Intravascular Ultrasound (IVUS) Guided Fixation of an Accidentally Crushed Coronary Stent

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SUMMARY

Stent deployment during coronary intervention has become more and more common recently. Inappropriate stent deployment may lead to unexpected high mortality and morbidity rates. A 62 year-old man with unstable angina presented with a bifurcation lesion after diagnostic coronary angiography. A drug-eluting stent was successfully deployed across the bifurcation lesion. However, after wire exchange and rewiring followed by high pressure balloon postdilatation, the stent was accidentally crushed under IVUS guidance. We used a looping wire technique and successfully redilated the crushed instent portion. This case suggests interventionists should not always change the wire before stent well deployment and should bear in mind the value of IVUS in managing such a complication. (Int Heart J 2008; 49: 621-627)

Key words: Percutaneous coronary intervention, Bifurcation lesion, Crushed stent, Intravascular ultrasound, Looping wire technique

STENT deployment failure may cause coronary artery thrombus formation, coronary artery occlusion, instent restenosis, and subsequent myocardial infarct.1) These complications are also associated with unexpected high morbidity and mortality rates. However, inadvertent stent crush is a rare, yet commonly missed, complication by interventionists if the coronary angiogram is not reviewed very carefully for a lower threshold of intravascular ultrasound (IVUS) use in such situations.2) Here, we describe a bifurcation stenting case that appeared to proceed smoothly, with inadvertent severe stent crush diagnosed and corrected with IVUS guidance.

CASE REPORT

A 62 year-old man with unstable angina was referred to our institute for coronary angiography. A critical bifurcation stenosis was found at the mid left ante-
Figure 1. Angiography demonstrating significant stenosis at the mid LAD just after giving off the 1st diagonal branch (LAO view with cranial angulation).

Figure 2. The lesion was stented with a Cypher 3.0 × 28 mm, deployed at 10 atm, crossing over the diagonal branch.
rior descending artery (LAD) and the diagonal branch was mildly diseased (Figure 1). His left circumflex artery and right coronary artery were both normal.

The left main ostium was engaged with a 6 Fr. Kimny guiding catheter (Boston) and a 0.014” Runthrough Floppy guide wire (Terumo) was advanced to the distal left anterior descending artery. Another 0.014” Rinato guide wire (Asahi) was advanced through the diagonal branch. The lesion was predilated with a 2.5 × 20 mm Maverick balloon (Boston) at 14 atm. A Cypher 3.0 × 28 mm (Cordis) drug-eluting stent was smoothly deployed across the lesion at 10 atm (Figure 2).

The LAD and diagonal wires were smoothly exchanged. A 3.0 × 10 mm NC Mercury (Abbott, high pressure balloon) was advanced over the LAD guidewire and inflated at the LAD stent at 16 to 22 atm. A subsequent angiogram showed normal flow with an ambiguous haziness at the distal stent segment (Figure 3). We advanced an IVUS catheter to further evaluate this stent. We found tissue prolapse (Figure 4F) at the distal stent segment (the area of angiographic haziness),

Figure 3. Angiography demonstrating normal coronary flow with an ambiguous haziness at the distal stent segment.
with a surprising severely crushed mid-to-proximal stent part (Figure 4C and 4D). Another Rinato wire was then advanced through the stent after making a loop of its distal floppy segment before approaching the stent “looping wire technique”. The operator attempted to confirm the new wire track with IVUS, however, the IVUS catheter could not be passed through the stent (Figure 5A). A Maverick 2.0 × 20 mm balloon (Boston) was advanced over this new wire and inflated at 12 atm (Figure 5B), after which the IVUS catheter passed easily and confirmed correct in-stent passage of the new wire (Figure 5C and 5D).

The stent was further expanded with a 3.0 × 10 mm NC Mercury balloon at 26 atm and a 3.5 × 8 mm Quantum balloon (Boston) at 22 atm (Figure 6A). The final IVUS study showed full stent expansion and deployment (Figure 6).
Figure 5. After rewiring by the looped wire technique, the IVUS catheter could not be passed through the stent (A). A 2.0 × 20 mm balloon dilated the new wire track (B). The IVUS catheter then easily passed over the wire, and the true track was confirmed throughout the stent; improved stent expansion was observed in IVUS cross-sectional (C) and long views (D).

Figure 6. Stent expansion was optimized with a 3.5 × 8 mm high pressure balloon (A). IVUS confirmed this good result (A-E; IVUS cross-sectional views and F; IVUS long view).
Coronary bifurcation lesions account for 20-25% of all percutaneous coronary intervention (PCI). In comparison to other PCIs, bifurcation interventions tend to have lower rates of procedural success, higher resource utilization, and higher rates of clinical and angiographic restenosis. Stents deployed at low pressure might leave a gap (underdeployment) between the stent and the wall of the proximal vessel that normally have a larger diameter. Guide wires and even a short balloon can go through stent struts (false-true or true-false-true) without an appreciable resistance, and this commonly causes stent crush after balloon inflation. Stent crush might be missed under fluoroscopy and angiography. Hence, a low threshold for IVUS use for any suspicious findings can be very helpful, not only in diagnosing, but also in guiding appropriate management for such a complication. During rewiring for the crushed stent, the following techniques can rescue this complication. Our technique emphasizes making a small loop of wire (the floppy part) before entering the crushed stent strut, which might prevent the wire from becoming entangled across the stent struts. Because the looping wire tip increases its cross sectional diameter, it is possible to avoid entering into the false lumen created by balloon angioplasty. In the case of complete stent crush, deploying another stent is the only option for treating this complication.

The lessons learned from this case are; 1) it is better to retain the (stented) main trunk vessel guide wire and use another (third) wire for recrossing to the side branch when a stent is deployed at low pressure; there is a discrepancy in the main trunk diameter before and postbranching; and when deploying a relatively undersized stent before further expansion by an oversized balloon. 2) Mechanical complications of bifurcation stenting might easily pass unrecognized; a high threshold of suspicion and IVUS use guards against such complications. 3) Some of the cases of inadvertent stent crush still can be fixed without deploying an additional stent, which is the most commonly applied strategy for such a scenario. 4) Rewiring can be attempted with a prolapsed wire tip technique, and the new wire track should be confirmed by IVUS either directly or after passage dilatation by a small-sized (2 mm diameter) balloon. One should take advantage of proximal stent edge or segment expansion; this should guide the looped wire within the stent.

With this case, we have highlighted the technical tips of rewiring in a bifurcation lesion, as well as the value of IVUS in diagnosing and managing such an easily missed complication.
REFERENCES


