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CASE REPORT
Coronary intervention

Intramural hematoma extending from a dissection within an implanted stent: a case report treated with fenestration using a cutting balloon

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Background Dissection after balloon dilation or stent implantation is a common complication of percutaneous coronary intervention. In general, coronary stent implantation for coronary artery dissection is safe when the dissection is completely covered by the stent, particularly when dissection occurs during pre-dilation. However, here, we report a case of severe restenosis caused by a pre-dilation hematoma that extended after stent implantation.

Case summary A 76-year-old man was diagnosed with angina on exertion and underwent percutaneous coronary intervention in the right coronary artery. After pre-dilation with a cutting balloon, non-flow-limiting dissection occurred. An everolimus-eluting stent was implanted, completely sealing the dissection, and intravascular ultrasound revealed adequate stent expansion without stent edge dissection. Two weeks after the procedure, confirmatory coronary angiography revealed severe restenosis extending from the distal stent edge to the distal right coronary artery. Intravascular ultrasound revealed a hematoma extending from the middle of the stent to the distal segment.

Discussion The patient had been on steroids for a long time. The cutting balloon used for pre-dilation may have created a deep dissection reaching the tunica media, already rendered vulnerable by steroids, potentially leading to injury to the vasa vasorum. The intramural hematoma from the bleeding vasa vasorum might have been the underlying cause of this phenomenon, as evidenced by its increase in size despite the entry of the dissection being completely sealed. Cardiologists should be aware of this possibility.

Keywords Coronary artery dissection • Cutting balloon • Hematoma • Intravascular ultrasound • Steroids • Case report

ESC curriculum 3.1 Coronary artery disease • 2.1 Imaging modalities • 3.4 Coronary angiography

Learning points

- Coronary stent implantation for coronary artery dissection is generally safe when the dissection is completely covered by the stent.
- This patient had been on prolonged steroid therapy rendering the tunica media vulnerable, and we observed an intramural hematoma extending from a dissection within an implanted stent.
- We should consider the possibility in patients on steroids or anticoagulants

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Introduction

Dissection after balloon dilation or stent implantation is a common complication of percutaneous coronary intervention (PCI). Several treatment strategies for coronary artery dissection have been reported.[1,2] Dissection by balloon dilation is not only a complication but also the main mechanism of lesion dilatation.[3] In most cases, a coronary stent is implanted to cover at least the entry of the dissection, which is a conventional treatment for coronary artery stenosis. This strategy is generally considered safe when the dissection area is completely covered by the stent, particularly in cases of dissection occurring during pre-dilation.[4] However, here, we report a case of an intramural hematoma extending from a dissection within an implanted stent.

Summary figure

Time	Event
Ten months before the visit	Patient was diagnosed with interstitial lung disease and initiated steroid treatments.
First presentation	Patient visited our hospital for shortness of breath on effort.
First admission	CAG showed three-vessel disease and the SYNTAX score was low.
Second admission	PCI to RCA was performed. After pre-dilatation with cutting balloon, a type C dissection occurred. An everolimus-eluting stent was implanted and completely sealed the dissection.
Third admission	At the time of PCI of LCX, severe stenosis from the distal stent edge to the distal RCA was observed. We changed the target of PCI from LCX to RCA. IVUS revealed that true-lumen compression caused by the hematoma. After successful fenestration, RCA blood flow was restored.
Fourth and fifth admissions	We performed PCI to LCX and LAD within 2 months.
Eight months after the PCI of the RCA	Follow-up CAG showed no restenosis.

Case presentation

A 76-year-old Japanese man presented to our hospital owing to dyspnoea upon exertion. He had a medical history of interstitial lung disease treated with low-dose steroids, along with hypertension and diabetes mellitus. On admission, the physical examination was normal. Laboratory data showed that the brain natriuretic peptide level was normal and troponin was not detected. The electrocardiogram showed sinus rhythm without ST-T changes. His left ventricular ejection fraction was 65% by the modified Simpson method. Coronary computed tomography revealed three-vessel coronary artery disease. Coronary angiography (CAG) was performed and revealed a 90% stenosis of the proximal right coronary artery (RCA), a 90% stenosis of the proximal left anterior descending (LAD) artery, and a 90% stenosis of the proximal left circumflex (LCX) artery (see Supplementary material online, *Video S1*).

The patient was diagnosed with effort angina pectoris upon exertion, and his SYNTAX score was 14. Therefore, we planned to treat his three vessels by using PCI. First, PCI of the RCA was performed. Intravascular ultrasound (IVUS) was performed after wire crossing and showed fibrous plaque and moderate calcification with a 270° calcium arc in the culprit lesion. After pre-dilatation with a cutting balloon (diameter, 2.5 mm), non-flow-limiting dissection occurred; this was a type C dissection according to the National Heart, Lung, and Blood Institute criteria.

An everolimus-eluting stent (diameter, 3.0 mm; length, 38 mm) was successfully implanted and completely sealed the dissection, and post-dilatation with a noncompliant balloon (diameter, 3.25 mm) was performed at the proximal edge of the stent. Intravascular ultrasound revealed adequate stent expansion without stent edge dissection (*Figure 1*).

After the procedure, the patient experienced paroxysmal atrial fibrillation with bradycardia and hypotension. He had no chest pain, and electrocardiography and laboratory tests revealed only nonspecific changes. Edoxaban and clopidogrel were prescribed at discharge.

Two weeks later, at the time of the PCI of the LCX, we observed severe stenosis from the distal stent edge to the distal RCA. Therefore, we changed the PCI target from the LCX to the RCA. The RCA was crossed by a conventional wire. Intravascular ultrasound revealed that the wire was in the true lumen and that a hematoma extended from the middle of the stent to the distal segment (*Figure 2* and Supplementary material online, *Video S2*). Although we could not identify the entry of the dissection, we empirically implanted an everolimus-eluting stent (diameter, 3.0 mm; length, 28 mm) to cover the distal edge of the previously implanted stent. However, blood flow was not restored, and IVUS revealed that true-lumen compression caused by the hematoma continued from the additional stent to the bifurcation of the atrioventricular branch and posterior descending branches. Thus, fenestration was required and was performed via a cutting balloon (diameter 3.0 mm) in the distal RCA. After successful fenestration, RCA blood flow was restored (see Supplementary material online, *Videos S3* and *S4*).

Subsequently, we preformed PCI of the LCX and LAD within two months. Eight months after PCI of the RCA, we performed follow-up CAG because of the abovementioned treatment course, despite the absence of symptoms. Coronary angiography revealed an absence of restenosis in the three vessels and that the blood flow of the RCA was well maintained (*Figure 3*).

Discussion

Here, we report on a case of intramural hematoma extending from a dissection within an implanted stent and treated with fenestration using a cutting balloon. The final CAG of the first PCI revealed no abnormalities, and IVUS revealed that the dissection was completely covered by the everolimus-eluting stent. To our knowledge, this phenomenon has been reported in only one case report, in which in-stent dissection was observed by optical coherence tomography.[5]

The patient in the present case report had been taking steroids for a long time. Steroids can render the collagen in the tunica media vulnerable and cause atherosclerosis.[6]

The addition of edoxaban at discharge may have led to the extended hematoma.

In this case, a cutting balloon was used for pre-dilation. The cutting balloon had three blades with heights of 0.13 mm, which might have created a deep dissection reaching the tunica media, already made

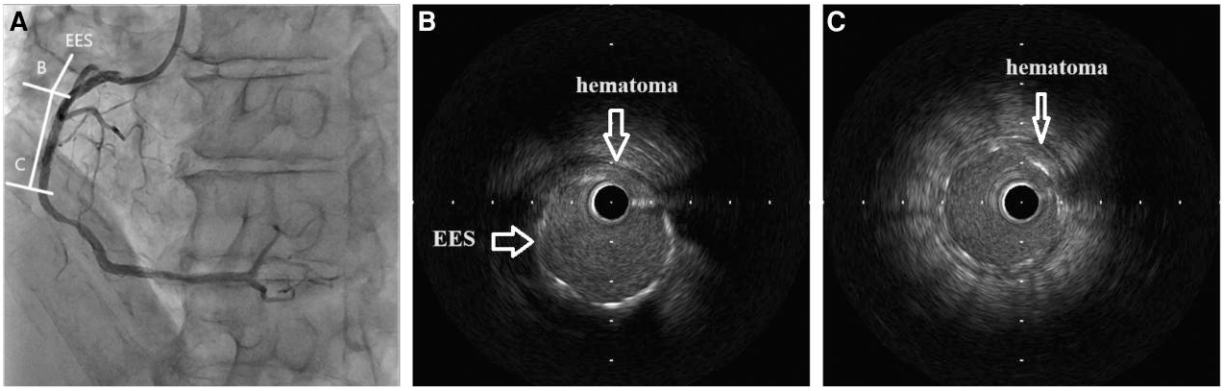

Figure 1 (*A*) We implanted an everolimus-eluting stent (diameter, 3.0 mm; length, 38 mm). The final coronary angiography of the first PCI revealed no abnormalities. (*B* and *C*) IVUS revealed that the dissection was completely covered by the everolimus-eluting stent. EES, everolimus-eluting stent.

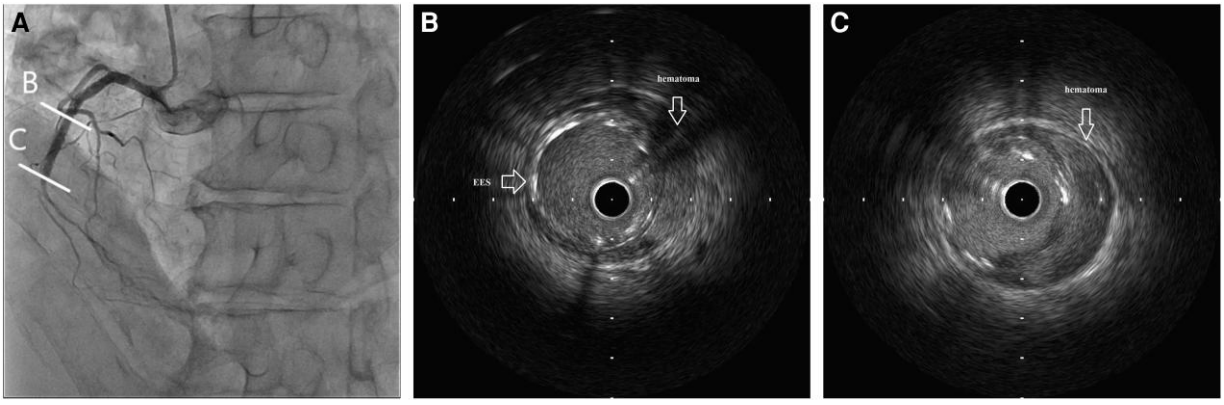

Figure 2 (*A*) Two weeks later of the first PCI, we observed severe stenosis from the distal stent edge to the distal RCA. (*B* and *C*) Intravascular ultrasound revealed a hematoma extending from the middle of the stent to the distal segment.

vulnerable by steroids, potentially causing injury to the vasa vasorum. The intramural hematoma from the bleeding vasa vasorum, and anticoagulation, might have been the underlying cause for this phenomenon, as evidenced by the increase in the size of the hematoma despite the intimal entry of the dissection being completely sealed.

The vasa vasorum is the microvasculature that enters the vessel walls. The vasa vasorum interna originates from the luminal surface or media, whereas the vasa vasorum externa mainly exists in the adventitia. Oxygen and nutrients are supplied to tunica media and adventitia of the coronary arterial walls via the vasa vasorum.[7] The vasa vasorum increases with the fibrous plaque volume and is associated with plaque vulnerability, requiring microvascular imaging.[8]

In cases of spontaneous coronary artery dissection, systemic anticoagulation should be discontinued in patients without other indications, because anticoagulation may increase the risk of hematoma expansion.[9] Our case was not spontaneous coronary artery dissection but it was similar in terms of the need for acute hematoma treatment. It is presumed that anticoagulation was one of the mechanisms of hematoma expansion after stent implantation.

Coronary artery dissection can be treated in several ways; however, the optimal treatment has not been clearly established. Options such as additional stent implantation to seal the dissection entry and fenestration using a cutting balloon available; however, these procedures may exacerbate the situation.[2]

Although the circumstances described in this case report may be rare, cardiologists must take notice.

Patient's perspective

He was satisfied with the treatment, and his symptoms improved.

Conclusion

In conclusion, we report a case of intramural hematoma extending from a dissection within an implanted stent. Therefore, the possibility should be considered, especially in patients on steroids or anticoagulants, and further investigations are warranted.

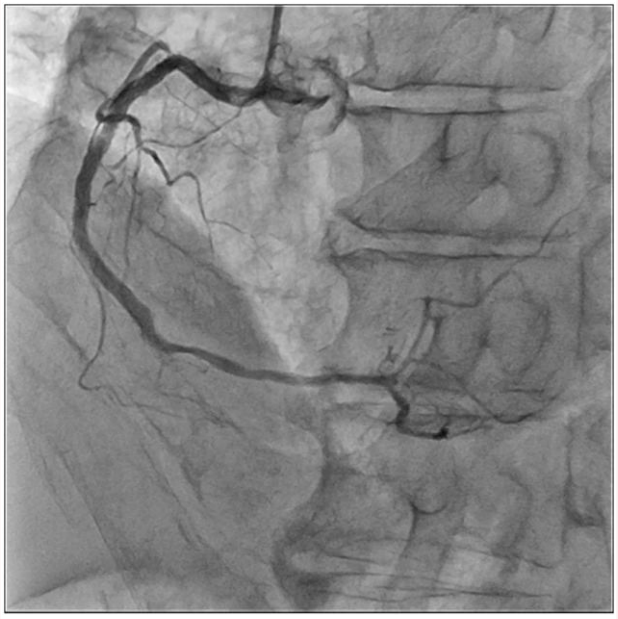

Figure 3 Follow-up angiography showed no restenosis.

Lead author biography

Dr Takeshi Okura is an interventional cardiologist. He worked as a staff at Division of Cardiology, Showa University Northern Yokohama Hospital, Japan from 2020.

Supplementary material

Supplementary material is available at *European Heart Journal – Case Reports* online.

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Data availability

Data sharing is not applicable to this article as no datasets were generated or analysed during the current study.

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