CASE REPORT

Lotus root-like appearance in the left anterior descending artery treated with a drug-coated balloon angioplasty

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1 | INTRODUCTION

A previous histologic study demonstrated that multiple channels within a coronary artery are a feature of recanalization or thrombus neovascularization.¹ Further clinical studies using optical coherence tomography (OCT) found that this phenomenon was consistent with spontaneous intraluminal thrombus recanalization.²⁻⁴ Multiple channels in a coronary artery have been described as having a “lotus root-like appearance.” Treatment is mainly performed by using a stent; however, the optimal treatment strategy remains unclear. In this study, serial OCT images of a lotus root-like appearance in a left anterior descending artery (LAD) treated with drug-coated balloon angioplasty are described.

2 | CASE PRESENTATION

A 68-year-old man was referred to our hospital because of acute chest pain. He had a history of myocardial infarction 30 years prior to hospital presentation. He had hypertension and dyslipidemia. Electrocardiography showed a normal sinus rhythm and regression of the R wave from lead V1 to V3 without ST-segment changes. Ultrasound echocardiography showed no abnormalities in wall motion. His serum troponin T level was not elevated. An emergency coronary angiography revealed moderate stenosis with contrast-filling defects in the proximal LAD (Figure 1A). The fractional flow reserve with maximal hyperemia, induced by intracoronary nicorandil administration, indicated positive ischemia.
at the distal LAD (fractional flow reserve value = 0.76). Based on the patient’s clinical background and findings from the examinations, a percutaneous coronary intervention was performed to treat the LAD lesion. After a guiding catheter (Heartrail QL 4.0; Terumo, Japan) was inserted into the ostium of the LAD, a Sion blue guidewire (Asahi Intecc Co., Ltd.) was inserted. The guidewire crossed the culprit lesion using a microguide catheter (FineCross MG, Terumo). OCT scanning was then performed using a Dragonfly OpStar imaging catheter (Abbott). OCT revealed a lotus root-like appearance with multiple lumens at the culprit lesion (Figure 1B, C). The ostium of the second diagonal branch was observed in a different channel and was separated from the main channel connected to the distal lumen of the LAD. Before dilation of the main LAD, a Sion blue guidewire (Asahi Intecc Co., Ltd.) was inserted into the second diagonal branch; however, the guidewire did not advance to the second diagonal branch. Therefore, we used a Crusade catheter (KANEKA Corp.) and a dual

FIGURE 1 Coronary angiography and optical coherence tomography An initial coronary angiography revealing contrast-filling defects and haziness in the proximal left anterior descending artery. (A) OCT images of the culprit lesion before percutaneous coronary intervention demonstrating the typical appearance of a lotus root. (B and C). An OCT immediately after DCB angioplasty revealing destruction of multiple lumens (D and E), and a coronary angiography 6 months after showing no significant stenosis in the proximal left anterior descending artery. (F) OCT images post-DCB angioplasty show almost all septa have disappeared. (G and H). DCB, drug-coated balloon; OCT, optical coherence tomography
lumen microcatheter mounted on a Sion blue guidewire to cross the guidewire in the second diagonal branch. After crossing the guidewires in both the LAD and second diagonal branch, OCT revealed that partition walls existed between the two guidewires. For treatment, a scoring balloon (NSE 2.5 × 13 mm; OrbusNeich, Hong Kong, China) was inflated at the culprit lesion in the LAD and subsequently at the ostium of the second diagonal branch. After inflation, OCT revealed that septa still remained. A larger diameter scoring balloon (NSE 3.5 × 13 mm, OrbusNeich) was then inflated at the culprit lesion in the main LAD to destroy the septa. Finally, a drug-coated balloon (SeQuent Please, 3.0 × 30 mm; NIPRO) was applied to avoid occlusion of the second diagonal branch using coronary stent implantation. OCT showed the destruction of multiple lumens immediately after drug-coated balloon angioplasty (Figure 1D,E). The patient’s chest symptoms fully resolved after this intervention, and no adverse events have been observed. A follow-up coronary angiography was performed 6 months after the precuneous coronary intervention. No stenosis was observed at the indexed sites (Figure 1F,G,H).

3 | DISCUSSION

A lotus root-like appearance is characterized by multiple vascular channels separated by wall partitions, communicating with each other, and converging into a single lumen at proximal and distal sites. The diagnostic modalities, OCT and intravenous ultrasound sonography, have revealed how septa divide the lumen into multiple small lumen channels. In this case, the patient experienced myocardial infarction 30 years before the presentation of the symptoms. Although the detailed mechanisms and duration of this condition are unknown, the multiple channels may have formed as a result of the natural recanalization of abundant thrombi in the LAD. In this case, the LAD showed features similar to those previously reported, such as various lumen sizes with smooth edges, no clear sites of plaque rupture, and no atheromatous plaque in the underlying vascular wall. In addition, functionally significant ischemic findings are often observed in lesions with a lotus root-like appearance; however, the stenosis rate in this lesion was angiographically determined to be moderate. The fractional flow reserve was examined with maximal hyperemia induced by intracoronary nicorandil administration. The reason for the “morphological-functional mismatch” is self-evident in the OCT images. It is inferred that the majority of the dead-ends of multiple intraluminal channels, except for skinny channels, can cause markedly limited coronary flow.

Percutaneous coronary intervention is inapplicable for these lesions due to its peculiar anatomical characteristics and the involvement of branch vessels. Nomura et al. reported the usefulness of OCT-guided stenting to maintain the patency of a side branch bifurcating from a lesion with a lotus root-like appearance. For lesions of this type, in order to avoid the occlusion of side branches by stenting, the use of a debulking device such as an excimer laser has been reported. To prevent side branch occlusion, the side branches of the main LAD were dilated. Since the channels were divided with partition walls, stenting in the main LAD might have obstructed the septal and diagonal branches. It was considered that once obstruction occurred, it would have been very difficult to pass the guidewire through the partition walls. In this case, stentless treatment using a scoring balloon and drug-coated balloon successfully resulted in no side branch obstruction after the angioplasty. Good results were obtained using a drug-coated balloon for the lotus root-like appearance. The lesion was evaluated using OCT in the chronic phase. Angioplasty with a drug-coated balloon may be a useful stentless strategy for coronary lesions with a lotus root-like appearance.

4 | CONCLUSIONS

This report presented a case of a lotus root-like appearance in the LAD. Percutaneous coronary intervention was performed to protect the side branches via guidewires and drug-coated balloon angioplasty. However, further studies are needed to determine the appropriate methods to evaluate these complex lesions.

AUTHOR CONTRIBUTION
Wataru Takagi and Toru Miyoshi were involved in the study concept and design, drafting the article, critical revision, and approval of the article. Tomoaki Okada and Kazumasa Nosaka were involved in the study concept and design, critical revision, and approval of the article. Masayuki Doi was involved in the data interpretation and approval of the article.

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CONFLICT OF INTEREST
The authors declare that they have no conflicts of interest.

DATA AVAILABILITY STATEMENT
Data are available upon request from the authors.
ETHICAL APPROVAL
Approval of the International Review Board was not required at our institution because this study was a case report.

CONSENT
Written informed consent was obtained from the patient for the publication of this report in accordance with the journal’s patient consent policy.

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