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Case Report

Fractured Guidewire in Calcified Chronic Total Occlusion: Is Rotational Atherectomy Contraindicated?

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Abstract

Background: Fracture of guidewires may occur during attempts to recanalize severely calcified chronic total occlusions (CTOs) via percutaneous coronary intervention (PCI). When a fractured guidewire becomes entrapped within the lesion, rotational atherectomy (RA) may serve as a safe rescue strategy. **Case**: We report a case in which RA was utilized both to recanalize the heavily calcified CTO and to simultaneously ablate the entrapped guidewire fragment. **Conclusions**: RA may serve as a safe rescue strategy to manage the fractured guidewires within CTO segments.

Keywords: chronic total occlusion; coronary artery disease; fractured guidewire; rotational atherectomy; percutaneous coronary intervention; case report

1. Introduction

Fracture of guidewires is a rare but serious complication of percutaneous coronary intervention (PCI), potentially leading to adverse outcomes such as restenosis, thrombosis, or coronary perforation. Management strategies for fractured guidewires range from conservative observation to percutaneous retrieval or surgical removal [1, 2]. However, only a few isolated reports have discussed the use of reintervention, particularly rotational atherectomy (RA), to treat calcified chronic total occlusions (CTOs) in the presence of a retained guidewire fragment. This case highlights the feasibility and safety of RA in such complex scenarios.

Video 1. Retrograde injections to confirm the successful wiring of the distal true lumen of the LAD. Video associated with this article can be found, in the online version, at https://doi.org/10.31083/HSF50693.

Video 2. Retrograde injections to confirm the successful wiring of the distal true lumen of the LAD. Video associated with this article can be found, in the online version, at https://doi.org/10.31083/HSF50693.

2. Case Report

A 46-year-old man was admitted to our hospital with a four-month history of recurrent angina. Electrocardiogram (ECG) showed T-wave inversions in leads V4–6, I and aVL (Fig. 1). Baseline biomarkers of myocardial injury were within normal limits, with high-sensitivity troponin I measured at 15 pg/mL, while transthoracic echocardiography demonstrated left ventricular enlargement and hypertrophy with preserved ejection fraction (EF = 69%). His past medical history was significant for type 2 diabetes mellitus, hypertension, and end-stage renal disease, for which he had been on maintenance hemodialysis for three years.

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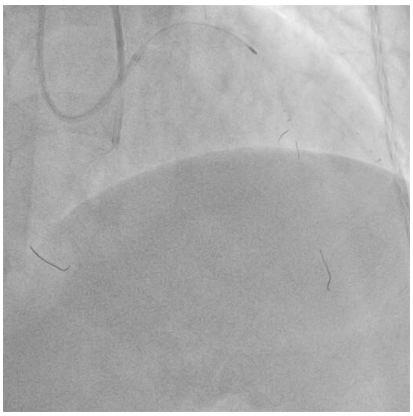
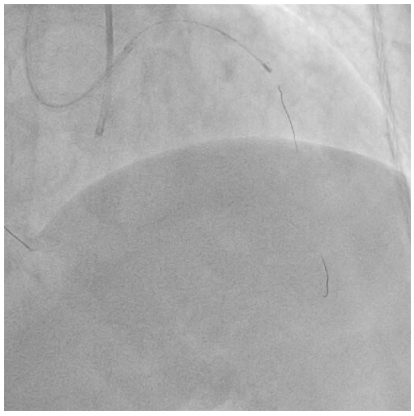
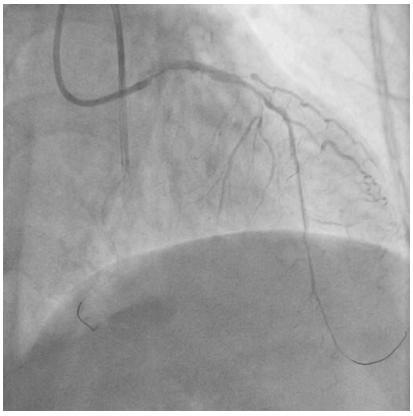
Video 3. Rotational atherectomy in the calcified CTO lesion combined with the fractured wire. Video associated with this article can be found, in the online version, at https://doi.org/10.31083/HSF50693.



Video 5. Rotational atherectomy in the calcified CTO lesion combined with the fractured wire. Video associated with this article can be found, in the online version, at https://doi.org/10.31083/HSF50693.



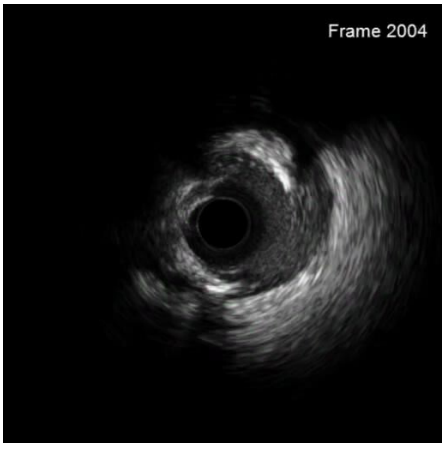
Video 4. Rotational atherectomy in the calcified CTO lesion combined with the fractured wire. Video associated with this article can be found, in the online version, at https://doi.org/10.31083/HSF50693.



Video 6. Angiographic images after RA. Video associated with this article can be found, in the online version, at https://doi.org/10.31083/HSF50693.

Selective coronary angiography (CAG) via the transradial approach revealed severe stenosis in the proximal right coronary artery (RCA) (Fig. 2A-1) and the mid-segment of the left circumflex artery (LCX) (Fig. 2B-1). Chronic total occlusions (CTOs) were identified in the posterolateral branch of the RCA (Fig. 2A-1) and the mid-segment of the left anterior descending artery (LAD) (Fig. 2C-1). Given the patient's high SYNTAX score, coronary artery bypass grafting (CABG) was recommended. However, the patient declined surgical revascularization, and a strategy of staged percutaneous coronary intervention (PCI) was subsequently planned.

The initial revascularization involved successful stent implantation in the proximal RCA (Fig. 2A-2) and drug-coated balloon treatment for the LCX (Fig. 2B-2). Nevertheless, attempts to recanalize the identified CTOs were unsuccessful. While employing the parallel wire technique as the rescue strategy, the Gaia Second Guidewire became en-



Video 7. IVUS images after RA. Video associated with this article can be found, in the online version, at https://doi.org/10.31083/HSF50693.

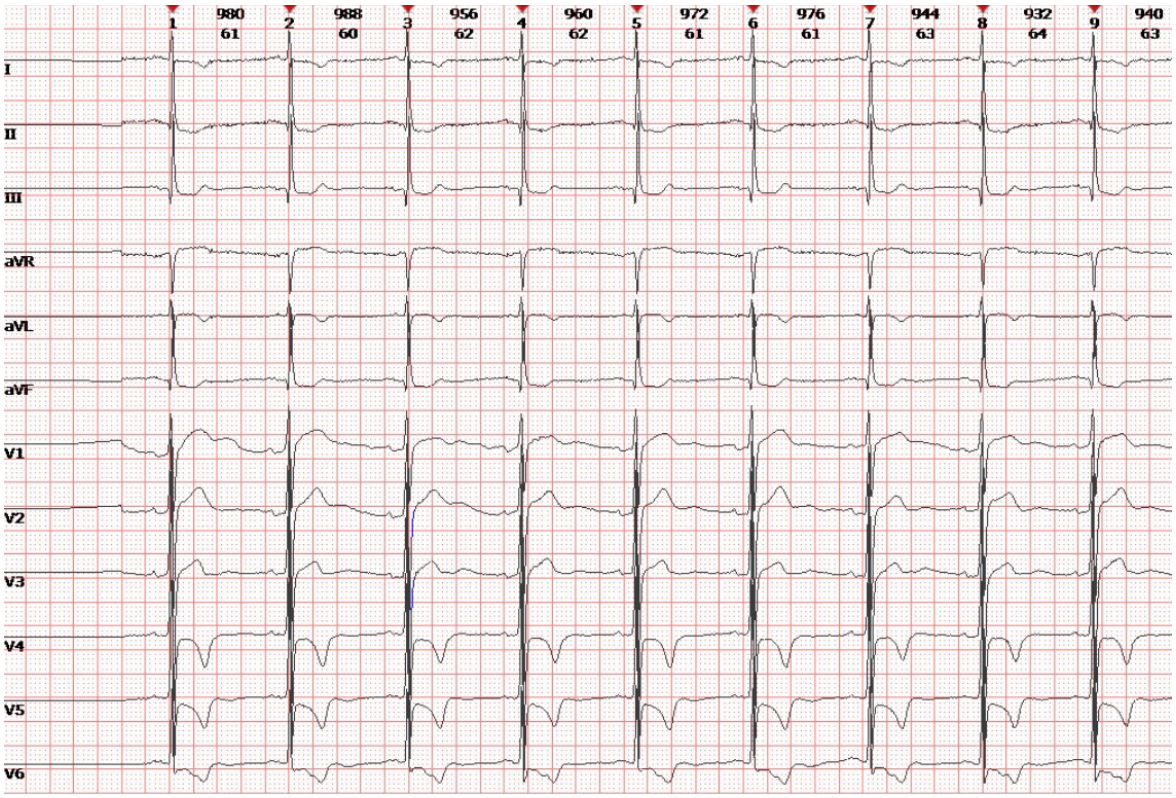


Fig. 1. Electrocardiography on admission.

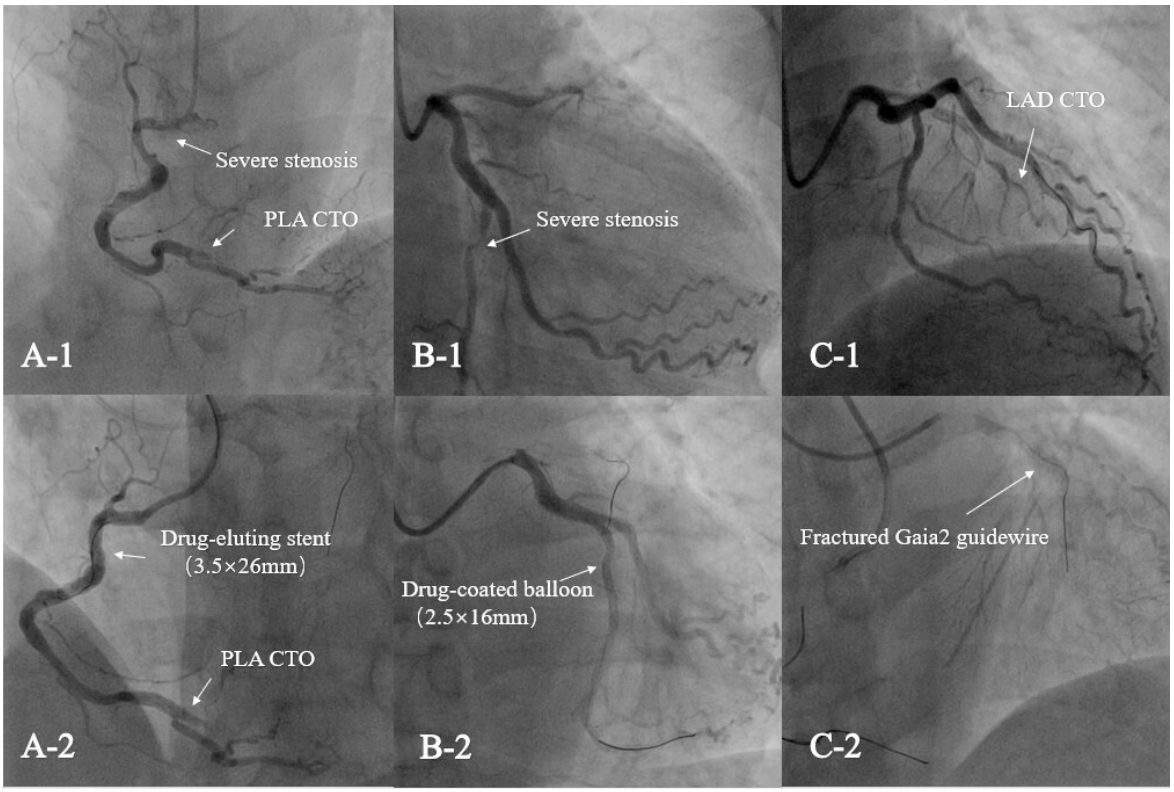


Fig. 2. Pre-and post-treatment angiographic images for right and left coronary artery. (A-1,B-1,C-1) Pre-treatment angiographic images. (A-2,B-2,C-2) Post-treatment angiographic images.

trapped, uncoiled, and ultimately fractured within the LAD (Fig. 2C-2).

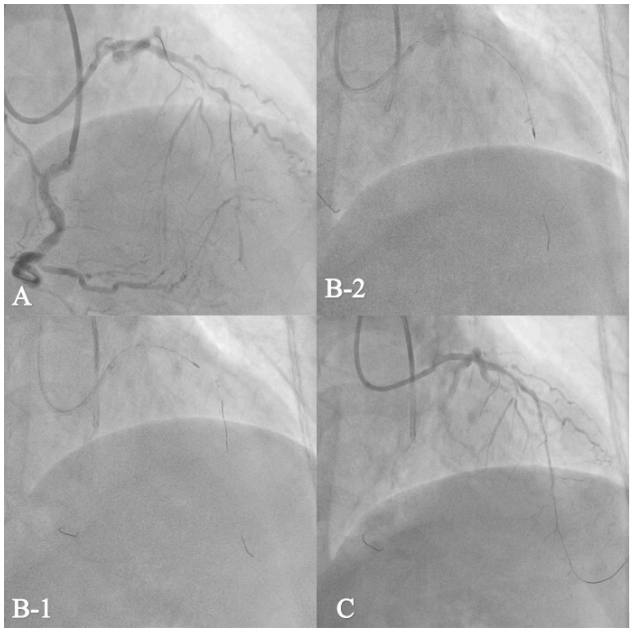
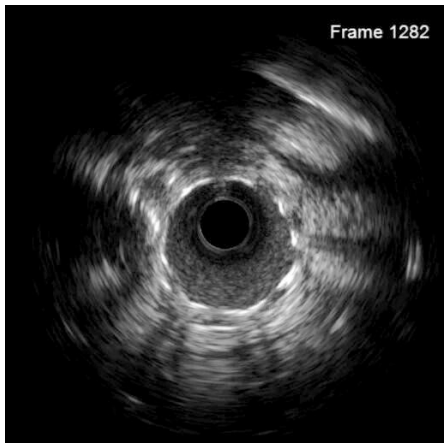


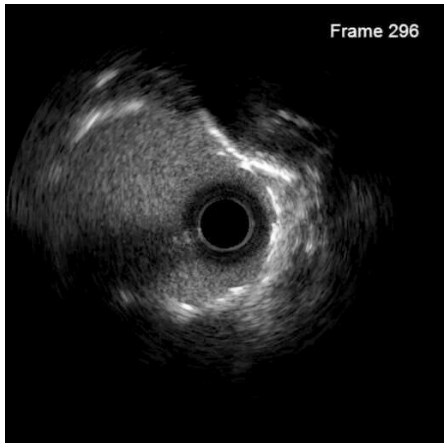
Fig. 3. Rotational Atherectomy for the calcified CTO lesion combined with the fractured guidewire. (A) Pre-RA angiographic images. (B-1,B-2) Images during RA. (C) Angiographic images post-RA. CTO, chronic total occlusion; RA, rotational atherectomy.

Video 8. Final angiographic images after stent implantation. Video associated with this article can be found, in the online version, at https://doi.org/10.31083/HSF50693.

After consultation with experienced interventional cardiologists, a second PCI attempt targeting the LAD-CTO via the transradial approach was scheduled one month later. A 7-Fr EBU 3.75 and a AL.75 guiding catheter (Medtronic, USA) were used to engage the LAD and RCA, respectively. Antegrade wire escalation was commenced using a Finecross ® MG Coronary Micro-Guide Catheter (130 cm; TERUMO, Japan). Initial attempts to cross the lesion with a Fielder XT-A guidewire (Ashahi, Japan) were unsuccessful. However, subsequent advancement with a Gaia Second guidewire (Asahi, Japan) successfully traversed the occlusion and entered the distal true lumen. Successful guidewire position in the distal true lumen was confirmed by retrograde contrast injection (Videos 1,2).



Video 9. Final IVUS images after stent implantation (LAD). Video associated with this article can be found, in the online version, at https://doi.org/10.31083/HSF50693.



Video 10. Final IVUS images after stent implantation (LM). Video associated with this article can be found, in the online version, at https://doi.org/10.31083/HSF50693.

Despite successful guidewire passage, the microcatheter could not be advanced across the lesion. Attempts at balloon predilatation using a Sprinter Legend 1.25 mm × 15 mm balloon (Medtronic, USA) failed to adequately expand the stenosis. The lesion remained resistant even after switching to a Workhorse Guidewire. Consequently, rotational atherectomy (RA) was performed using a 1.25 mm burr with the RotaPro system (Boston Scientific Corp.). Although a transient stall occurred, the burr was not entrapped.

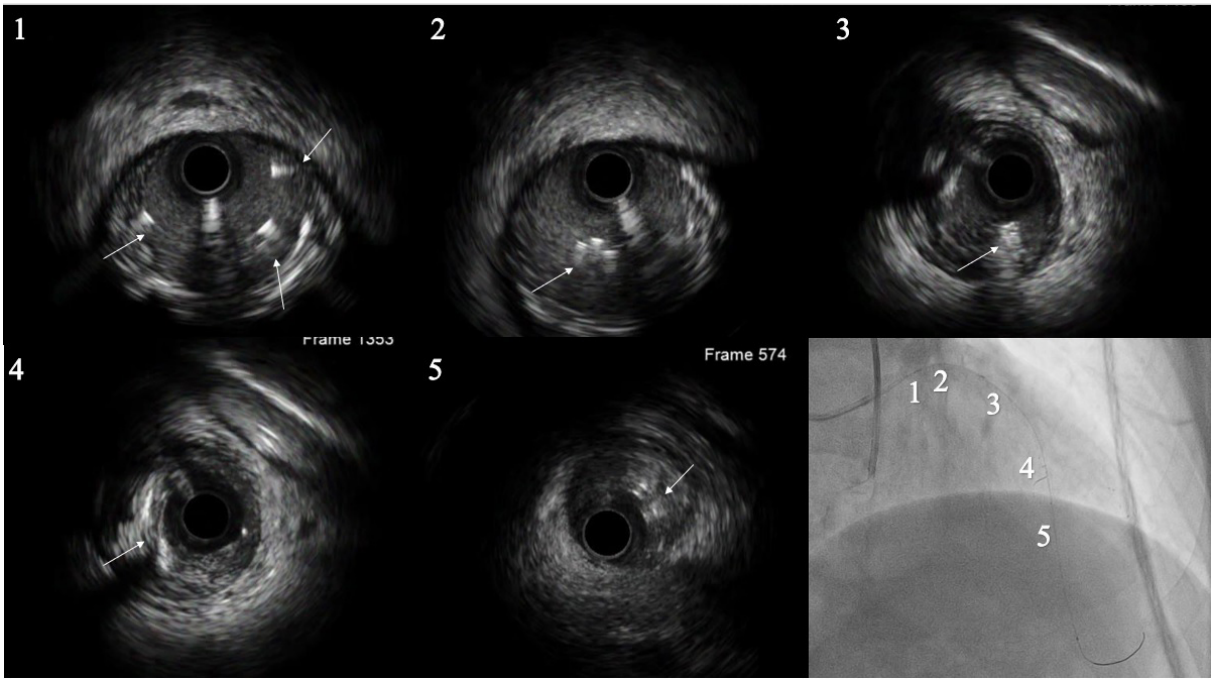


Fig. 4. Untangled guidewire and guidewire fragments after RA. The numbers on the angiographic image coincide with the numbered IVUS position images. Arrow: untangled guidewire.

Notably, the previously fractured and entrapped guidewire segment was successfully ablated into small fragments during the atherectomy procedure (Fig. 3, Videos 3,4,5,6).

Following successful atherectomy and serial predilatation, intravascular ultrasound (IVUS)-guided (Fig. 4, Video 7) implantation of three overlapping drug-eluting stents was performed, extending from the distal segment of the lesion to the ostium. Final angiography and IVUS confirmed optimal stent expansion and apposition, with complete encapsulation of the fractured guidewire segment within the stented segment of the LAD (Fig. 5 and Videos 8,9,10). The dosage of contrast (iodixanol) during the operation was 100 mL. The patient received an additional dialysis the next day and was uneventfully discharged two days later with dual antiplatelet therapy (aspirin and ticagrelor). At one-year follow-up, the patient remained free from recurrent angina pectoris and myocardial infarction.

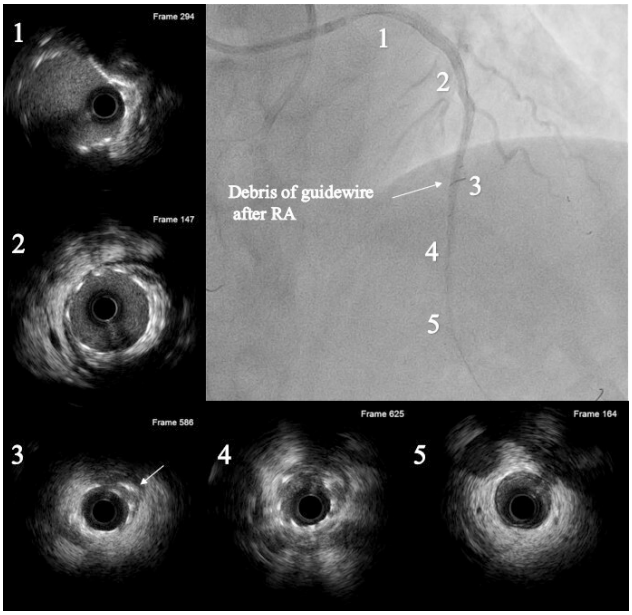


Fig. 5. Guidewire fragments sealed by the drug-eluting stents. Final angiographic and intravascular ultrasound (IVUS) images after stents implantation. The numbers on the angiographic image coincide with the numbered IVUS position images.

3. Discussion

Although there have been isolated reports of guidewire entrapment being resolved with the use of RA, the optimal management of fractured guidewires within CTO segments remains unclear. To our knowledge, this case may represent the first documented instance of complete ablation of a fractured guidewire within a CTO lesion using RA.

It is well established that bifurcation lesions, severe vessel tortuosity and calcification, as well as the use of stiff-tipped guidewires, are recognized risk factors for guidewire entrapment and fracture. Improper handling during CTO interventions, such as continuous rotation in a single direction, particularly with hydrophilic guidewires like the Gaia series, may result in filament uncoiling, untanglement and tip breakage [2,3]. Fragments of broken guidewires retained within coronary CTO lesions are rarely associated

with major complications, and conservative management is typically recommended in such cases [4,5].

Reintervention, particularly using RA near a fractured guidewire, has not been reported and carries inherent procedural risks. Primary concerns include burr entrapment and vessel perforation. Furthermore, if the retained guidewire extends into the left main coronary artery, fragmentation during RA could result in systemic embolization. In our case, the decision to proceed with RA was based on the hypothesis that the CTO lesion was severely calcified and that the fractured guidewire was firmly embedded within the calcified segment, thereby reducing the risk of wire displacement during RA. Given the chronic total occlusion of the target vessel, the potential for clinically significant ischemic sequelae resulting from distal embolization of small ablated fragments was considered relatively low compared to intervention in a patent vessel. Nonetheless, despite successful encapsulation of the larger proximal fragment within the stented segment, the risk of residual distal debris contributing to late stent thrombosis or microvascular dysfunction remains a theoretical concern [6]. Thus, prolonged dual antiplatelet therapy may be may be necessary to reduce the risk of thrombotic complications.

Finally, we must reiterate that CABG remains the preferred treatment option for such complex cases. Especially when complications such as guidewire or balloon entrapment occur, surgical intervention is an effective remedial measure. Our case indicated that RA may serve as a feasible strategy for fragment ablation and removal under some circumstances, but the long-term prognosis (including long-term coronary artery patency) of the patient requires more prolonged data from imaging and clinical follow-up.

4. Conclusions

Rotational atherectomy may serve as a safe rescue strategy to manage the fractured guidewires within chronic total occlusion segments.

Availability of Data and Materials

Data to support the findings of this study are available on reasonable requests from the corresponding author.

Author Contributions

XLH collected the data and wrote the article. JHZ, GSF and WBZ designed and critical reviewed the article. All authors have read and approved the final manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

The study was carried out in accordance with the guidelines of the Declaration of Helsinki. This case report was exempt from Institutional Review Board (IRB) approval in accordance with the policies of the Sir Run Run Shaw Hospital of Zhejiang University. Written informed consent for publication was obtained from the patient.

Acknowledgment

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Conflict of Interest

The authors declare no conflict of interest.

Supplementary Material

Supplementary material associated with this article can be found, in the online version, at https://doi.org/10.31083/HSF50693.

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