Double Coronary Artery Stent Fracture With Coronary Artery Microaneurysms

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Summary

Even though drug-eluting stent (DES) implantation is an effective treatment for coronary artery stenosis, there are growing concerns related to the real usefulness of DESs due to their increased incidence of thrombosis, stent fracture, and late stent malapposition in comparison to bare metal stents. We have previously reported a case of stent fractures and multiple microaneurysms in both the left anterior descending and left circumflex coronary arteries. In the present case, we demonstrate the ability of dual-source spiral computed tomography to evaluate the various complications of DESs. (Int Heart J 2009; 50: 127-132)

Key words: Drug-eluting stent, Computed tomography, Coronary, angiography, Coronary artery disease

Drug-eluting stents (DESs) successfully prevent restenosis in the majority of patients.1,2 However, some clinicians have questioned the usefulness of DESs owing to the increased incidence of thrombosis and death in DES patients compared to bare metal stent (BMS) patients during follow-up.3,4 Numerous intravascular ultrasound (IVUS) studies have reported an increased frequency of late stent malapposition (LSM) in patients with DESs, suggesting that there may be an association between LSM and late stent thrombosis.5,6 Recently, stent fracture has been recognized as a complication of DES leading to both restenosis and occlusion, especially in long coronary lesions with sirolimus-eluting stents.7 We have previously reported cases with stent fractures and microaneurysms in both the left anterior descending coronary artery (LAD) and left circumflex coronary artery (LCX), both of which were diagnosed by dual-

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source spiral computed tomography (DSCT).

**Case Report**

A 67-year-old woman presented with a 7-day history of chest pain. She had a history of essential hypertension. Forty months prior, she had been admitted to hospital due to unstable angina pectoris and had undergone implantation of 4 coronary stents at the following sites: proximal right coronary artery (RCA) ....

![Images of medical scans showing DES fractures and microaneurysms](image_url)

**Figure 1.** Dual-source computed tomography showed DES fractures in both the LAD (panel A, white arrowhead) and the LCX (panel B, white arrowhead). However, the BMS in the RCA was patent without intraluminal hypodensity (panels C and F). Coronary microaneurysms in the LAD (panel D, white arrow) and the LCX (panel E, white arrow) were confirmed by dual-source computed tomography. Both coronary microaneurysms in the LAD (panel G, black arrow) and the total obstruction in the LCX (panel H, black arrowhead) were confirmed by diagnostic invasive coronary angiography. Both clear stent fractures in the LAD (panel I, white arrowhead) and the patent RCA stent were confirmed. LAD indicates left anterior descending artery; LCX, left circumflex artery; and RCA, right coronary artery.
DOUBLE CORONARY ARTERY STENT FRACTURE

(BMS, 3.5 × 24 mm Arthos-Pico®, AMG International, Raesfeld-Erle, Germany), proximal and middle LAD (two overlapped sirolimus-eluting stents, 3.0 × 18 mm Cypher® and 3.0 × 23 mm Cypher®, Cordis Corporation, Miami Lakes, Florida), and proximal LCX (one sirolimus-eluting stent, 2.5 × 33 mm Cypher®, Cordis Corporation, Miami Lakes, Florida). We performed DSCT (Siemens Medical Solutions, Forchheim, Germany) for noninvasive evaluation of chest pain. Coronary CT angiography showed DES fractures and microaneurysms in the LAD (Figure 1A and 1D) and LCX (Figure 1B and 1E). Total occlusion at LCX stent was also demonstrated (Figure 1E). However, the Arthos-Pico® stent in the RCA was intact without in-stent restenosis (ISR) and the stent wall was noted to be thinner when compared against the Cypher® stent (Figure 1C and

Figure 2. Intravascular ultrasound using a pull-back system from the distal coronary artery showed coronary stent fractures and coronary artery microaneurysms in both the LAD (panels A, B, C, and G) and the LCX (panels D, E, F, and H). There were stent struts in the distal LAD (panel C), proximal LAD (panel A), distal LCX (panel F), and proximal LCX (panel D). However, the stent strut was not observed in the mid-portion of the stent (panels B and E) which indicated the presence of stent fractures. The white arrows indicate coronary artery microaneurysms. LAD indicates left anterior descending artery and LCX, left circumflex artery.
One day later we performed diagnostic invasive coronary angiography (ICA). Diagnostic ICA showed both coronary microaneurysms in the LAD (Figure 1G) and total obstruction in the LCX (Figure 1H). Both the clear stent fracture in the LAD (Figure 1I) and the patent stent in the RCA were confirmed by ICA (Figure 1L). IVUS (iLab® Ultrasound Imaging System, Boston Scientific Corporation, Minneapolis, MN, USA) using a pull-back system from the distal coronary artery showed stent fractures and coronary artery microaneurysms in both the LAD (Figure 2A-2C) and the LCX (Figure 2D-2F). IVUS revealed a large amount of neointimal hyperplasia in the sirolimus-eluting stent in the LCX. We performed coronary balloon angioplasty in the LCX, without additional stent implantation. There was no recurrence of chest pain, and the patient was discharged from our hospital after intensive medical therapy.

**DISCUSSION**

Stent fractures occur by several mechanisms, including increased rigidity of overlapping stents, higher radial forces in long stents, in hypermobile or tortuous vessels, and high pressure angioplasty balloon dilatation. Fractured stent struts can cause local mechanical irritation of the vessel, which may result in inflammation and neointimal hyperplasia. Stent fractures may represent a new mechanism of restenosis in DESs. Restenosis could also reflect decreased local drug availability secondary to distortion of the stent architecture and polymer coating. Exposure of a free metal strut after stent fracture into the vessel lumen could clearly trigger platelet activation and resultant stent thrombosis.

The present case illustrated multiple complications of DES in one patient. There were stent fractures and microaneurysms in both the LAD and the LCX. A totally occluded sirolimus-eluting stent was also noted in the LCX. In our case, the long overlapping stents and hypermobility of the LAD may have led to the stent fracture. We can not explain why restenosis occurred in the LCX, but not in the LAD. Further investigation of the predictors of DES restenosis, such as procedural and lesion features, will aid in elucidating the exact cause of restenosis in fractured DESs.

Sixty-four slice multi-detector row computed tomography (MDCT) has high sensitivity and specificity and provides valuable information in the setting of coronary artery disease, including the characteristics of the coronary stent lumen. However, there are factors confounding stent assessment in MDCT: mechanical factors (beam hardening, blooming effect, and partial volume averaging effect), stent type, and cardiac motion. Sun, et al reported meta-analysis data related to assessment of coronary ISR showing moderate sensitivity (85%)
and specificity (97%). Even though MDCT has not reached the diagnostic ability to replace ICA for the detection of coronary ISR, it would be useful as a screening method for exclusion of coronary ISR.\textsuperscript{12} Moreover, recently developed DSCT has made it possible to assess coronary stents within a larger range of heart rates, with decreased motion artifact.\textsuperscript{13,14}

Though the incidence of DES fracture might be low, clinicians should attentively look for stent fractures on both ICA and noninvasive tools such as MDCT. Interestingly, the present case demonstrated variable visibility of the coronary stent lumen on DSCT, according to stent type. Possible explanations for this phenomenon include differing stent material and strut thickness. The Cypher\textsuperscript{®} stent is made of thin stainless steel 316L (strut thickness, 0.14 mm) and the Arthos-pico\textsuperscript{®} stent is made of cobalt-chromium alloy (strut thickness, 0.074 mm). Further investigation is needed to clarify variability in the stent visibility on MDCT according to stent type and thickness.

In conclusion, our case was clinically significant for two reasons. First, there were stent fractures and microaneurysms in both the LAD and the LCX in a single patient. Second, MDCT proved to be a good noninvasive method for evaluating stent fractures.

**REFERENCES**


