

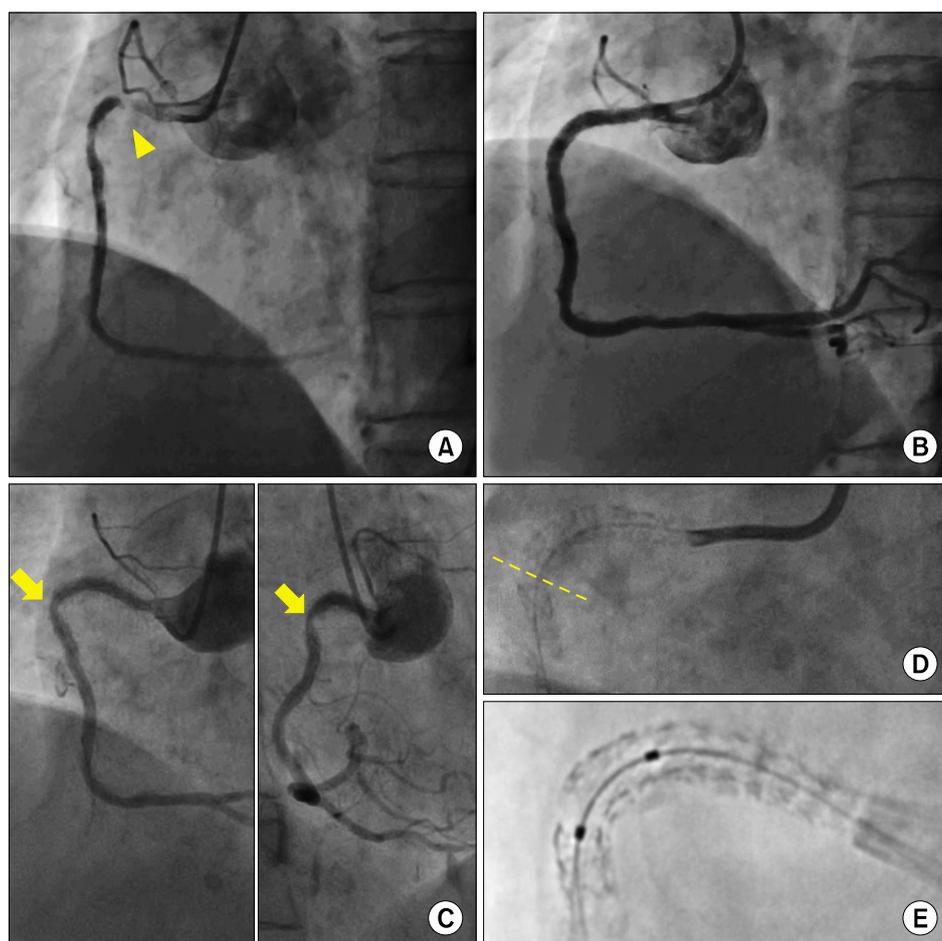
## Intravascular Ultrasound-Guided Treatment for In-stent Restenosis Associated with Stent Fracture in Overlapped Drug-eluting Stents

Min Chul Kim, Myung Ho Jeong\*, Doo Sun Sim, Young Joon Hong, Ju Han Kim, and Youngkeun Ahn

Division of Cardiology, Department of Internal Medicine, Chonnam National University Hospital, Gwangju, Korea

A 68-year old female patient visited our hospital due to effort angina 1 month ago. She had a history of hypertension and diabetes mellitus, and underwent 2 instances of percutaneous coronary intervention (PCI) at right coronary artery (RCA). A 3.5×32 mm Taxus® (Boston Scientific, Natick, MA, USA) was implanted for proximal RCA 14 years ago, and 3.5×28 mm Cypher® (Cordis, Hialeah, FL,

USA) was implanted for significant in-stent restenosis (ISR) in RCA 8 years ago (Fig. 1A, 1B). Twelve-lead electrocardiography showed sinus bradycardia, and the level of cardiac biomarkers were within normal range. Transthoracic echocardiography showed normal left systolic function without wall motional abnormality. So, she was diagnosed with unstable angina pectoris and coronary angiog-



**FIG. 1.** Last coronary angiography (CAG) at 8 years ago revealed critical in-stent restenosis (ISR) in right coronary artery (panel A, arrow head). It was successfully treated with an additional drug-eluting stent (DES, panel B). CAG revealed ISR at the stented site (panel C, arrow). However, the fluoroscopic image (panel D, dotted line) and Stent-Boost® enhanced fluoroscopic image (panel E) revealed complete transection of the DESs overlapped site.

### Corresponding Author:

Myung Ho Jeong

Division of Cardiology, Department of Internal Medicine, Chonnam National University Hospital, 42 Jebong-ro, Dong-gu, Gwangju 61469, Korea

Tel: +82-62-220-6243, Fax: +82-62-228-7174, E-mail: myungho@chollian.net

### Article History:

Received January 12, 2019

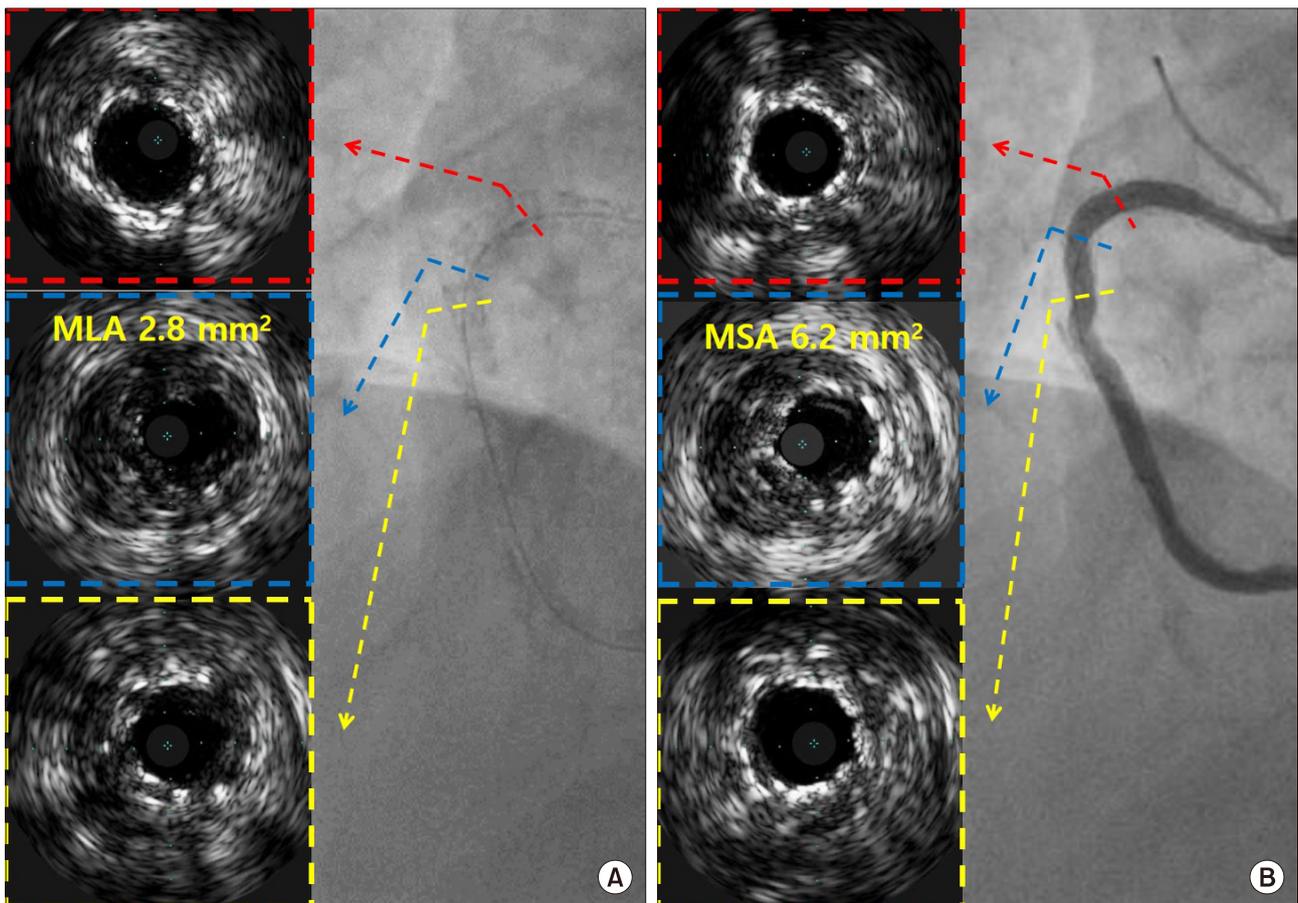
Revised June 8, 2019

Accepted June 25, 2019

raphy (CAG) was done and the CAG showed normal left coronary artery system, but significant type-IC ISR in RCA (Fig. 1C). However, fluoroscopic image and StentBoost® enhanced fluoroscopic image revealed complete transection in previous drug-eluting stents' (DES) overlapped site (Fig. 1D, 1E). After wiring into RCA using Runthrough® wire (Terumo, Tokyo, Japan), we examined intravascular ultrasound for further evaluation, and it confirmed complete stent fracture in DES overlapped site (Fig. 2A). As the patient complained effort angina, and minimal lumen area at the stent fracture site were significant ( $2.8 \text{ mm}^2$ ), we decided to perform PCI for this lesion. After balloon angioplasty using a  $3.5 \times 10 \text{ mm}$  non-complaint balloon was used to burst pressure (RAIDEN3®, Kaneka, Tokyo, Japan), a  $3.5 \times 15 \text{ mm}$  Xience Sierra® (Abbott Vascular, Santa Clara, CA, USA) was implanted at the ISR site. However, follow-up CAG showed stent underexpansion, therefore we performed additional balloon angioplasty using a  $3.5 \times 10 \text{ mm}$  non-complaint balloon. Final CAG showed good distal flow without significant residual stenosis (Fig. 2B).

This case is highly unique in that it was successfully

managed using a newer generation DES. Although stent fracture in this case occurred in sirolimus-eluting stent at RCA which was the most common type of DES related to stent fracture and the most common site of fracture, respectively, complete stent fracture at the DES overlapped site is very rare.<sup>1</sup> Overlapping coronary stent technique may increase the risk of stent fracture, and most stent fractures were observed near stent overlapping zones.<sup>2,3</sup> It is noteworthy that not all stent fractures are candidates for this treatment.<sup>4</sup> However, the patient in the current case complained of recently developed angina and lesion area was significant (reference area in non-left main coronary artery is  $4.0 \text{ mm}^2$ ). Furthermore, complete separation in stent segment was known to be related to adverse clinical outcomes with stent thrombosis and ISR than partial stent fracture.<sup>3</sup> In case of 1st generation stent fracture needing PCI, newer generation DES seems to be more effective.<sup>4</sup> This case emphasizes the importance of stent optimization after PCI, and highlights the usefulness of intravascular imaging and enhanced fluoroscopic imaging to accurately detect stent fracture which was not available using conven-



**FIG. 2.** Intravascular ultrasound confirmed complete stent fracture in drug-eluting stents (DES)s overlapped site (A, middle image), and previous DES overlapping in distal to stent fracture site (A, bottom image). There was no significant in-stent restenosis (ISR) in previously implanted Taxus® proximal to the stent fracture site (A, top image). Final coronary angiography after  $3.5 \times 18 \text{ mm}$  Xience Sierra® implantation for ISR site showed good distal flow without significant residual stenosis (B). MLA: minimal lumen area, MSA: minimal stent area.

tional fluoroscopic image.<sup>5</sup>

## ACKNOWLEDGEMENTS

This study was supported by a grant of the Bio & Medical Technology Development Program of the NRF funded by the Korean government, MSIP (2017M3A9E8023001).

## CONFLICT OF INTEREST STATEMENT

None declared.

## REFERENCES

1. Kuramitsu S, Jinnouchi H, Shinozaki T, Hiromasa T, Matsumura Y, Yamaji Y, et al. Incidence and long-term clinical impact of late-acquired stent fracture after sirolimus-eluting stent implantation in narrowed coronary arteries. *Am J Cardiol* 2017;120:55-62.
2. Canan T, Lee MS. Drug-eluting stent fracture: incidence, contributing factors, and clinical implications. *Catheter Cardiovasc Interv* 2010;75:237-45.
3. Nakazawa G, Finn AV, Vorpahl M, Ladich E, Kutys R, Balazs I, et al. Incidence and predictors of drug-eluting stent fracture in human coronary artery a pathologic analysis. *J Am Coll Cardiol* 2009; 54:1924-31.
4. 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.
5. Lee JH, Kim U. Optical coherence tomography-guided treatment of multiple stent fracture in patients with overlapping drug-eluting stents. *Korean Circ J* 2018;48:1030-1.