



ELSEVIER

Contents lists available at ScienceDirect

Journal of Cardiology Cases

journal homepage: www.elsevier.com/locate/jccase

Case Report

A Case Report: Directional coronary atherectomy supported with optical coherence tomography is useful for the slit lesion

Takeshi Niizeki (MD, FJCC)^{a,*}, Tadateru Iwayama (MD)^a, Yu Kumagai (MD)^a, Etsuo Tsuchikane (MD)^b^a Department of Cardiology, Okitama Public General Hospital, Yamagata, Japan^b Department of Cardiology, Toyohashi Heart Center, Aichi, Japan

ARTICLE INFO

Article history:

Received 28 May 2021

Revised 22 June 2021

Accepted 5 July 2021

Keywords:

Angina

Atherectomy

Percutaneous coronary intervention

ABSTRACT

Background: Directional coronary atherectomy (DCA) was revived in Japan in 2014. DCA is a special procedure to remove the atherosclerotic plaque of coronary artery during percutaneous coronary intervention. We present the case of a 91-year-old woman with symptoms of angina. Coronary angiography revealed significant stenosis with a slit lesion of the proximal left anterior descending artery. Because she had a high risk of bleeding, we did not want to implant a stent to prevent bleeding events. Then, we performed optical coherence tomography (OCT) and intravascular ultrasound to evaluate the morphology of the slit lesion in more detail. OCT showed clearly that the direction of the flap was counterclockwise and the edge of the flap was located in the epicardium. Since we could understand the localization of plaque distribution fully by OCT examination, we successfully removed the flap by DCA based on information from OCT. After that, we performed balloon dilatation with a 3.0-mm drug-coated balloon and finished without implanting the stent successfully. Her symptoms completely disappeared and postoperative course was good.

DCA supported with OCT might be one of the options in high bleeding risk patients, suggesting a potential stent-less therapeutic option.

<Learning objective: There may be hesitation about implantation of stents in patients with high risk of bleeding, such as the elderly. Stent-less percutaneous coronary intervention using directional coronary atherectomy followed by drug-coated balloon under optical coherence tomography (OCT) guidance may be the one of the option for patients with a high risk of bleeding, because OCT can more clearly show the feature of the lesion and the effect of treatment compared to intravascular ultrasound.>

© 2021 Japanese College of Cardiology. Published by Elsevier Ltd.

This is an open access article under the CC BY-NC-ND license

[\(http://creativecommons.org/licenses/by-nc-nd/4.0/\)](http://creativecommons.org/licenses/by-nc-nd/4.0/)

Introduction

Drug-eluting stents have improved clinical outcomes of patients treated by percutaneous coronary intervention (PCI). Drug-coated balloons (DCB, paclitaxel-coated balloon, SeQuent® Please NEO, NIPRO, Osaka, Japan) are effective for in-stent restenosis and small-vessel disease [1, 2]. Directional coronary atherectomy (DCA, Atherocut™, NIPRO) was revived in Japan in 2014 and it has been reported that DCB treatment after DCA is a potential strategy to

avoid stent implantation and makes better long-term results compared to conventional balloon angioplasty [3]. Stent-less treatment is useful to reduce bleeding events, especially in high bleeding risk (HBR) patients [4].

This case had a slit lesion with ischemic response of the left anterior descending artery (LAD), and fulfilled HBR criteria. We considered stent-less treatment to be better to avoid bleeding events. Intravascular ultrasound (IVUS, OptiCross, Boston Scientific, Natick, MA, USA) revealed the flap and intimal thickening of a slit lesion. In addition, we performed optical coherence tomography (OCT, Dragonfly OpStar™, St Jude Medical, St Paul, MN, USA) to assess the morphology of the slit lesion in more detail. As OCT demonstrated the direction of the flap and the edge of the flap, we successfully removed the flap from the edge toward the root by

* Corresponding author: Takeshi Niizeki, MD, FJCC, Department of Cardiology, Okitama Public General Hospital. Ooaza Nishi Ohtuka 2000, Kawanishi Town, Yamagata Prefecture, Japan, 992-0601, Tel: +81-238-46-5000, Fax: +81-238-46-5711

E-mail addresses: takeshiniizeki83@gmail.com, takeshi.niizeki@okitama-hp.or.jp (T. Niizeki).

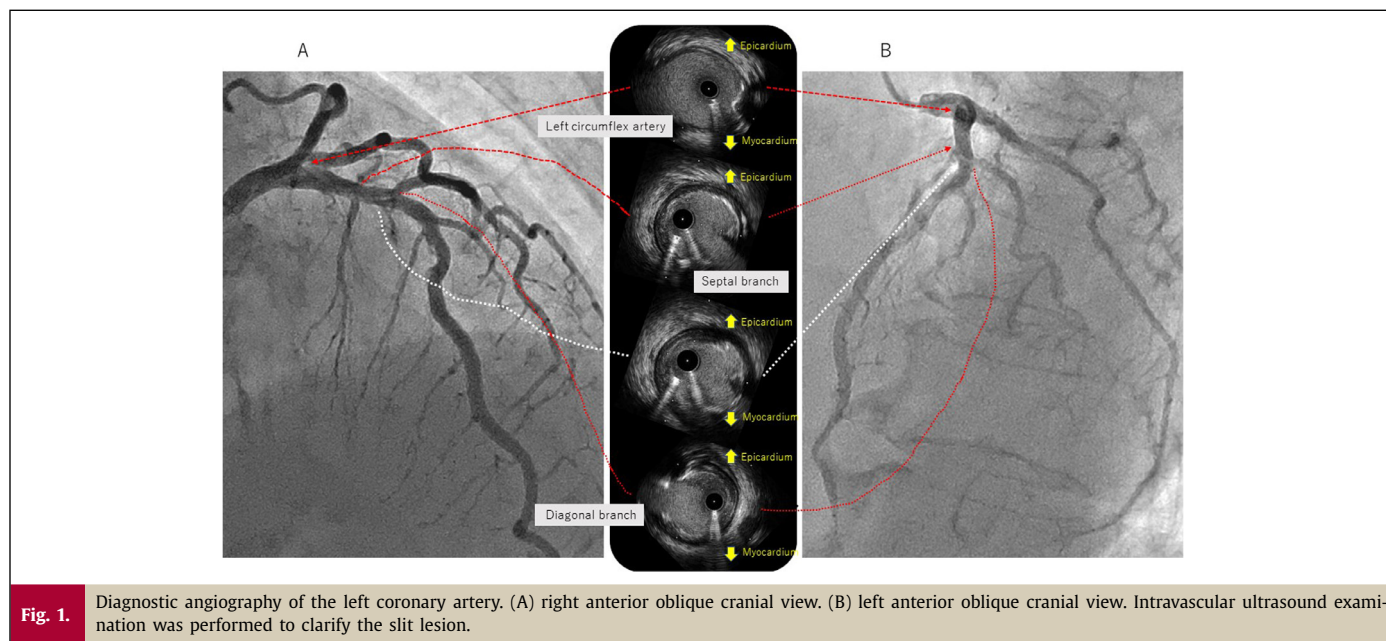


Fig. 1. Diagnostic angiography of the left coronary artery. (A) right anterior oblique cranial view. (B) left anterior oblique cranial view. Intravascular ultrasound examination was performed to clarify the slit lesion.

rotating DCA clockwise. Because we confirmed the sufficient resection by OCT, IVUS, and angiogram, we finished by balloon dilatation with 3.0-mm DCB. We describe a first case report of stent-less treatment strategy using DCB for a slit lesion by using OCT. Because there are many HBR patients, the approach reported here may be a potentially useful technique for HBR patients even with slit lesions.

Case report

A 91-year-old woman was hospitalized with a complaint of exertional angina (CCS Class III). Her coronary risk factors were hypertension, dyslipidemia, and diabetes, but no renal dysfunction. Her CHADS2 score was 6, and her HAS-BLED score was 5 (items of hypertension, stroke, bleeding, elderly, and drugs applied). An electrocardiogram showed atrial fibrillation and horizontal ST-T depression in V4-6 leads (max 0.1 mV). Transthoracic ultrasonography revealed reduction of the anterior left ventricular wall. Left coronary angiography revealed a slit lesion of the LAD (Fig. 1A and B; Video 1). There was no lesion in the right coronary artery. We performed instantaneous wave-free ratio (iFR) to examine whether the slit lesion was a significant lesion. Because the iFR showed 0.68 (cut-off value: 0.89) and symptoms persisted despite adequate medication (isosorbide dinitrate, nicorandil, and calcium channel blocker), we decided to implement the elective PCI after explaining other treatment options such as coronary artery bypass grafting or optimal medical therapy. However, she just fulfilled HBR criteria [1: elderly, 2: low body weight (body mass index 20.1 kg/m²), 3: anemia (hemoglobin 10.2 g/dl), 4: chronic kidney disease (estimated glomerular filtration rate 53.8 ml/ml/1.73m²), 5: oral administration of direct oral anticoagulants (DOAC) due to chronic atrial fibrillation] as reported by JCS 2020 Guideline [5]. HBR is helpful to assess the bleeding risk and we can identify the appropriate antithrombotic therapy according to each patient [5]. Then, we wanted to perform stent-less treatment to avoid bleeding events after PCI. However, putting stents followed by a short duration of antiplatelet therapy is also one option. If DCA did not work well, we also took stenting treatment into account.

The approach site was right femoral artery. We used the guiding catheter of the CL3.5 SH, 8Fr, 100 cm (RoadMaster, GOODMAN

Co. Ltd, Aichi, Japan). Since IVUS was performed to evaluate morphology of the slit lesion, IVUS revealed the flap and intimal thickening (Fig. 1 and Video 2). Since we assumed that the flap was created by dissection or rupture of atherosclerotic plaque, this slit lesion was described as a flap in our report. We considered that only balloon dilatation without DCA would be difficult to squash the flap. Then, we performed OCT examination to further analyze the properties of the flap. Because the OCT clarified the direction of the flap in detail (Fig. 2A and Video 3), we tried to remove the flap by DCA in order to avoid the implantation of a stent. The direction of the flap was counterclockwise and the edge of the flap was located in the epicardium as shown in Figure 2A, then we succeeded in removing it from the edge (direction of epicardium) toward the root of the flap (direction of operator side) by rotating DCA L-size clockwise: 2 atm, 10 times as shown in Figure 2B-D. After that, we confirmed the sufficient resection by OCT (Fig. 2E and Video 4). It is important to realize the distribution of plaque when performing the DCA. Finally, we performed the dilatation with 3.0 mm DCB and final angiogram showed excellent results successfully without stenting (Fig. 3A and B; Video 5). The result of the pathology showed that lesion consisted of fibrous plaque with thrombi. Her symptoms completely disappeared and postoperative course was good, although we are following only with anticoagulant monotherapy as before treatment. Although the introduction of any antiplatelet drugs is originally recommended, we are continuing careful follow-up with DOAC alone because of good result by DCB after DCA.

Discussion

The developments of stent technology and PCI procedure improve outcomes in patients with ischemic heart disease [6, 7]. If the case is a non-HBR patient, stent treatment is preferable. However, dual antiplatelet therapy (DAPT) is required after stent implantation to prevent stent thrombosis. One of the problems after PCI is that DAPT increases bleeding events [5]. Then, HBR patients are suited to stent-less treatment. The stent-less treatment with DCB may have advantages of shortening the DAPT compared with a stent strategy, because no metallic scaffold and polymer remain [8]. However, evidence of stent-less treatment is not sufficient yet,

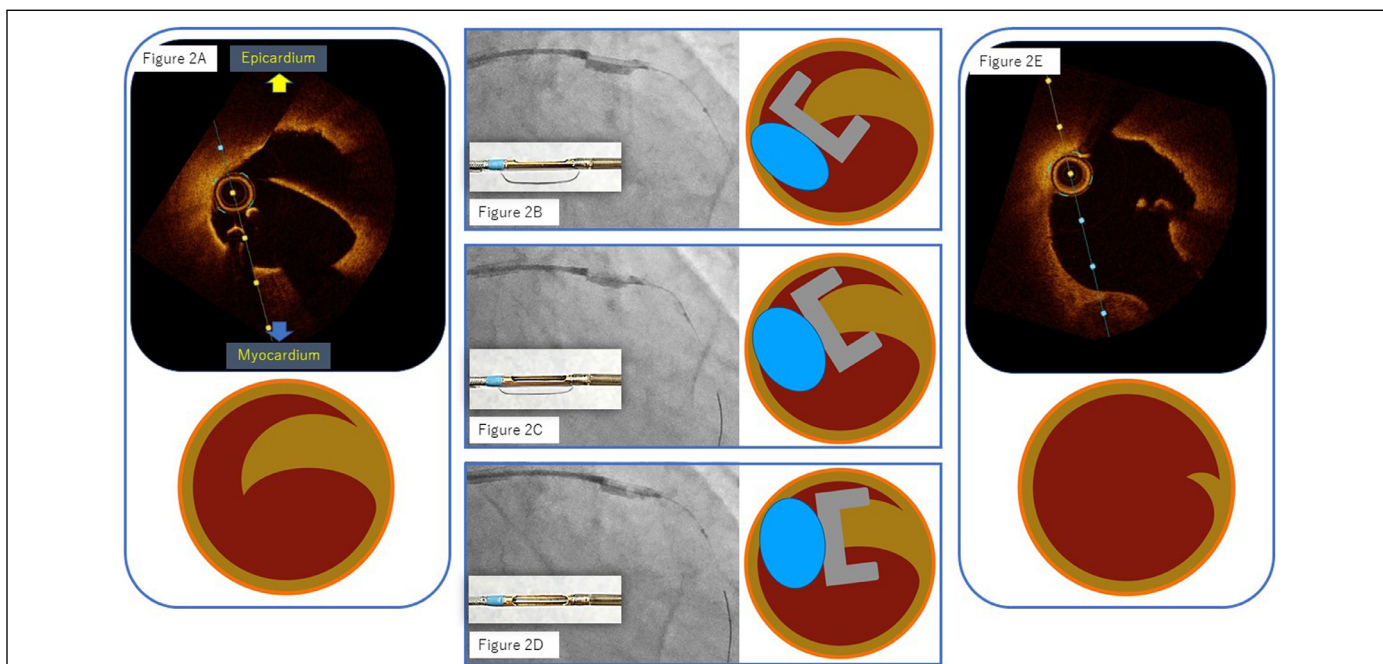


Fig. 2. (A) examination of optical coherence tomography (OCT) before directional coronary atherectomy (DCA). (B-D) actual DCA procedure and scheme of the DCA strategy. (E) confirmation by OCT after DCA.

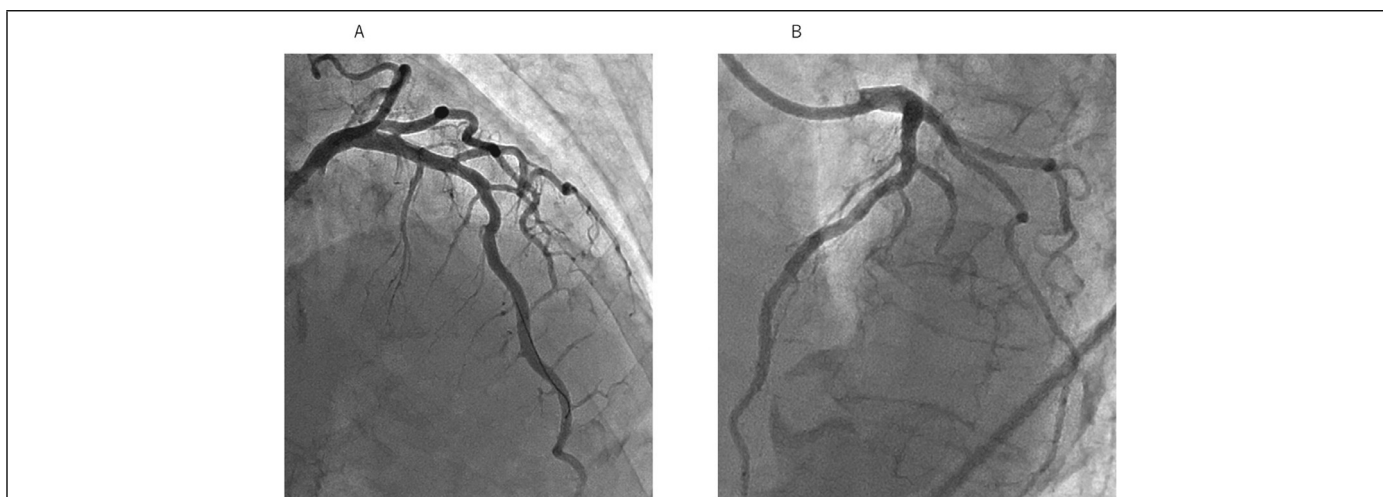


Fig. 3. Final angiography of the left anterior descending artery. (A) Right anterior oblique cranial view. (B) Left anterior oblique cranial view.

so it is necessary to build decent evidence of stent-less treatment in the future. DCA works effectively in stent-less treatment as in this case. We need to be committed to providing the right treatment for each individual patient.

In addition, HBR has become a hot topic in Japan, since the number of elderly patients is increasing [5]. It has been reported that bleeding risk is higher especially in elderly patients ≥ 80 years of age because of their frailty and comorbidities [5]. Since our case just belonged to HBR, we would not like to have implanted a stent. Because we could realize the feature of the flap including the direction of the edge by OCT examination, we could remove the flap by DCA successfully. Since the resolution of OCT is 10-fold higher than that of IVUS, OCT proved useful for understanding detailed morphology of the lesion [9]. The direction of rotation is extremely important for removing the flap in the treatment of DCA. We think

that the full understanding of plaque distribution by combined OCT and IVUS examination is desirable to avoid complications when using DCA for the flap lesion. Recently, it has been reported that plaque rupture and erosion are involved in acute coronary syndrome using OCT [10]. Although we assumed that the flap was created by similar mechanisms like atherosclerotic plaque dissection or rupture, it is unclear. We would like to investigate the mechanism of lesion formation in detail in the future.

DCA is now available again since 2014 in Japan and DCB after DCA has become popular to avoid stent implantation [1-3]. Since the effect of plaque reduction is more conclusive in DCA than conventional balloon angioplasty, we decided to use DCB after DCA for stent-less treatment. Although there are more reports about DCA treatment recently, this approach is the first report that DCA is a useful technique even in the slit lesion. We would

like to seek additional effectiveness and possibilities of DCA in the future.

Conclusions

Stent-less PCI using DCA followed by DCB under OCT guidance may be an option for HBR patients unsuitable for stent implantation, because OCT clearly demonstrates the morphology.

Declaration of Competing Interest

All of the authors have no conflicts of interest to disclose.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:[10.1016/j.jccase.2021.07.002](https://doi.org/10.1016/j.jccase.2021.07.002).

References

- [1] Sato A, Kijima M, Ichimura S, Yaegashi D, Anzai F, Shimizu T, Matsui Y, Kaneko H, Sakamoto K, Seino Y, Maruyama Y, Takeishi Y. Short-term outcome of percutaneous coronary intervention with directional coronary atherectomy followed by drug-coated balloon: a preliminary report. *Cardiovasc Interv Ther* 2019;34:149–54.
- [2] Hirohata A, Shimi T, Yoshioka R. Stentless treatment strategy for left circumflex artery ostial stenosis: Directional coronary atherectomy followed by drug-eluting balloon. *J Cardiol Cases* 2019;21:85–8.
- [3] Kitani S, Igarashi Y, Tsuchikane E, Nakamura S, Seino Y, Habara M, Takeda Y, Shimoji K, Yasaka Y, Kijima M. Efficacy of drug-coated balloon angioplasty after directional coronary atherectomy for coronary bifurcation lesions (DCA/DCB registry). *Catheter Cardiovasc Interv* 2021;97:E614–23.
- [4] Shiraishi J, Kataoka E, Ozawa T, Shiraga A, Ikemura N, Matsubara Y, Nishimura T, Ito D, Kojima A, Kimura M, Kishita E, Nakagawa Y, Hyogo M, Sawada T. Angiographic and clinical outcomes after stent-less coronary intervention using rotational atherectomy and drug-coated balloon in patients with de novo lesions. *Cardiovasc Revasc Med* 2020;21:647–53.
- [5] Nakamura M, Kimura K, Kimura T, Ishihara M, Otsuka F, Kozuma K, Kosuge M, Shinke T, Nakagawa Y, Natsuaki M, Yasuda S, Akasaka T, Kohsaka S, Haze K, Hirayama A. JCS 2020 guideline focused update on antithrombotic therapy in patients with coronary artery disease. *Circ J* 2020;84:831–65.
- [6] Schwalm JD, McKee M, Huffman MD, Yusuf S. Resource effective strategies to prevent and treat cardiovascular disease. *Circulation* 2016;133:742–55.
- [7] Suzuki Y, Tsuchikane E, Katoh O, Muramatsu T, Muto M, Kishi K. Outcomes of percutaneous coronary interventions for chronic total occlusion performed by highly experienced Japanese specialists: The first report from the Japanese CTO-PCI Expert Registry. *JACC Cardiovasc Interv* 2017;10:2144–54.
- [8] Waksman R, Pakala R. Drug-eluting balloon: the comeback kid? *Circ Cardiovasc Interv* 2009;2:352–8.
- [9] Niizeki T, Ikeno E, Iwayama T, Watanabe M. Difficult wiring of a recanalized thrombotic lesion in the right coronary artery analyzed with optical coherence tomography. *Am J Case Rep* 2018;19:941–5.
- [10] Shimamura K, Kubo T, Akasaka T. Evaluation of coronary plaques and atherosclerosis using optical coherence tomography. *Expert Rev Cardiovasc Ther* 2021;19:379–86.