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Rotational Atherectomy for Ablation of Multiple Channel Structure Observed by Optical Frequency Domain Imaging

Authors' Contribution:
Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
Funds Collection G

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Conflict of interest: None declared

Patient: Male, 71
Final Diagnosis: Silent myocardial infarction
Symptoms: Dynpnea
Medication: —
Clinical Procedure: —
Specialty: Cardiology

Objective: Unusual or unexpected effect of treatment

Background: Previous case reports have shown that regardless of the etiology, multiple channel structures can be treated successfully by routine percutaneous coronary intervention. However, there are no general recommendations for intervention because multiple channel structures are complex and rarely diagnosed.

Case Report: A 71-year-old male was admitted to our hospital due to bronchial pneumonia. After admission, the patient experienced acute decompensated heart failure. Coronary angiogram revealed 3 diseased vessels with heavy calcification. Although the patient's syntax score was high, we performed percutaneous coronary intervention (PCI) on each vessel based on his request and in consideration of his dementia. After PCI for the left circumflex and descending arteries, we performed PCI for the right coronary artery (RCA) using optical frequency domain imaging (OFDI). A multiple channel structure and calcified nodule were observed by OFDI. We performed rotational atherectomy (RA) on the RCA, and the 2 structures were ablated. After RA, we dilated the lesions with a scoring balloon and deployed a drug-eluting stent.

Conclusions: RA was effective in ablating partition walls of the multiple channel structure observed using OFDI.

MeSH Keywords: Atherectomy, Coronary • Drug-Eluting Stents • Optical Imaging • Percutaneous Coronary Intervention

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Background

Coronary lesions containing recanalized thrombi are characterized by multiple small channels [1]. These lesions may also be a result of neovascularization of thrombi. Previous case reports have shown that regardless of the etiology, multiple channel structures can be treated successfully by routine percutaneous coronary intervention (PCI) [2,3]. In this case report, we present a patient with multiple channel structures in the proximal right coronary artery (RCA) observed by optical frequency domain imaging (OFDI). Based on the OFDI findings, we performed rotational atherectomy (RA) and successfully ablated partitions of the structure. As a result, good stent expansion was obtained after balloon dilatation. The focus of this report is to demonstrate the utility of RA in the treatment of multiple channel structures observed by OFDI.

Case Report

A 71-year-old male was admitted to our hospital due to bronchial pneumonia. At the time of admission, he was undergoing medical treatment for hypertension, diabetes mellitus, dyslipidemia, old cerebral infarction, and Alzheimer's disease. His blood pressure was 151/81 mmHg, pulse rate was 81 beats/minute, and body temperature was 37.0°C. Chest computed tomography revealed bronchial wall thickening. We diagnosed bronchial pneumonia and initiated antibiotics administration. On post-admission day 2, he experienced acute decompensated heart failure. We determined afterload mismatch and diastolic dysfunction as the cause of heart failure, indicated by a blood pressure reading of 242/107 mmHg. An electrocardiogram revealed a sinus rhythm strain pattern in the I, aVL, and V4–V6 leads. The echocardiography examination showed preserved left ventricular ejection fraction (62.8%), diastolic dysfunction, and mild hypokinesis of the inferior wall. Treatment for heart failure was initiated with a noninvasive positive pressure ventilator, vasodilator drugs, and diuretics. After improvement of the patient's symptoms, myocardial stress perfusion scintigraphy enabled the determination of the redistribution of inferior and lateral walls. Coronary angiogram (CAG) revealed severe stenosis lesions with heavy calcification at the proximal RCA (Figure 1), proximal-mid left descending artery (LAD), and a sub-total lesion at the proximal left circumflex artery (LCX) (Figure 2). Although his syntax score was high (44.5), we performed multi-vessel PCI based on the patient's request and after our consideration of his dementia and old cerebral infarction. We first performed PCI on the LCX and then for the LAD. Finally, we performed PCI on the RCA. For this, a 7-Fr guiding catheter (ASAHI Hyperion SAL-1.0 SH, ASAHI INTECC, Aichi, Japan) was inserted into the RCA, and the guidewire (SION blue, ASAHI INTECC) easily passed through the lesion. We observed the lesion by OFDI catheter (Fast View, Terumo, Tokyo, Japan) (Figure 3). The multiple channel structure (Figure 3B) was seen at the proximal RCA. Furthermore, the calcified nodules (Figure 3C, 3D) were seen distal to the structure. There were calcified plaques at the proximal and distal sites (Figure 3A, 3E). We performed RA using an RA system (Rotalink Plus 1.75 mm, Boston Scientific Corporation, Natic, MA, USA) to ablate the multiple channel structure and calcified nodule after exchanging the guidewire (RotaWire Floppy, Boston Scientific

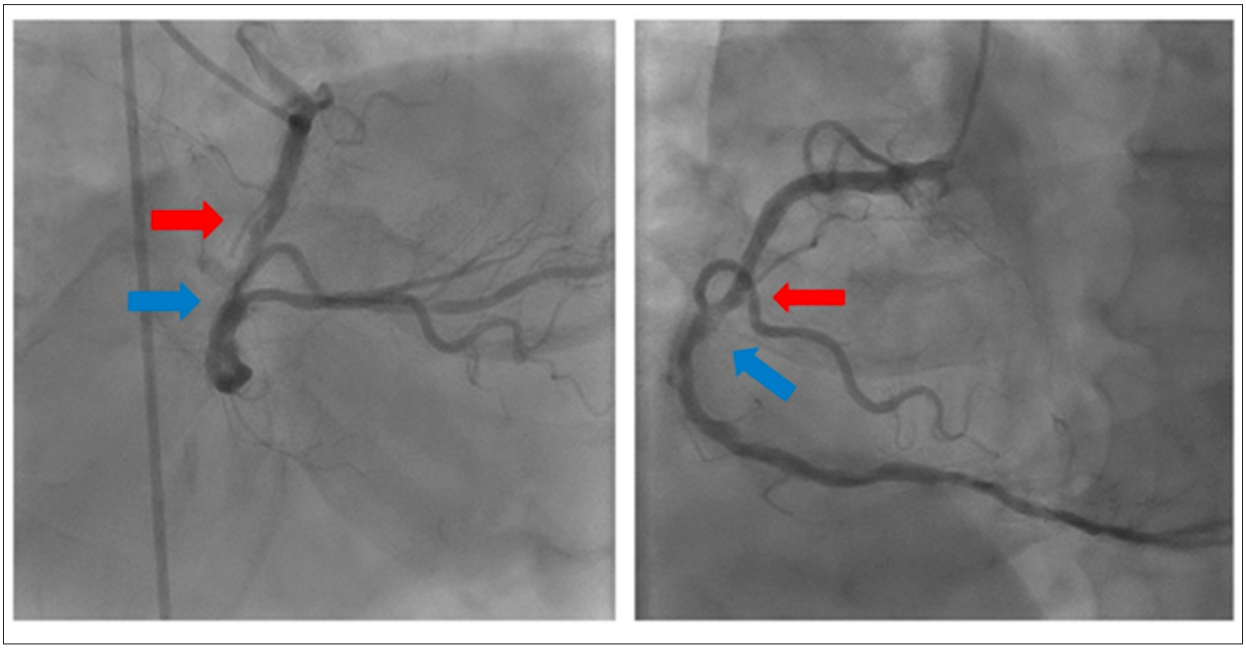

Figure 1. Right coronary angiogram showing stenotic lesions at the proximal site: red arrow: stenotic lesion with slit; blue arrow: stenotic lesion with calcification.

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Figure 2. Left coronary angiogram showing sub-total occlusion lesion in the left circumflex proximal site and stenotic lesion in the left ascending artery mid site.

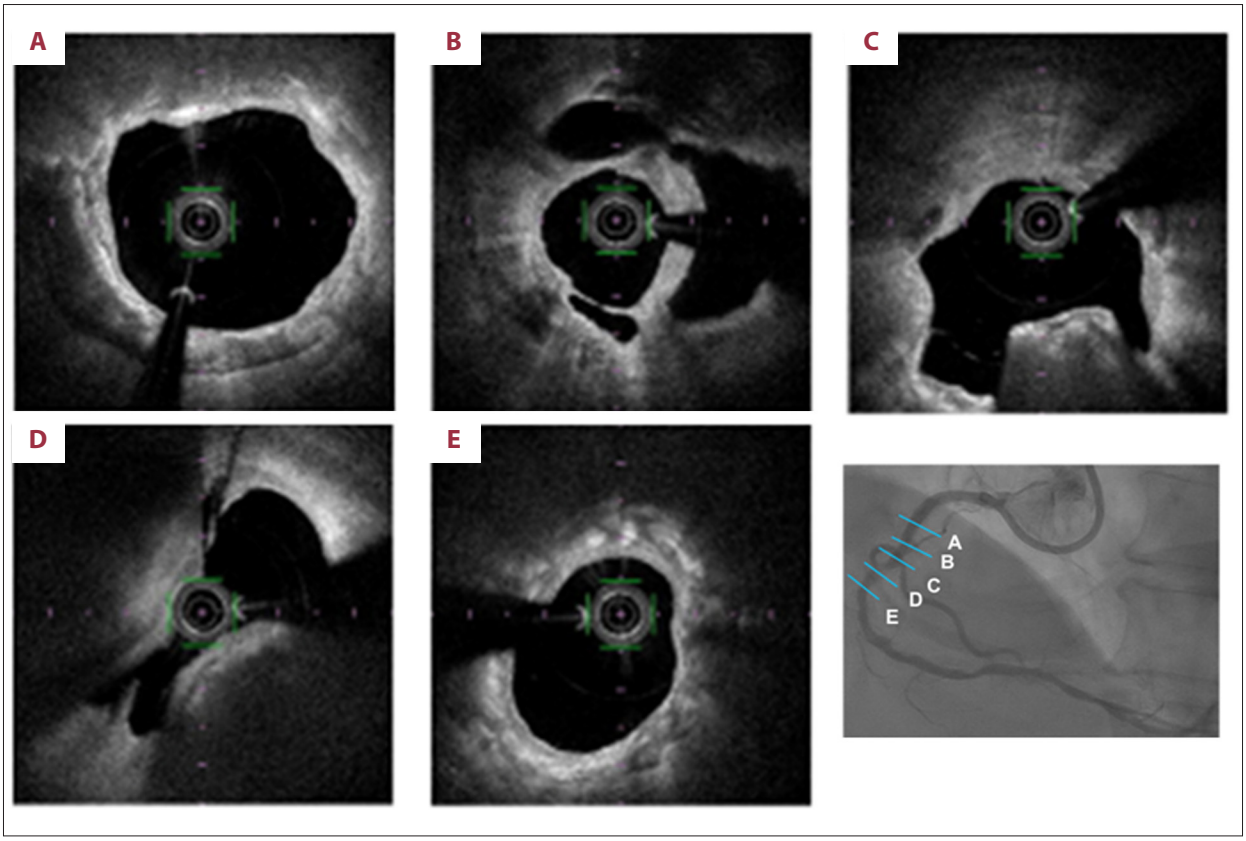

Figure 3. Optical frequency domain imaging findings demonstrate the calcified plaque (**A, E**), multiple channel structure (**B**), and calcified nodule (**C, D**).

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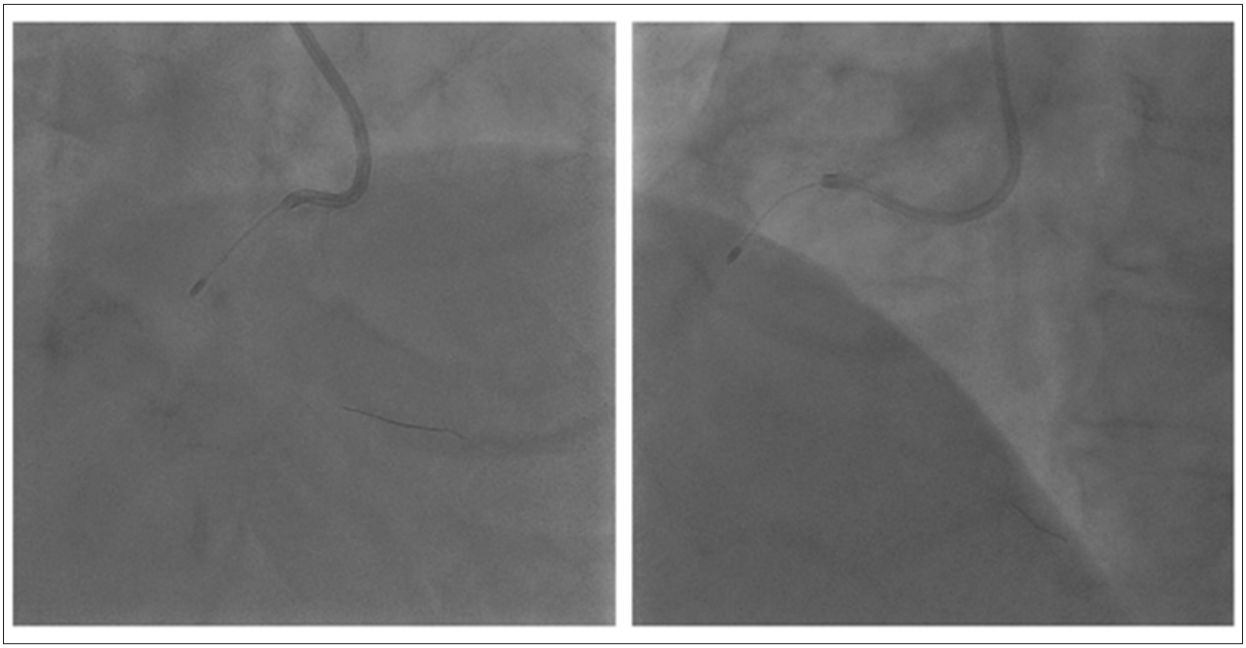

Figure 4. Rotational atherectomy in the right coronary artery proximal site.

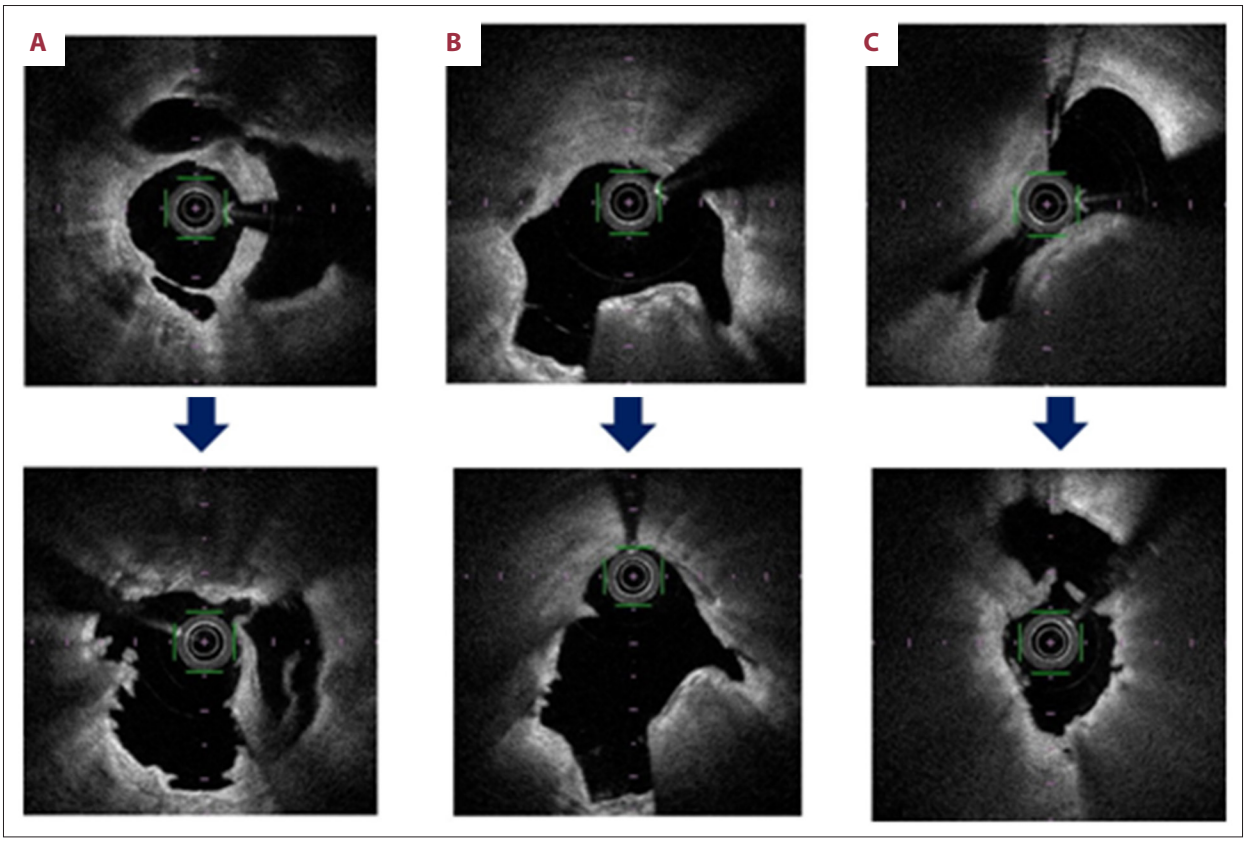

Figure 5. Optical frequency domain imaging findings post-rotational atherectomy reveal that the multiple channel structure (**A**) and calcified nodule (**C**) are ablated. A part of the calcified nodule (**B**) could not be ablated due to guidewire bias. Especially in the multiple channel structure (**A**), the partition walls are ablated and thinned.

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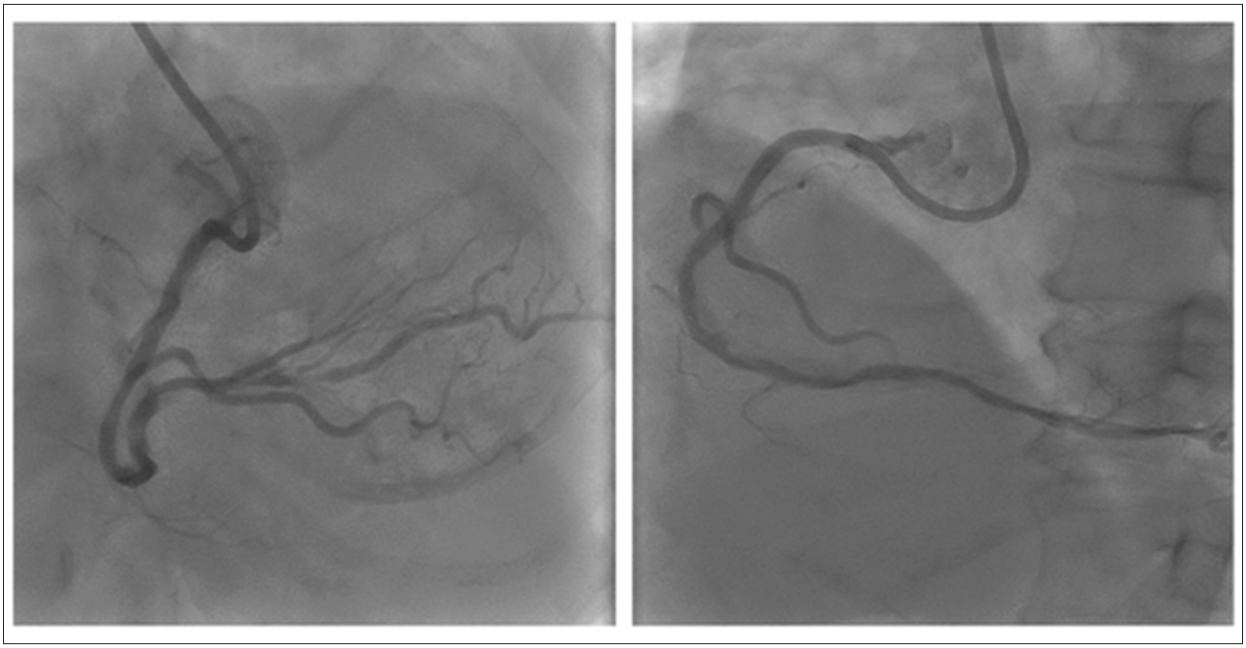

Figure 6. Final angiogram.

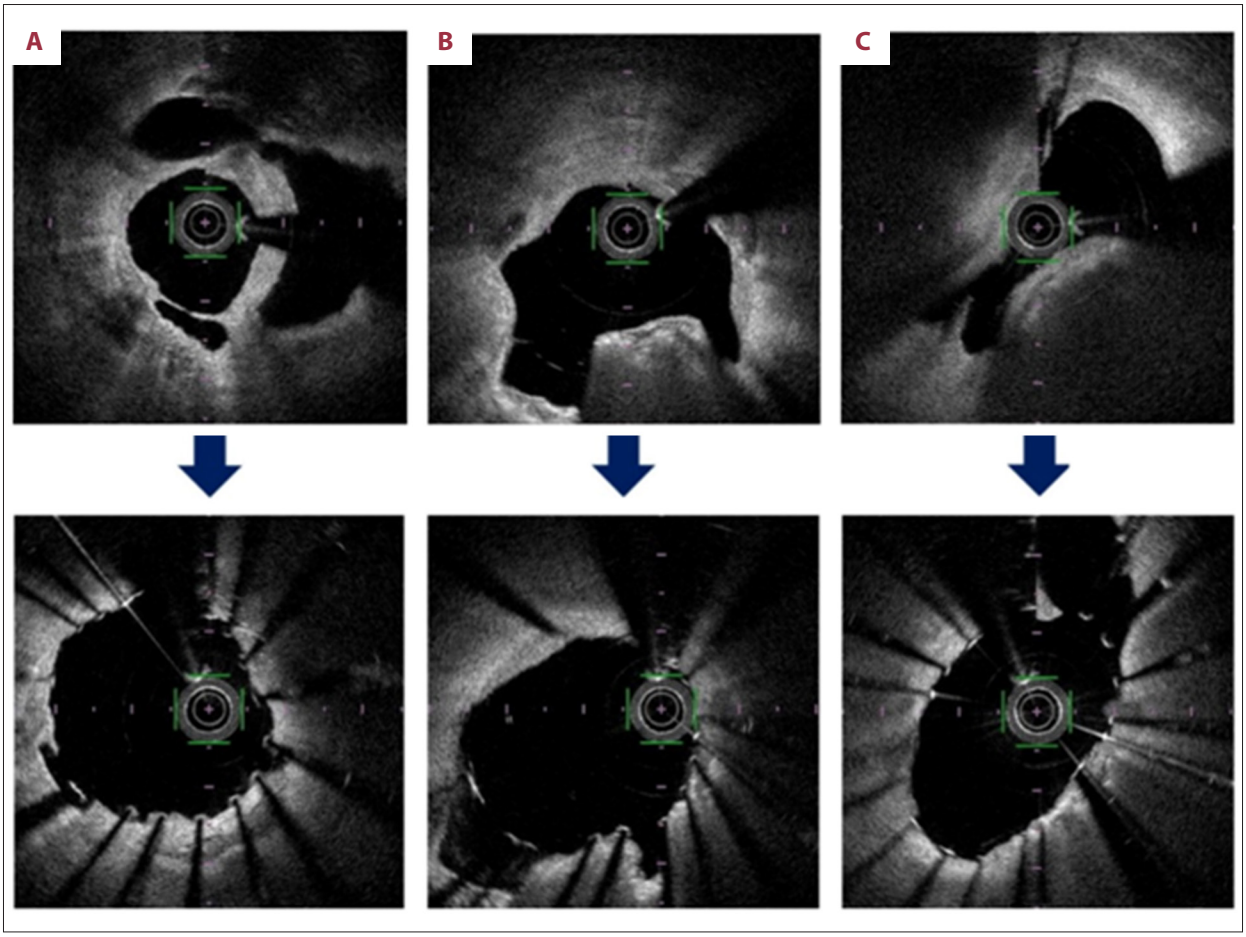

Figure 7. Final optical frequency domain imaging findings show good stent expansion in multiple channel structure (**A**) and calcified nodules (**B, C**).

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Corporation, Natic, MA, USA) (Figure 4). Burr speed was selected at 180 000 rpm and there was a drop of 5000 rpm at the multiple channel structure and again at the calcified nodule. After the RA passed the lesions, OFDI revealed that the multiple channel structure (Figure 5A) and calcified nodule (Figure 5C) were ablated. The total number of ablations was 13, and slow flow or no flow was not observed. Part of the calcified nodule (Figure 5B) could not be ablated due to guidewire bias. Especially in the multiple channel structure, the partition walls were ablated and thinned (Figure 5). The lumen area measured by OFDI before and after RA enlarged from 2.4 mm^2 to 4.8 mm^2. Then, we performed balloon angioplasty using a scoring balloon (NSE Alpha 3.0/13 mm, Goodman, Aichi, Japan). The lumen area was enlarged, and we deployed a drug-eluting stent (Resolute Onyx 3.5/30 mm, Medtronic Cardiovascular Inc., Santa Rosa, CA, USA). After post-dilatation, we confirmed good coronary flow and stent expansion by CAG and OFDI (Figures 6, 7A–7C). We determined that the PCI was successful in ablating the RCA lesions. As there are no general recommendations for intervention of multiple channel structure, we report this rare treatment of multiple channel structure.

Discussion

The incidence of patients with multiple channel structures in the coronary artery observed by optical coherence tomography (OCT) has been reported in several studies. Based on histologic studies, a multiple channel structure within the coronary artery is a feature of thrombus recanalization or neovascularization. Coronary lesions containing recanalized thrombus are characterized by multiple small channels on OCT, with most showing functional significance. Multiple channel structures have been described as having a "lotus root-like appearance", "honeycomb-like appearance", or "Swiss cheese pattern" [4,5]. Previous reports indicate that such complex lesions can limit functional coronary flow and can be successfully treated by routine PCI [6]. According to the literature, most cases of multiple channel structure are functionally significant and require intervention. Favorable outcomes of treatment with drug-eluting stents, drug-coated balloons, or bio-resorbable vascular scaffolds have been reported [7].

In the present case, several mechanisms of multiple channel structure formation could be considered. We speculate that this structure might have been due to an organized ruptured plaque, recanalization of a thrombus, or substituted tissue after a spontaneous coronary artery dissection. In addition, OFDI findings suggested calcification on the partition walls. Precise recognition of calcified plaque morphology by OFDI may serve to determine the treatment strategy for patients with atherosclerotic coronary disease [8]. However, previous reports have not revealed the relationship between RA and calcified nodules. Regardless of the mechanism, the possibility of distal embolism was considered low based on the OFDI findings, and we performed RA for the proximal RCA. Because of the possibility of insufficient stent expansion due to inflexible partition walls, we decided that RA was an appropriate procedure for this lesion. Consequent to performing the procedure, partition walls of the multiple channel structure were ablated and became thin, allowing good expansion of the drug-eluting stent.

Generally, partition walls can be penetrated using a standard balloon or scoring balloon. We believe that RA will be the optional choice in case of a bifurcation lesion, in which the partition walls cannot be penetrated by a balloon due to the presence of hard tissue. Partition walls of multiple channel structures in a bifurcation lesion should be considered as a risk for side branch occlusion. In some cases, a part of the channel flows into a side branch. In cases where the partition walls on a side branch cannot be cut or a guide wire cannot be inserted into the side branch cavity, the possibility of side branch occlusion is high.

Currently, there are no general recommendations for intervention because multiple channel structures are complex and rarely diagnosed. However, there have been several advances in treatment modalities. In instances where lesions prevent wires from passing through, double-lumen catheter and parallel wire techniques have been useful for entering adjacent cavities [9]. In addition, scoring and cutting balloons might be effective for penetrating partition walls. One case study reported treatment of a honeycomb-like structure using a scoring balloon and deployment of a drug-eluting stent. However, the structure could not be fenestrated completely even with the buddy wire technique [10]. When balloons are not able to penetrate partition walls due to the presence of hard tissue, RA might be an effective treatment option for multiple channel structure lesions.

Conclusions

OFDI demonstrated a multiple channel structure in the proximal RCA. We performed RA and ablated partitions of the multiple channel structure. After this procedure, we acquired good stent expansion at the proximal RCA.

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Conflict of interest

None.

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References:

1. Kang SJ, Nakano M, Virmani R et al: OCT findings in patients with recanalization of organized thrombi in coronary arteries. JACC Cardiovasc Imaging, 2012; 5(7): 725–32
2. Toutouzas K, Karanasos A, Stathogiannis K et al: A honeycomb-like structure in the left anterior descending coronary artery: Demonstration of recanalized thrombus by optical coherence tomography. JACC Cadiovasc Interv, 2012; 5: 688–89
3. Nakanishi T, Kawata M: A case of coronary lesion with lotus root appearance treated by percutaneous coronary intervention with intravascular ultrasound guidance. Cardiovasc Interv Ther, 2010; 25: 131–34
4. Khoueiry GM, Magnus P, Friedman BJ, Kaplan AV: Honeycomb-like appearance of hazy coronary lesions: OCT image report of a racanalized thrombus. Eur Heart J Cardiovasc Imaging, 2014; 12: 1247
5. Kato M, Dote K, Sasaki S: Recanalized image of thrombotic occlusion with coronary plaque rupture: A lotus root-like appearance by optical coherence tomography. Can J Cardiol, 2011; 27: 871..e1–2
6. Kadowaki H, Taguchi E, Kotono H et al: A lotus root-like appearance in both the left anterior descending and right coronary arteries. Heart Vessels, 2016; 31: 124–28
7. Lin M, Su Z, Li J et al: Honeycomb-like structure in the right coronary artery treated with a drug-eluting stent: A case report and literature review. J Int Med Res, 2018; 46: 2008–13
8. Ijichi T, Nakazawa G, Torii S et al: Evaluation of coronary arterial calcification *ex-vivo* assessment by optical frequency domain imaging. Atherosclerosis, 2015; 243: 242–47
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: 941–45
10. Haraki T, Uemura R, Masuda S et al: A honeycomb-like structure in the left anterior descending coronary artery treated using a scoring device and drug-eluting stent implantation: A case report. J Med Case Rep, 2016; 10: 80

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