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CASE REPORT

Recurrent and Multiple-site Stent Fractures in the Left Anterior Descending Artery: A Case Report and Literature Review

Shih-Jung Jang[1], Yu-Lin Ko[1]

[1]*Department of Internal Medicine, Division of Cardiology, Cardiovascular Medical Center, Taipei Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, Xindian County, New Taipei City, Taiwan, Republic of China*

Coronary artery stent fracture (SF) occurs in drug-eluting stent (DES) era but recurrent and multiple DES fracture was rare. We report a case of recurrent and multiple-site SF and review the literature regarding the prevalence, possible mechanism, and management of recurrent SF. If recurrent SF occurs, the deployment of an alternative DES, except sirolimus-eluting stent, is the option of successful management.

Key words: Stent fracture, drug-eluting stent, percutaneous coronary intervention

INTRODUCTION

Coronary artery drug-eluting stents (DESs) have dramatically reduced the rate of in-stent restenosis (ISR). However, stent fractures (SF) in the DES area have been widely reported.[1] Risk factors for SF include excessive tortuosity, angulation, bifurcation lesion or change in angulation following stent implantation of coronary vessels. Furthermore, increased stent length, overlapping stents, alternative stent design (open or close cell, strut thickness) related radial force and conformability, and overexpansion of stents because of high inflation pressures may also increase the risk of SF.[1] SF has emerged as an effective predictor of ISR and other adverse outcomes, including stent thrombosis. The management of SF is still controversial. Recurrent SF following percutaneous coronary intervention (PCI) is uncommon. We report a case of recurrent and multiple-site SF and review the literature regarding the prevalence, possible mechanism, and management of recurrent SF.

CASE REPORT

A 75-year-old man was admitted in April 2008. His primary complaint was that, in the month prior, he had experienced sudden syncope and progressive dyspnea on exertion. He had a 6-year history of hypertension with regular medication. In addition, he underwent coronary artery bypass surgery (CABG) with a left internal mammary artery (LIMA) graft to the left anterior descending (LAD) artery in December 2002. The coronary angiography in April 2008 revealed an occluded LIMA graft with an angulated lesion of 70% stenosis at the middle segment of the LAD artery. A balloon angioplasty with a 2.5 mm × 20 mm Maverick balloon (Boston Scientific Corporation) followed by the implantation of a 2.5 mm × 23 mm Cypher sirolimus-eluting stent (SES) (Cordis Corporation) was performed successfully [Figure 1]. Relief of dyspnea was noted following the intervention. He was readmitted in April 2009 complaining mainly of progressive symptoms of angina pectoris in the 3 months prior. ISR with a fracture in the Cypher SES was found under coronary angiography [Figure 2]. PCI was performed by implanting a 2.5 glan mm Xience V everolimus-eluting stent (EES) (Abbott Laboratories Service Corporation) to repair the SF [Figure 3]. However, the patient was readmitted in November 2010, complaining of recurrent angina and dyspnea on exertion associated with low blood pressure, dizziness, and cold sweating. A repeated coronary angiography showed ISR at the middle segment of the LAD artery with recurrent SF at the former position of the previously implanted SES

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Corresponding Author: Prof. Yu-Lin Ko, Department of Internal Medicine, Division of Cardiology, Cardiovascular Medical Center, Taipei Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, 289 Jianguo Road, Xindian County, New Taipei City 231, Taiwan, Republic of China. Tel: +886-2-6628-9779 ext. 5709; Fax: +886-2-6628-9009. E-mail: yulinkotw@yahoo.com.tw

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and another SF at the distal part of the second DES (the EES) [Figure 4]. A 2.5 mm × 14 mm Nobori biolimus-eluting stent (BES) (Terumo Corporation) was implanted to cover the new SF site and subsequently, a poststenting dilatation was performed using a 2.75 mm × 9 mm noncompliant Sprinter balloon (Medtronic Incorporation) at a maximum pressure of 20 atm along the two stent-overlapping sites with adequate angiographic results [Figure 5]. Under regular clinical follow-up and medical treatment after the PCI in November 2010 until now, the patient had stable symptoms of angina pectoris and no progression of any dyspnea.

DISCUSSION

Although not unique to the DES era, SF was rarely reported in the pre-DES era. In the DES era, the reported SF rate has varied from <1% to 8% in clinical studies to up to 29% in autopsy studies.[1] According to the literature, a homogeneous or a heterogeneous stent is not uncommonly used to treat such lesions, especially in cases with adverse clinical outcomes. Most commonly, SF is found in the right coronary artery, particularly in cases of recurrent SF.[2] The presented case is unique in that three types of DES were implanted in the mid-LAD artery with a previously occluded LIMA. Table 1 contains a review and summary of the literature regarding multiple and recurrent SF in the LAD artery.

Stent fractures in the left anterior descending artery

The LAD artery is located at the long axis of the heart. During a cardiac contraction, twisting and torsion motions occur. The boundary of the basal and apical segment of the ventricle near the middle segment of the LAD artery may be described as the "hinge point" during cardiac contraction. This is also the point at which the LIMA graft is often inserted into the middle segment of the LAD artery during bypass surgery. Therefore, as in the present case, SF may occur more frequently as a result of increased vessel angulation and movement.

Is there any disparity in the incidence of stent fractures in different left anterior descendings?

Previous studies have shown a higher incidence of SF in SESs compared with paclitaxel-eluting stents.[1] Kuramitsu *et al*. reviewed 1035 patients who underwent

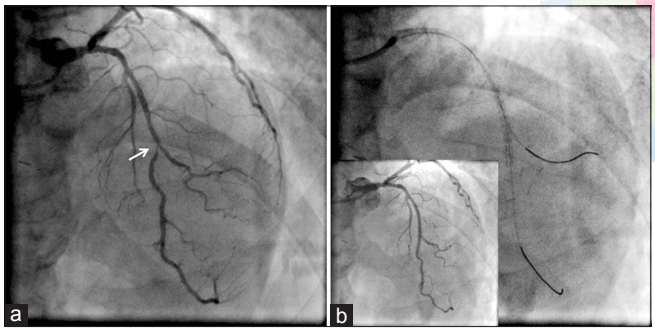

Figure 1: (a) left anterior descending middle segment stenosis before stenting (white arrow) (2008). (b) Poststenting image under fluoroscopy (in the bottom picture, final angiogram after stenting)

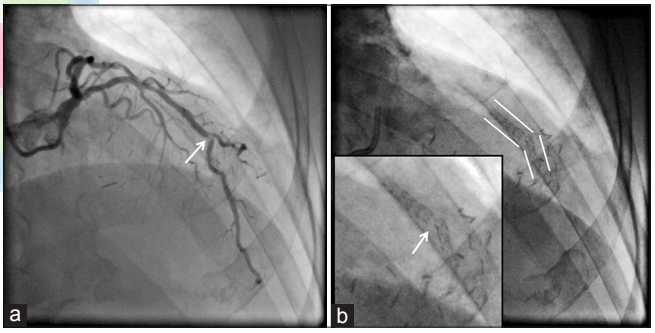

Figure 2: (a) Repeating angiogram (2009) showed left anterior descending middle segment intra-stent restenosis (white arrow). (b) Left anterior descending stent fracture was found under fluoroscopy (in the bottom picture, fracture point as white arrow)

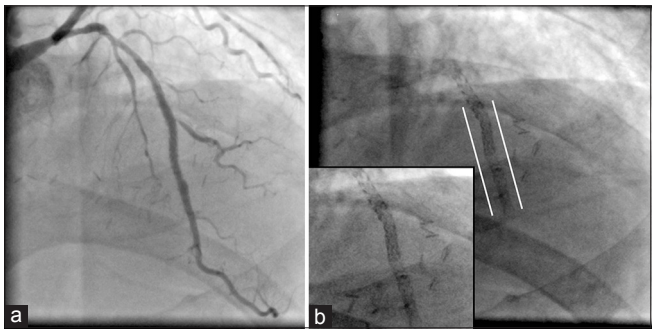

Figure 3: (a) Angiography after second drug-eluting stent (Xience V stent) to cover left anterior descending stent fracture. (b) Two overlapping stents under fluoroscopy

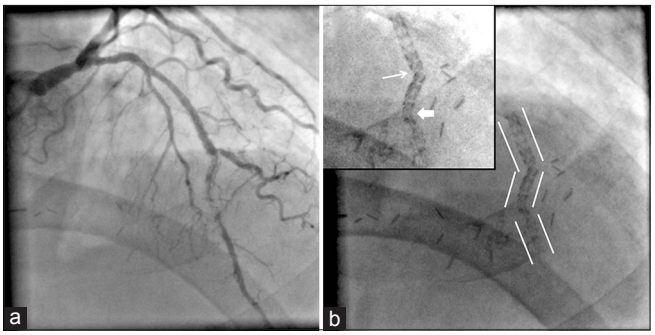

Figure 4: (a) Recurrent symptoms attacked and further angiography (2010) revealed intra-stent restenosis. (b) Under fluoroscopy, recurrent (white arrow) and new (bolder arrow) stent fractures were found

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Table 1: Reported cases of multiple and/or recurrent LAD artery SF

Case	Age/ gender	SF location	Fractured stent type	Number of SFs	Stents length (mm)	Stent overlap	Indication for initial PCI	Time to SF (month)	Management	Notes
Lee *et al*.	64/male	Mid LAD/ D1	SES	3	SES 3×33 SES 2.5×23	Yes	NSTEMI/ST	35	Thrombolytic therapy	Multiple SFs diagnosed simultaneously
Sanchez-Recalde *et al*.	44/male	Mid-distal LAD	SES	3	SES 3×33 SES 3×28 SES 3.5×28	Yes	Asymptomatic	9	None	Multiple SFs diagnosed simultaneously
Hetterich *et al*.	57/male	Mid LAD	SES	4	SES 3.5×33 SES 2.5×18	Yes	Angina/ISR	12/12/ 1/10	Multiple PCIs with 3.5×33, 3.5×8, and 3.5×13 SESs	Recurrent SF at the same site (site of LIMA insertion)
Hussain *et al*.	NA	Mid LAD	SES and EES	2	SES 3.5×23 EES 3.5×28	Yes	NA	NA	NA	Recurrent same-segment SF
Alqarqaz *et al*.	41/female	Mid LAD/ distal LAD	SES SES	2	SES 2.5×28 SES 2.5×18 SES 2.75×8	Yes	STEMI/ NSTEMI/ STEMI/angina	8/13 36/48	SES/medical/SES/ CABG	Multiple and recurrent SF
Jang *et al*.	75/male	Mid LAD/ mid-distal LAD	SES/EES	2	SES 2.5×23 EES 2.5×28	Yes	Unstable angina	12/19	EES then BES	SF at the possible site of LIMA insertion; recurrent same-segment SF and new-segment SF

PCI = Percutaneous coronary intervention; D1 = 1st diagonal branch; SES = Sirolimus-eluting stent; ST = Stent thrombosis; NSTEMI = Non-ST elevation myocardial infarction; ISR = In-stent restenosis; LIMA = Left internal mammary artery; EES = Everolimus-eluting stent; NA = Not available; STEMI = ST elevation myocardial infarction; CABG = Coronary artery bypass graft; BES = Biolimus-eluting stent; LAD = Left anterior descending; SFs = Stent fractures

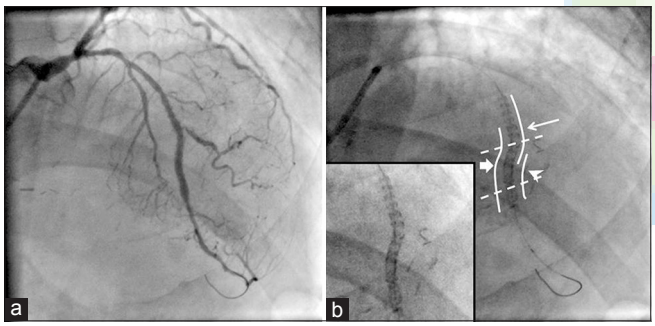

Figure 5: (a) Final angiography after third drug-eluting stents (Terumo Nobori stent). (b) Fluoroscopy of two stent fracture sites (dotted lines) and overlapping stents with first (white arrow), second (bolder arrow) and third (arrowhead) drug-eluting stents

EES implantation and found SF in 2.9% lesions through plain fluoroscopy or intravascular ultrasound (IVUS).[3] By contrast, Kuramitsu *et al*. also reported the incidence of SF by Nobori BESs is in 4.1% lesions.[4] Several cases reported SF after zotarolimus-eluting stent (Medtronic Incorporation) implantation.[5-7] These results suggest the possibility that the use of all DESs carries a risk of SF; however, the exact incidence rate of SF for each DES requires further clarification.

Previously reported recurrent stent fractures in the left anterior descending artery

Three other cases of recurrent DES-SF in the LAD artery have been reported [Table 1]. All lesions were located on the mid-LAD artery. As in our presented case, one of these cases involved a patient with a previous LIMA graft applied to the LAD artery. In each of these cases, the initial stenting was performed using an SES. Two of these cases involved patients who were treated with homogeneous stents, and in one case, a patient was treated through heterogeneous stenting using an EES. Furthermore, one case involved multiple PCIs with SESs, which were performed at the LIMA insertion site, while another case was treated through bypass surgery.

What is the long-term outcome of stent fractures management?

At present, no conclusion has been reached regarding the proper management of a DES fracture. Implantation of another DES, particularly an alternative type of DES, to cover the SF site is commonly performed. When recurrent SF develops, CABG, including minimally invasive bypass surgery, is another commonly used treatment. Currently, the use of a bioabsorbable scaffold may be a new direction for SF management because this method prevents scaffold fracture few years after deployment. Lee *et al*. reported a series of 15 SF patients treated with homogeneous or heterogeneous DESs (seven of 15 patients), medical treatment, or bypass surgery.[8] ISR occurred in only one case, no recurrent SF was detected at the 6-month angiography follow-up, and no deaths had occurred at the time of the 20-month follow-up. Park *et al*. found 28 cases of SF in 4845 patients undergoing PCI.[9] Eight patients underwent target lesion

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revascularization, with a balloon angioplasty in three cases and a DES implantation in the other five cases. At follow-up, only one patient was found to have angina, and no repeated target lesion revascularization was required. Analyzing a series of 20 patients with DES-SF who had been treated with DES, Freixa *et al*. found an increased risk of recurrent SF when homogeneous stenting was performed using an SES.[10] These results suggested that recurrent SF rarely occurred; however, homogeneous stenting, particularly with an SES, should be avoided.

Limitation

Because of the clear images of angiographic stenosis and metallic disconnection under fluoroscopy, no further IVUS had been performed in serial intervention. It could be the limitation of our case to clarify the etiology of SF. Besides, in our case, no followed coronary angiography could make sure whether there is the missing event of "silent" SF. Periodically, noninvasive stress study had been performed for evaluation from 2012 to 2015 after the last PCI. The results of Technetium 99 m (99 mTc) – labeled single photon emission computed tomography myocardial perfusion imaging (performed after intravenous injection of dipyridamole) revealed mild myocardial ischemia at the anteroapical wall persistently. Because of no unstable symptoms as the events before previous PCIs, the patient refused to repeat the invasive coronary angiogram.

CONCLUSION

Although reports of SF are not uncommon in the DES era, recurrent and multiple-site SF is seldom reported. With the management of the lesions near bypass graft insertions or the ISR of long lesions with overlapping stents, further imaging studies such as IVUS or optical coherence tomography imaging may be necessary. These images could facilitate the evaluation of the lesion characteristics and stent implantation and thus, probably prevent SF. If SF occurs, then alternative DES deployment or CABG are reasonable options for successful management, particularly in cases of recurrent SF.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Mohsen MK, Alqahtani A, Al Suwaidi J. Stent fracture: How frequently is it recognized? Heart Views 2013;14:72-81.
2. Alqarqaz M, Albashaireh D, Guerrero M. Multiple and recurrent coronary stent fractures. J Invasive Cardiol 2014;26:E7-12.
3. Kuramitsu S, Iwabuchi M, Haraguchi T, Domei T, Nagae A, Hyodo M, *et al*. Incidence and clinical impact of stent fracture after everolimus-eluting stent implantation. Circ Cardiovasc Interv 2012;5:663-71.
4. Kuramitsu S, Iwabuchi M, Yokoi H, Domei T, Sonoda S, Hiromasa T, *et al.* Incidence and clinical impact of stent fracture after the Nobori biolimus-eluting stent implantation. J Am Heart Assoc 2014;3:e000703.
5. Lee PH, Lee SW, Lee JY, Kim YH, Lee CW, Park DW, *et al.* Two cases of immediate stent fracture after zotarolimus-eluting stent implantation 2015;45:67-70.
6. Wu MC, Cheng CC, Huang TY. Fracture of zotarolimus-eluting stent after implantation. Tex Heart Inst J 2009;36:618-20.
7. Park JS, Cho IH, Kim YJ. Stent fracture and restenosis after zotarolimus-eluting stent implantation. Int J Cardiol 2011;147:e29-31.
8. Lee SE, Jeong MH, Kim IS, Ko JS, Lee MG, Kang WY, *et al.* Clinical outcomes and optimal treatment for stent fracture after drug-eluting stent implantation. J Cardiol 2009;53:422-8.
9. Park KW, Park JJ, Chae IH, Seo JB, Yang HM, Lee HY, *et al.* Clinical characteristics of coronary drug-eluting stent fracture: Insights from a two-center des registry. J Korean Med Sci 2011;26:53-8.
10. Freixa X, Almasood AS, Khan SQ, Wainstein R, Osherov A, Mackie K, *et al*. Decreased risk of stent fracture-related restenosis between paclitaxel-eluting stents and sirolimus eluting stents: Results of long-term follow-up. Catheter Cardiovasc Interv 2012;79:559-65.