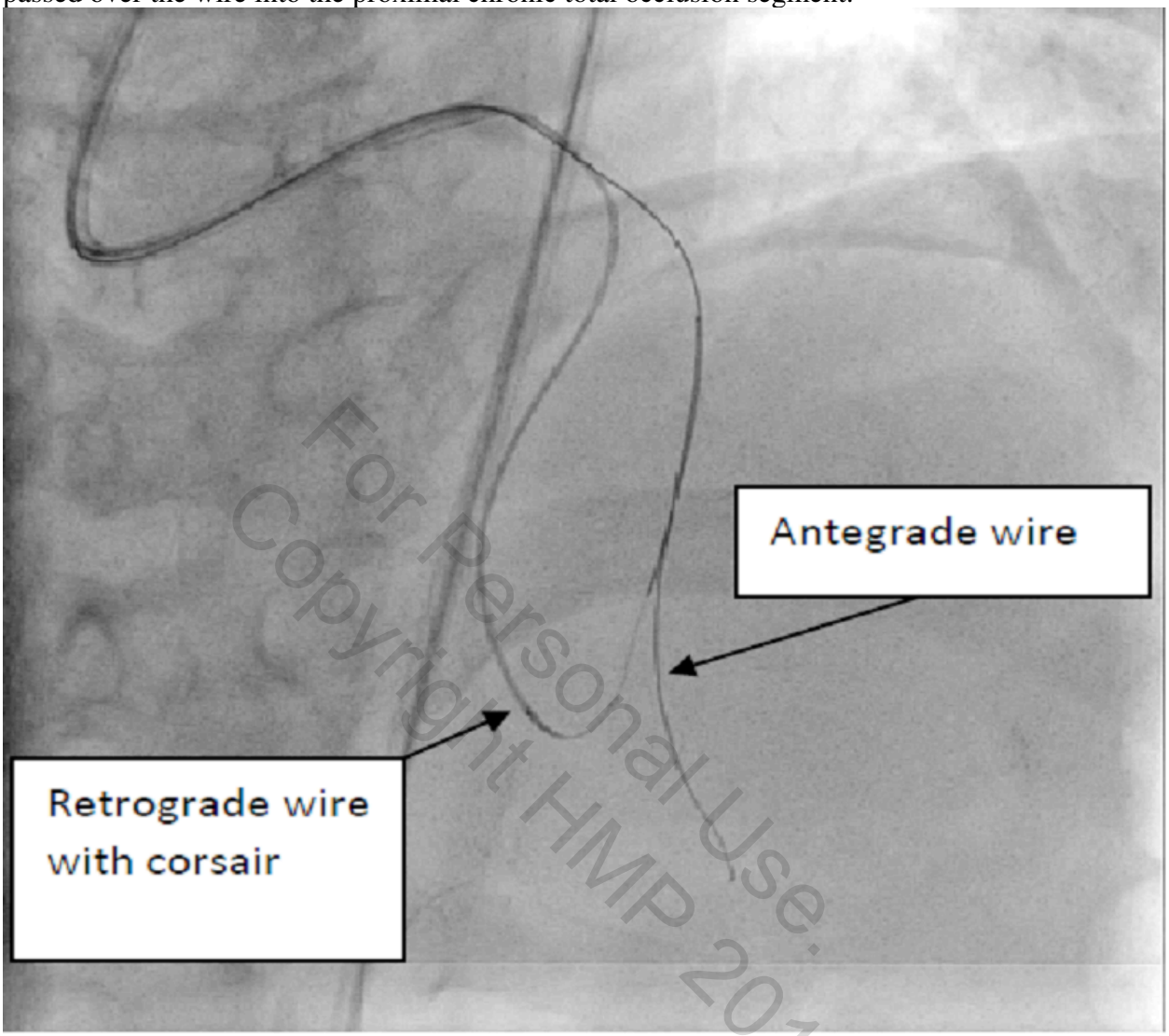

Figure 7. After removal of retrograde wire, Fielder XT guidewire successfully passed antegradely.

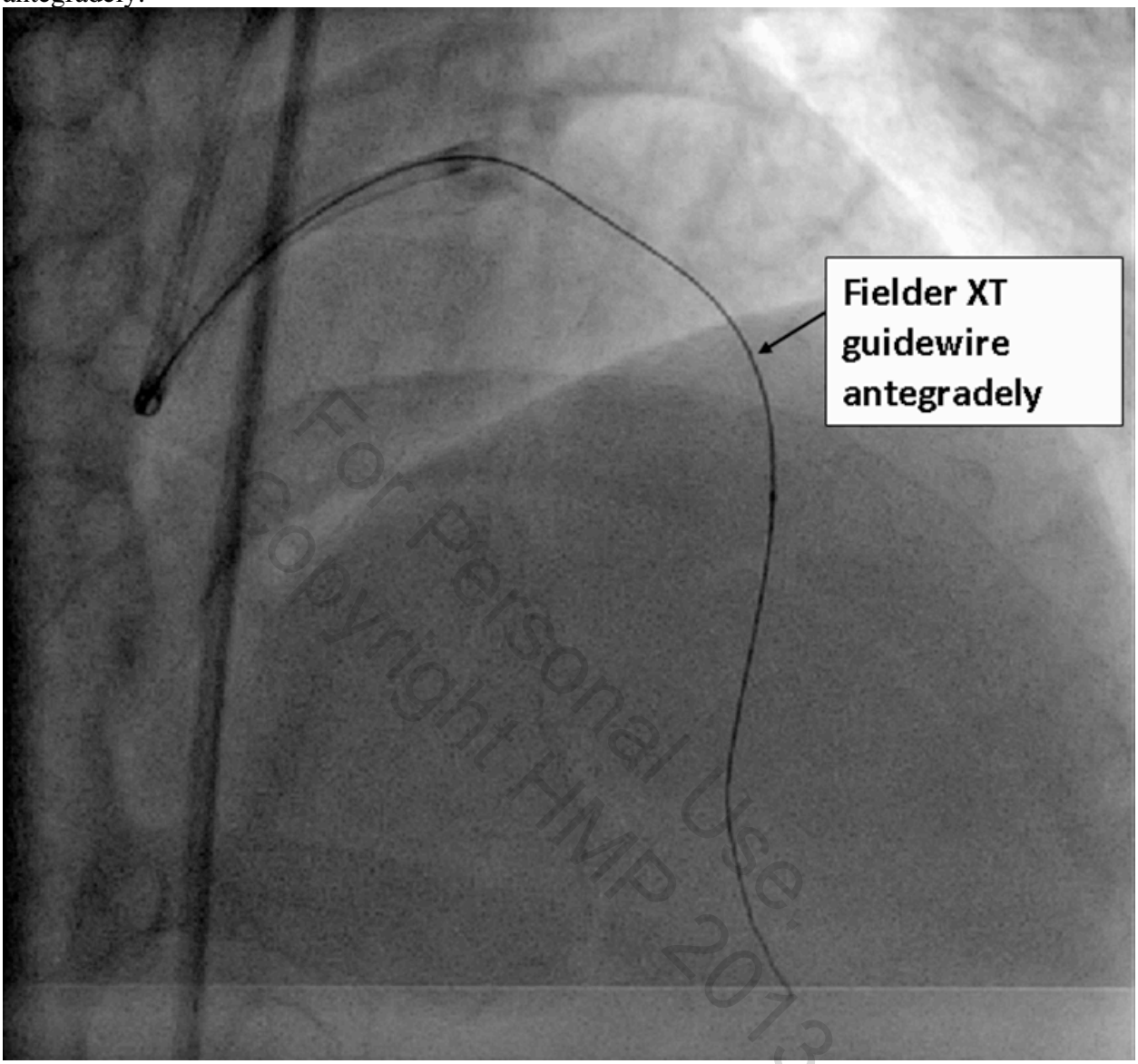

Figure 8. Deployment of distal stent (2.5 x 32 mm).

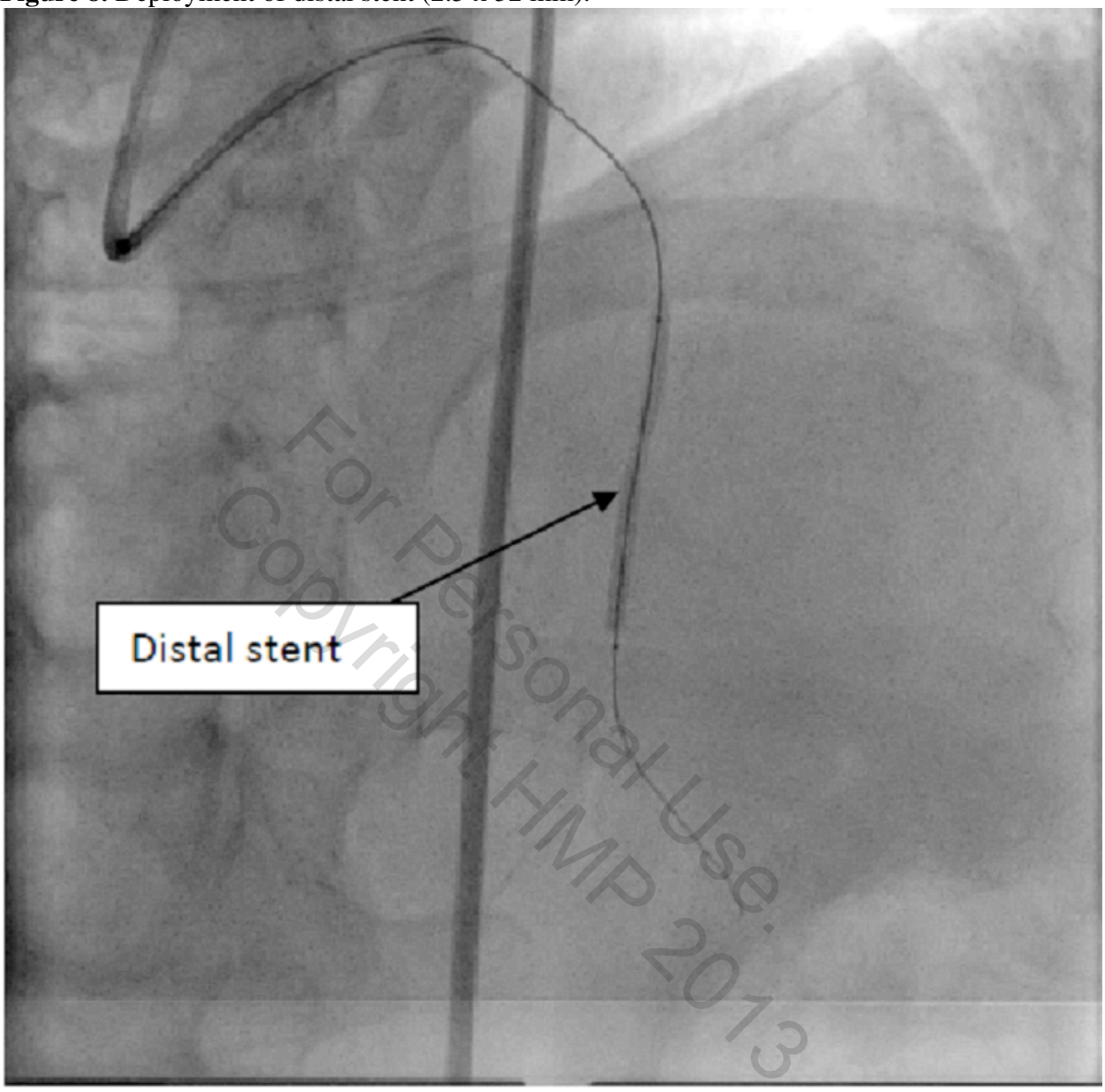

Figure 9. Deployment of proximal stent (2.5 x 28 mm).

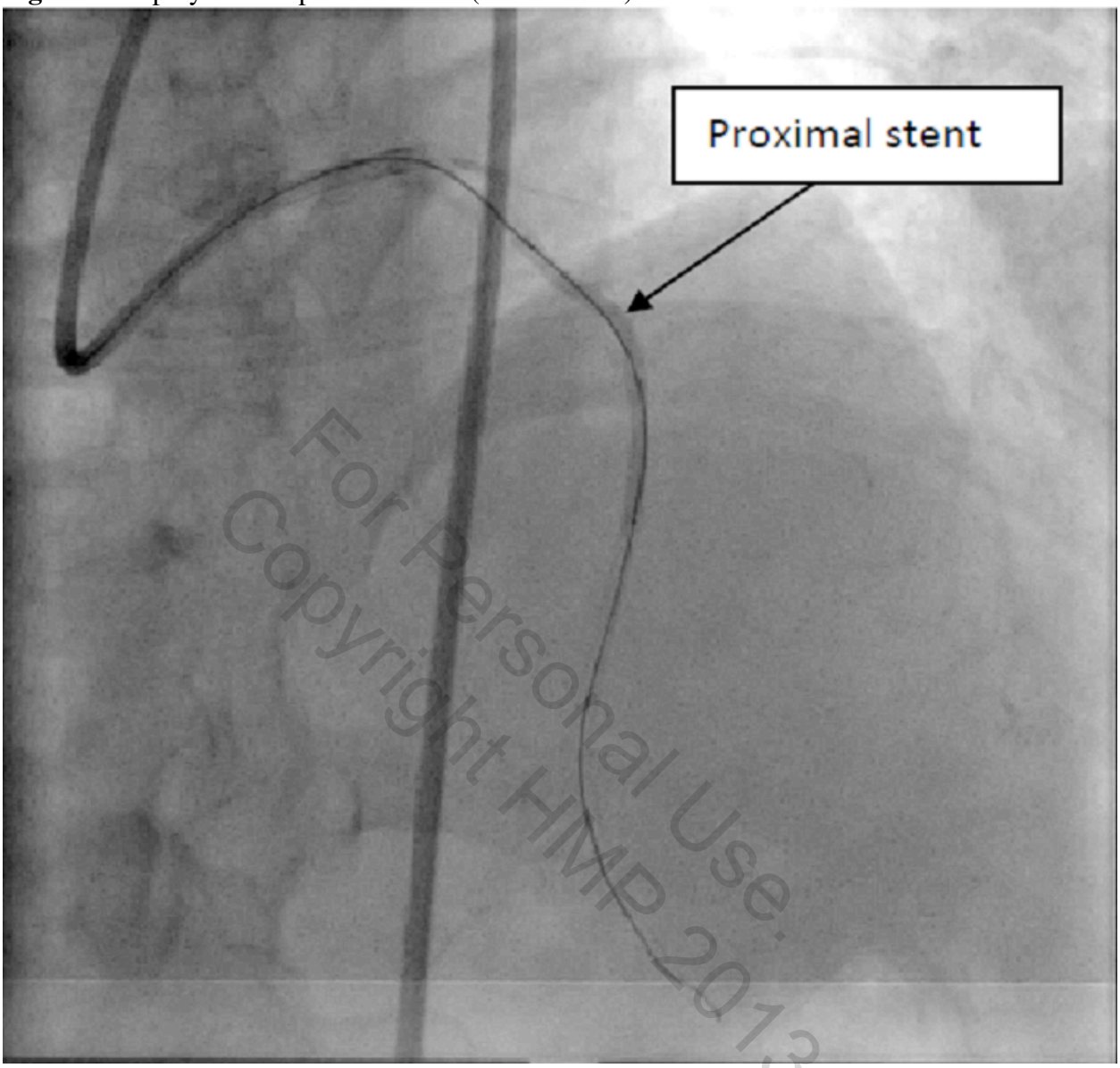

Figure 10. Postprocedure angiogram showing successful recanalization of left anterior descending coronary artery with TIMI-3 flow.