

A Case of a Zotarolimus-Eluting Stent Fracture in the Left Anterior Descending Artery in a Patient Undergoing Hemodialysis

In Hye Cha, Seong Hwan Kim, Sang Yup Lim*, Jeong Chun Ahn and Woo Hyuk Song

Department of Internal Medicine, Korea University Ansan Hospital, Ansan, Korea

Although stent fracture after implantation of a drug-eluting stent (DES) is a rare complication, it has been suggested to be a cause of restenosis. To date, most DES fractures have been associated with sirolimus-eluting stents. We describe here a case of a zotarolimus-eluting stent fracture after 8 months of stent placement in a calcified left anterior descending artery lesion in a patient undergoing hemodialysis.

Key Words: Stents; Complications; Fracture

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/3.0>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

Article History:

received 1 January, 2011
accepted 25 March, 2011

Corresponding Author:

Sang Yup Lim
Department of Internal Medicine,
Korea University Ansan Hospital, 516
Gojan-dong, Danwon-gu, Ansan
425-707, Korea
TEL: +82-31-412-6755
FAX: +82-31-412-5594
E-mail: vnlover@hanmail.net

INTRODUCTION

Drug-eluting stents (DES) have greatly reduced in-stent restenosis by inhibiting neointimal growth. Recently, however, stent fracture has emerged as a complication associated with in-stent restenosis, stent thrombosis, and aneurysm formation.^{1,2} Most stent fractures are associated with sirolimus-eluting stent (SES) implantation in the right coronary artery. Stent fractures are extremely rare with a paclitaxel-eluting stent or zotarolimus-eluting stent (ZES) in the left anterior descending artery (LAD) or in a left circumflex artery lesion.³

Here we describe a case of a stent fracture that occurred with a ZES that had been implanted in a calcified LAD lesion in a patient undergoing hemodialysis due to chronic renal insufficiency.

CASE REPORT

A 44-year-old male patient was admitted with a history of effort-related chest pain for several months. He had a history of diabetes mellitus for 8 years and chronic renal insufficiency with hemodialysis for 3 years. The ECG showed left ventricular hypertrophy without ST segment change.

Coronary angiography revealed severe calcified eccentric stenosis in the LAD (Fig. 1). The LAD was engaged with a 6-Fr guiding catheter (JL4, Cordis, Miami Lakes, FL, USA), predilatation was performed with a Sprinter 2.5×20 mm balloon (Medtronic, Minneapolis, MN, USA), and a ZES

(Endeavor 3.0×30 mm, Medtronic) was deployed at 12 atm. Additional high-pressure ballooning with a 3.0×12 mm balloon (Quantum, Boston Scientific, Natick, MA, USA) at 16 atm showed good angiographic results (Fig. 2). After the procedure, the patient remained asymptomatic, and he was discharged and followed up through the outpatient department.

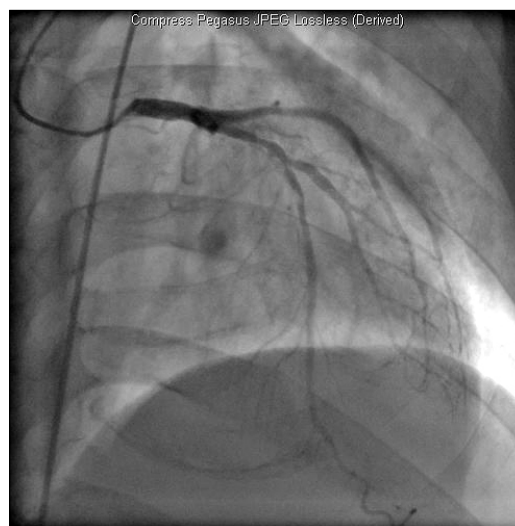


FIG. 1. Initial coronary angiography showed diffuse stenosis in the proximal and mid portions of the LAD. LAD: left anterior descending artery.

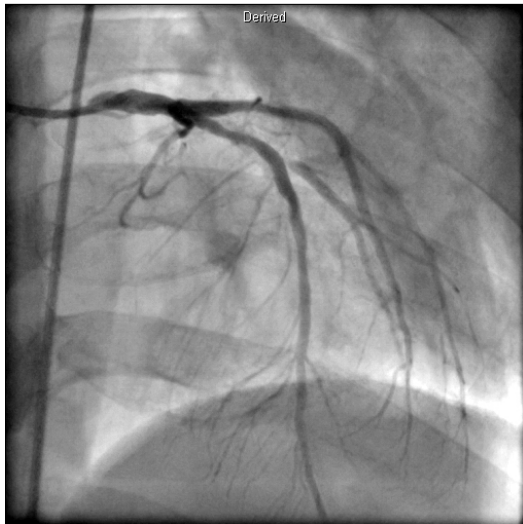


FIG. 2. Post-PCI angiography revealed well-deployed ZES. PCI: percutaneous coronary intervention, ZES: zotarolimus-eluting stent.

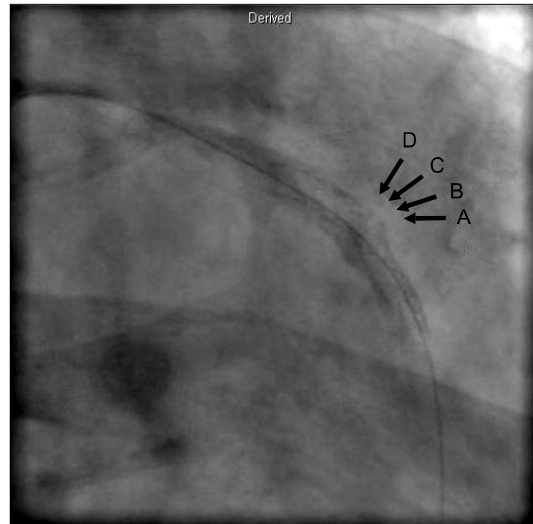


FIG. 3. Follow-up coronary angiography and fluoroscopy showed a gap in the stent strut. A-D: a gap in the stent strut.

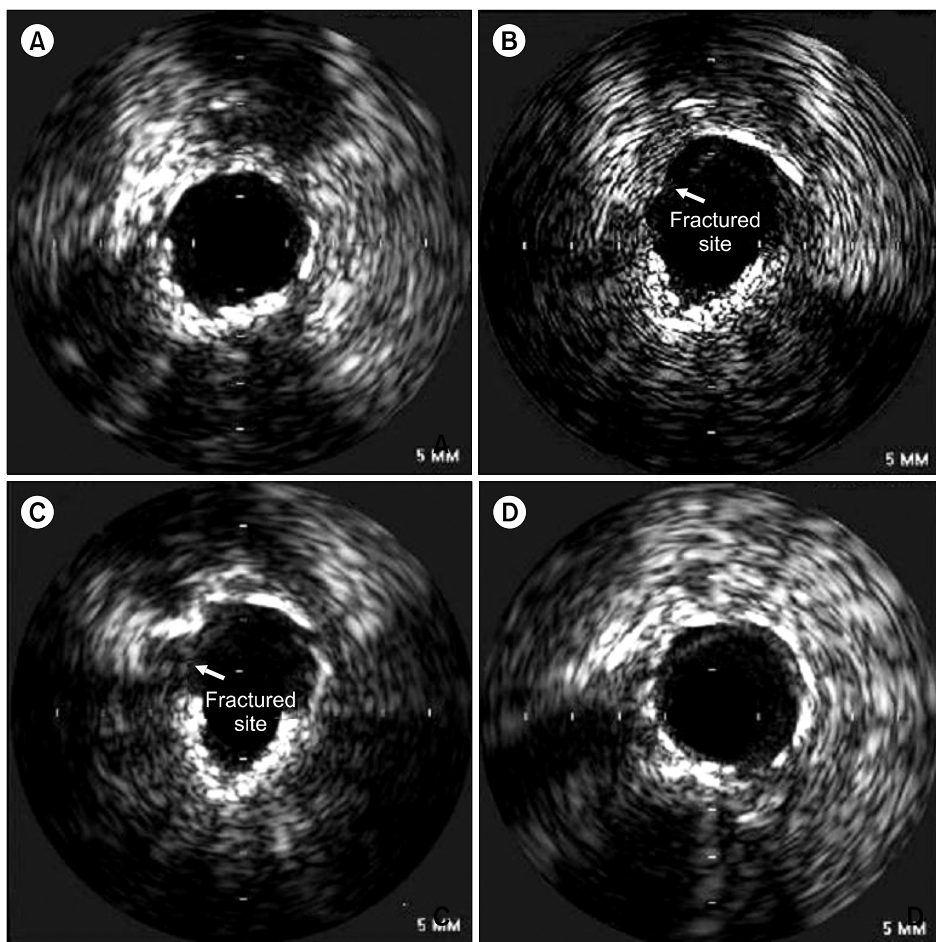


FIG. 4. IVUS showed absent stent strut at the fractured site. Serial IVUS findings at the fractured site. IVUS: intravascular ultrasonography, white arrow: fractured site.

Eight months after the procedure, new recurrent chest pain developed during hemodialysis despite full anti-anginal medication, and follow-up coronary angiography was performed. Mild in-stent restenosis was found in the mid-

dle of the previously implanted ZES, and fluoroscopic images showed that the ZES had a gap in the middle of the stent indicating a stent fracture (Fig. 3). Intravascular ultrasonography study (IVUS) with an automated pullback

speed of 0.5 mm/s was performed, and the IVUS revealed partial absence of the stent struts in the middle of the stent, corresponding to the area of the stent fracture (Fig. 4). The external elastic lamina area was 4.82 mm², the stent area was 4.56 mm², the minimum lumen area was 4.21 mm², the neointimal area was 0.47 mm², and the percentage of neointimal area was 28%.

Although the minimal luminal area was over 4 mm² and the percentage of neointimal area was small, we decided on a stent-in stent strategy because of the patient's recurrent chest pain after full anti-anginal medication and chose another kind of open cell designed stent. A paclitaxel-eluting stent (Taxus Liberte 3.0×12 mm, Boston Scientific) was deployed at the fractured site at nominal pressure. Final coronary angiography showed good results, and IVUS showed no discontinuation of the stent struts.

The patient was discharged with antiplatelet medication. No adverse cardiac events were noted during the 24 months of clinical follow-up, and the patient remains asymptomatic on medications.

DISCUSSION

Stent fracture is rare but is considered to be an important cause for stent thrombosis, re-intervention, and myocardial infarction after DES implantation.^{4,5} Increased mechanical stresses on the stent predispose towards stent fracture. Factors such as a long, extremely angular and calcified lesion; post-dilatation with high pressure; and increased wall motion along the right coronary artery are likely to be contributing risk factors of stent fracture.^{6,7}

Sirolimus-eluting stent implantation is another independent predictor of stent fracture, and most cases have been reported with SES.^{8,9} The closed cell design of the SES is less deformable in response to dynamic loading imposed by the movement of coronary arteries and makes a weak point at which a stent fracture may develop. However, stent fracture has also been reported with paclitaxel-eluting stents or ZES, although it is extremely rare,¹⁰ and there have been no reported cases in the LAD in a hemodialyzed patient.

Revascularization of a stent fracture is controversial because there is a possibility of recurrence of the stent fracture and the outcome of the stent fracture lesion is thought to be poor. In this case, we performed revascularization because the patient complained of angina and there was a risk of stent thrombosis or localized aneurysm formation.¹¹⁻¹⁴ We successfully treated the patient with a different kind of open-cell-designed short stent implantation. We chose the SES because the closed-cell design tends to fracture by the movement of coronary arteries. Also, because we thought that the oversized, high-pressure ballooning may have contributed to stent fracture, we did not use high-pressure ballooning during the second percutaneous coronary intervention, and the patient has remained asymptomatic during 9 months of clinical follow-up.

Although stent fractures appear to be more frequent af-

ter SES implantation and in the right coronary artery, they can occur in any kind of DES and in any part of the coronary arteries, as in the present patient. Because clinical data on stent fractures are limited, future large multicenter studies will be required to determine the exact mechanisms and long-term management of stent fracture.

REFERENCES

1. Lee MS, Jurewitz D, Aragon J, Forrester J, Makkar RR, Kar S. Stent fracture associated with drug-eluting stents: clinical characteristics and implications. *Catheter Cardiovasc Interv* 2007; 69:387-94.
2. Kim JS, Lee SY, Lee JM, Yoon YW, Ahn CM, Kim MH, et al. Significant association of coronary stent fracture with in-stent restenosis in sirolimus-eluting stents. *Coron Artery Dis* 2009;20:59-63.
3. Shaikh F, Maddikunta R, Djelmami-Hani M, Solis J, Allaqaband S, Bajwa T. Stent fracture, an incidental finding or a significant marker of clinical in-stent restenosis? *Catheter Cardiovasc Interv* 2008;71:614-8.
4. Lim HB, Hur G, Kim SY, Kim YH, Kwon SU, Lee WR, et al. Coronary stent fracture: detection with 64-section multidetector CT angiography in patients and in vitro. *Radiology* 2008;249:810-9.
5. Alizadehranjbar K, Cheung PK, Hui W. A rare and late angiographic presentation of DES fracture. *J Invasive Cardiol* 2008;20: E324-6.
6. Aoki J, Nakazawa G, Tanabe K, Hoye A, Yamamoto H, Nakayama T, et al. Incidence and clinical impact of coronary stent fracture after sirolimus-eluting stent implantation. *Catheter Cardiovasc Interv* 2007;69:380-6.
7. Choe H, Hur G, Doh JH, Namgung J, Lee SY, Park KT, et al. A case of very late stent thrombosis facilitated by drug eluting stent fracture: comparative images before and after stent fracture detected by 64-multidetector computed tomography. *Int J Cardiol* 2009;133:e125-8.
8. Okumura M, Ozaki Y, Ishii J, Kan S, Naruse H, Matsui S, et al. Restenosis and stent fracture following sirolimus-eluting stent (SES) implantation. *Circ J* 2007;71:1669-77.
9. Kim HS, Kim YH, Lee SW, Park DW, Lee CW, Hong MK, et al. Incidence and predictors of drug-eluting stent fractures in long coronary disease. *Int J Cardiol* 2009;133:354-8.
10. Watanabe T, Tamura A, Miyamoto K, Kadota J. Fracture of a paclitaxel-eluting stent implanted for in-stent restenosis at the site of sirolimus-eluting stent fracture. *Int J Cardiol* 2010;140:e12-3.
11. Manola S, Pintarić H, Pavlović N, Stambuk K. Coronary artery stent fracture with aneurysm formation and in-stent restenosis. *Int J Cardiol* 2010;140:e36-9.
12. Aziz S, Morris JL, Perry RA. Late stent thrombosis associated with coronary aneurysm formation after sirolimus-eluting stent implantation. *J Invasive Cardiol* 2007;19:E96-8.
13. Okamura T, Hiro T, Fujii T, Yamada J, Fukumoto Y, Hashimoto G, et al. Late giant coronary aneurysm associated with a fracture of sirolimus eluting stent: a case report. *J Cardiol* 2008;51:74-9.
14. Lee SE, John SH, Lim JH, Rhew JY. Very late stent thrombosis associated with multiple stent fractures and peri-stent aneurysm formation after sirolimus-eluting stent implantation. *Circ J* 2008;72:1201-4.