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HOW-TO-DO-IT

Threading the Eye of the Needle: A Challenging Case of Iatrogenic Spiral Coronary Artery Dissection

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Catheter induced coronary dissection is an uncommon but potentially catastrophic complication of coronary angiography. We report a case of a 48-year-old female with normal coronary arteries on angiography complicated by extensive catheter induced spiral dissection. Wiring into the true lumen was a formidable challenge as a consequence of the large false lumen obliterating the true lumen. We present management strategies and in particular, highlight the important role of intravascular ultrasound (IVUS) imaging.

Keywords Coronary artery dissection • True lumen • Tactile resistance • Intravascular ultrasound • IVUS

A 48-year-old female with hypertension and hyperlipidaemia, underwent invasive coronary angiography to investigate chest pain associated with a troponin rise. Angiography demonstrated smooth epicardial coronary arteries (Figure 1A). The procedure was complicated by an extensive catheter induced, spiral dissection extending from the ostial right coronary artery (RCA) to mid posterior descending artery (PDA), associated with TIMI I-II flow (Figure 1B), chest pain and inferior ST-elevation.

An attempt was made to wire the true lumen using a JR4 guide and BMW guidewire, however significant tactile resistance was encountered in the proximal vessel. Assuming the wire was in the false lumen, the guide was changed to a short tip JR3.5 to reduce guidewire bias entering the false lumen. The BMW wire was passed into the distal posterior left ventricular (PLV) branch with ease (Figure 1B), but angiography demonstrated an absence of both the right ventricular (RV) marginal and posterior descending artery (PDA) side branches (Figure 1A), suggesting that the guidewire was in the false lumen.

An intravascular ultrasound (IVUS) was performed on the BMW guidewire in the PLV to clarify its luminal position. A 5F 40Mhz OptiCross (BostonScientific, Natick, US) catheter was taken to the mid RCA, which confirmed the guidewire was in the false lumen. The true lumen was confirmed to be obliterated by the sizeable echolucent false lumen with anterograde flow (Figure 2A). IVUS imaging performed at the ostium of the right catheter ablation (RCA) demonstrated the catheter entering into the true lumen, with a large intimal-medial defect evident representing the likely location of catheter dissection (Figure 2B). Keeping the BMW guidewire in the false lumen, the IVUS catheter was withdrawn and placed proximal to the ostium of the RCA to provide real-time visual guidance in wiring the true lumen. Using this technique, the true lumen was successfully wired using a Sion Blue guidewire, though there was significant tactile resistance. Repeat IVUS imaging confirmed the wire was in true lumen. (Figure 2C,D).

Given the dissection had extended into the distal vessel, the ostial-proximal segment was stented first to secure the entry point into the dissection flap and improve anterograde flow within the true lumen using two overlapping 4.0 × 28 mm Promus Premier (Boston Scientific, Natick, US) drug-eluting stents (Figure 3A). A third overlapping

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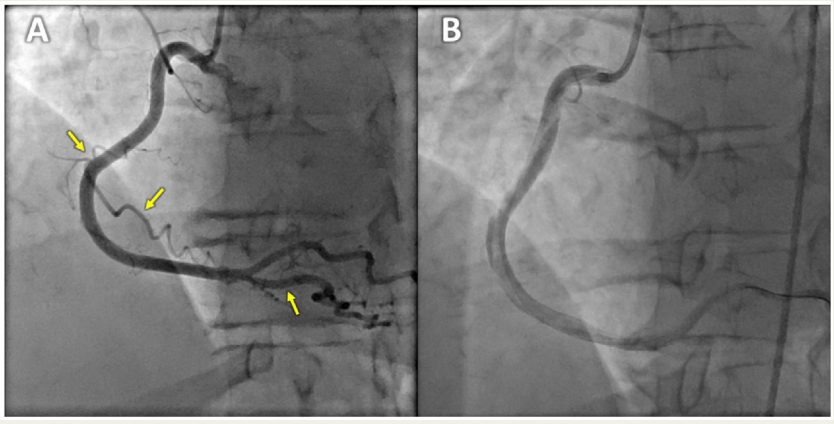

Figure 1 Coronary angiography at baseline and following iatrogenic right coronary artery dissection.
A – Initial diagnostic coronary angiogram demonstrating angiographically smooth RCA. **B** – Extensive spiral coronary artery dissection extending from RCA ostium to PLV. In comparison with **(A)**, the PDA and RV marginal side-branches were absent.
Abbreviations: RCA, right coronary artery; PLV, posterior left ventricular; RV, right ventricular.

stent was required to treat severe luminal compression due to intramural haematoma (IMH) at the outlet of the stented segment (Figure 3A). Final IVUS imaging confirmed fully expanded and well apposed stents, with mild persistent luminal compression of the distal non-stented RCA secondary to intramural haematoma (Figure 2E,F).

On completion of the case, the patient was pain free with ST-segment elevation resolution. Final angiographic images demonstrated residual IMH with TIMI 3 flow into the PDA, with restoration of flow to all side-branches, including the proximal-mid PLV (Figure 3B). The patient had an uncomplicated post-procedure recovery with preserved ventricular function on echocardiography and was asymptomatic at 3-month follow-up.

Discussion

Iatrogenic catheter induced coronary dissection (ICD) during angiography is an uncommon (<0.2%) but potentially catastrophic complication [1,2]. Mechanical injury during diagnostic angiography typically results from either catheter manipulation or forceful injection of contrast medium. Risk factors for ICD include atherosclerotic or calcific disease at the ostium, catheter shape and in the case of the RCA, a ''shepherd's crook'' steeply angulated proximal segment [3]. The rate of ICD during diagnostic angiography is significantly higher (3.4%) in females with spontaneous coronary artery dissection [4], likely reflecting the underlying fragility of their arterial wall and possible connective tissue disease. Furthermore, as illustrated in this case, dissection in the absence of coronary plaque tends to be more extensive compared to vessels with atherosclerosis, as the associated medial atrophy and scarring limits propagation of the dissection [5,6].

Several important lessons can be learnt from this case.

1) As a general principle, angiography should be minimised in the presence of coronary dissection in order to limit hydraulic propagation. However, careful interpretation of the initial angiogram often acquired to confirm diagnosis and extent of dissection, can be helpful in guiding management strategy. The presence of side-branches can be useful in identifying anterograde flow into the true lumen. In this case, there was extensive spiral dissection associated with a large false lumen with anterograde flow along course of the RCA compressing the true lumen, as evident by the absence of the RV marginal and PDA branches (Figure 1B). The absence of contrast staining on angiography and the presence of side branches in the distal PLV, demarcates the segment at which the false lumen enters back into the true lumen (Online Video 1). Appreciating the interface between the false and true lumen can be crucial if all attempts to wire the true lumen have failed and the patient is in haemodynamic extremis. In this scenario, a less than ideal strategy of ''full-metal jacket'' stenting from the distal true lumen through the false lumen along the course of the RCA and back to the true lumen at the ostium would have at least salvaged flow into the PLV territory.
2) Wiring into the true lumen is critical and can be most technically challenging in coronary dissection (Table 1). Reducing wire bias into the false lumen can be facilitated by remote wiring from the ostium as the guide catheter may be directly engaged in the false lumen. By placing a second guidewire in a proximal side branch or false lumen, the 'double-wire technique' can provide additional guide support when attempting distal wiring [3]. Conventional teaching emphasises the importance of tactile feedback in wiring coronary dissections, with resistance thought to represent wire passage into the false lumen. As demonstrated in this case, tactile resistance can be misleading with paradoxical ease of wiring into a

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