

A case of type IIIb endoleak with stent fracture after AFX stent graft with endovascular treatment

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ABSTRACT

Purpose: Type IIIb endoleak is a complication of endovascular repair of abdominal aortic aneurysms. The frequency of a type IIIb endoleak is approximately 0.23%. Because of its rarity, it poses diagnostic and treatment challenges.

Case Report: A 72-year-old man underwent endovascular repair of an abdominal aortic aneurysm with an AFX with DuraPly™ (Endologix LLC, Irvine, CA, USA). One year later, he developed a type IIIb endoleak with rapid re-expansion of the aortic aneurysm due to stent fracture of main body of AFX. He then underwent a second AFX endovascular repair; however, one month after, follow-up ultrasonography showed blood flowing into the abdominal aortic aneurysm from the site of the previous type IIIb endoleak. A third endovascular repair was performed using an Excluder® (W. L. Gore & Associates, Newark, DE, USA); fortunately, during the six-month follow-up, the endoleak did not recur and the diameter of the aneurysm did not enlarge.

Conclusion: Type IIIb endoleak is a very rare complication of endovascular aortic aneurysm repair and can be difficult to treat. However, it is essential to ensure that the proximal and distal seal zones are adequate, fixation is secure, and the components sufficiently overlap.

1. Introduction

Endovascular aneurysm repair (EVAR) is the most common and minimally invasive method to treat an abdominal aortic aneurysm (AAA).¹ However, the complication of endoleak is reported to occur in approximately 30% of cases.² Trans-graft (type III) endoleaks are classified into two types: type IIIa endoleaks, caused by disconnections of modular graft components, and type IIIb endoleaks, caused by defects or erosion of the graft fabric.² The frequency of type IIIb endoleaks is approximately 0.23%, which is quite rare;¹ as a result, challenges regarding the therapeutic strategy and definitive diagnosis of this complication are still present.² In this report, we describe a case of type IIIb endoleak with stent fracture one year after EVAR, which was refractory to treatment.

2. Case report

The 74-year old patient with cardiac and pulmonary comorbidities underwent EVAR with an AFX with DuraPly™ (Endologix LLC, Irvine, CA, USA) for a 76mm diameter aneurysm, in 2019, when he was 72 years old.

The first EVAR was performed without any complication, and a type II endoleak from the lumbar artery was observed, we opted for endograft surveillance through long-term outpatient follow-up. Computed tomography (CT) at one and six months after EVAR showed no change in the aneurysm diameter. However, A CT scan in July 2020 revealed an enlarged abdominal aortic aneurysm diameter of 78 mm and lung cancer. The patient was referred to the Department of Pulmonary Surgery for treatment of lung cancer. During treatment for lung cancer, the abdominal aortic aneurysm was enlarged from 78 mm to 86 mm, and contrast-enhanced CT was performed in April 2021. The patient was referred to our department as a suspected type Ib endoleak (Fig. 1). The aortic aneurysm diameter was rapidly enlarged from 86 mm to 94 mm on CT in June 2021, which was performed immediately before the operation.

From the CT images, we determined that it was a type Ib endoleak from the right leg of the stent graft and thought it was treatable with the extension of the iliac stent-graft to external iliac artery. However, we found out intraoperatively that fluoroscopy showed that a part of the main body stent was moving inward in accordance with the heartbeat. Digital subtraction angiography (DSA) showed a pronounced contrast leak from the same area (Fig. 2). Therefore, it was determined that the

Abbreviations: AAA, Abdominal aortic aneurysm; CT, Computed tomography; DSA, Digital subtraction angiography; EVAR, Endovascular aneurysm repair.

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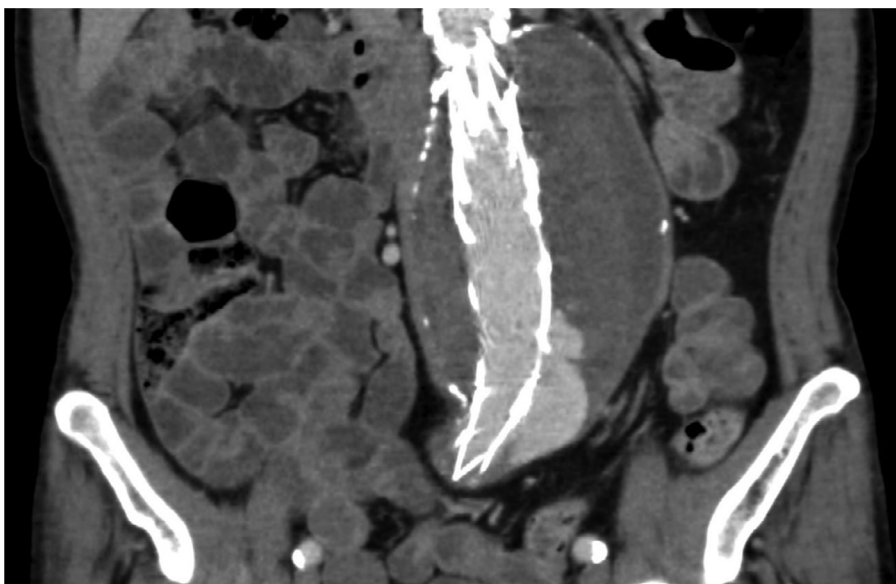


Fig. 1. Contrast-enhanced computed tomography image 12 months after the first endovascular aortic repair. A large amount of contrast leakage into the abdominal aortic aneurysm is observed.

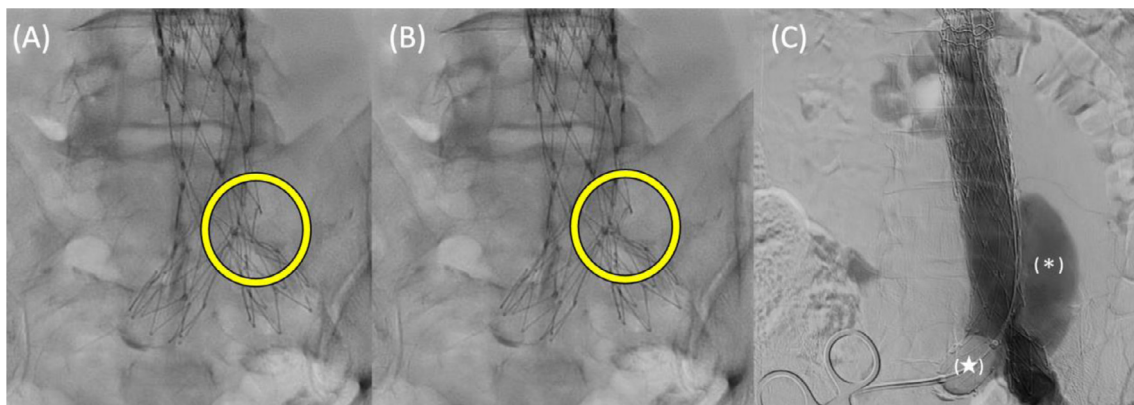


Fig. 2. Intraoperative image of the second endovascular surgery. (A) and (B) show stent fracture. The stent in the area circled is moving in accordance with the heartbeat. (*) indicates leakage of contrast medium at the location of stent fracture (C). (★) is a balloon expanded to exclude type Ib endoleak from the right limb.

cause of the rapid expansion of the AAA was not a type Ib, but a type IIIb endoleak with stent fracture. We thought that we could treat it by covering the injured area extensively with the main body of the AFX, so we performed a re-EVAR with AFX in June 2021.

The operation was completed without endoleak and the patient was once discharged and attended as an outpatient. But, one month after the repeated EVAR, follow-up was performed by abdominal ultrasonography instead of contrast-enhanced CT due to chronic renal failure. The images showed blood flowing into the AAA from the site of the previous type IIIb endoleak (Fig. 3A). Abdominal symptoms suggesting impending rupture were also observed; hence, we decided to perform a third EVAR in August 2021.

Intraoperatively, DSA showed leakage of contrast medium from the right side of the graft into the aortic aneurysm. A gap had developed between the first AFX and second AFX, and contrast medium had leaked through the gap into the AAA though the first AFX stent fabric tear. Balloon compression was implemented on each leg, and DSA was performed to evaluate the endoleak location. However, balloon compression failed to disappear the endoleak, and a third EVAR was performed with an Excluder® (W. L. Gore & Associates, Newark, DE, USA) to land on the distal side of the first and second stent from below the renal artery. DSA after stent deployment revealed that the type IIIb endoleak from the distal side had disappeared. Additionally, intraoperative color Doppler abdominal ultrasonography was performed, and it confirmed that the

type IIIb endoleak in the AAA had disappeared (Fig. 3B). There was no recurrence of endoleak and no enlargement of the aortic aneurysm diameter over the next six months.

In March 2022, that was seven months after our last EVAR, the patient died of lung cancer.

3. Discussion

We experienced a case of Type IIIb endoleak with stent fracture, a very rare condition that could be treated by endovascular therapy, although with great difficulty.

The incidence of a type IIIb endoleak ¹ is extremely low (0.23%). According to the cases reported so far, the causes of type IIIb endoleaks include spontaneous fabric break, stent fracture, and stent migration.³⁻⁷ The stent graft's main body was reported to be the common location for type IIIb endoleaks in 34.8% of cases, and the next common area was the flow divider [8] in 32.6% of cases.

Kwon et al. ⁸ focused on the endoskeleton of the AFX as the cause of type IIIb endoleaks in AFX stents and speculated that, since the AFX comes in contact with the aorta more frequently than other exoskeletal devices, chronic wear and tear may cause fabric damage in patients with significantly calcified vessels. However, the AFX stent model reported by Kwon et al. was of an earlier generation, while the current AFX stent is said to have improved durability and tear resistance due to the use of

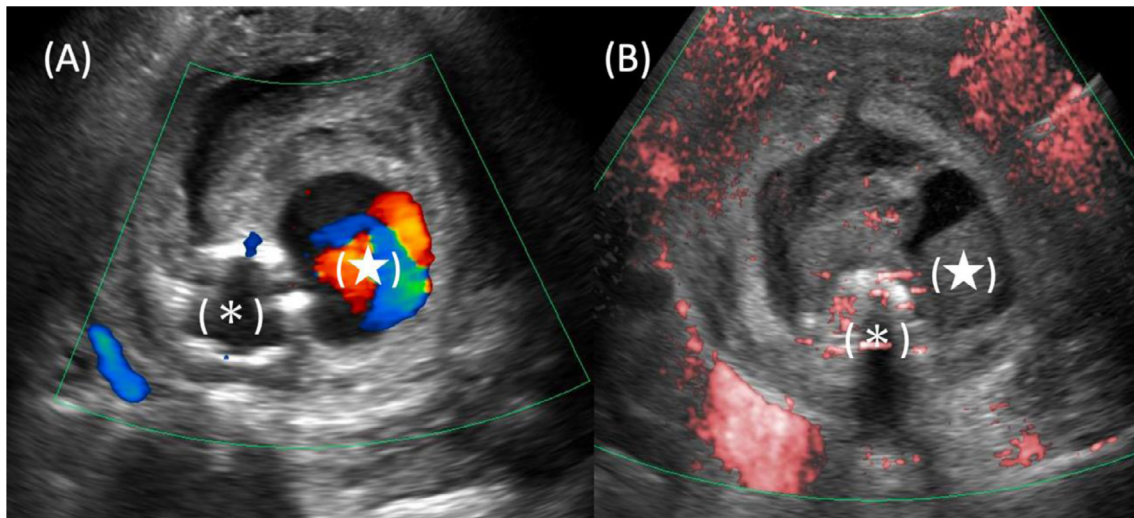


Fig. 3. Abdominal ultrasonographic images. (A) shows images obtained one month after the second endovascular surgery. (B) shows the intraoperative images obtained in the third endovascular surgery. (*) indicates in-stent graft, and (★) indicates aortic aneurysm outside the stent graft. The color Doppler finding in (A) disappeared in (B).

DuraPly™ in the fabric. In our case, in which DuraPly™ was installed, the type IIIb endoleak caused by abrasion of the artificial vessel against the calcification may have been a very rare complication. We also suspected that stent rupture at the same site was very rare, although the mechanism is still unknown.

In this case, an endoskeletal AFX was inserted during the first EVAR, and we presumed that re-stent grafting with another exoskeletal device might leave a type IIIa endoleak because the grafts will not fully attach to each other; thus, we chose to re-stent using the same stent graft model. However, as a result, the overlap zone or the landing zone was insufficient, and there was a gap between the endoskeleton of the first AFX stent and the active seal of the second AFX stent on the peripheral side. As described by Lemmon et al.,⁹ adequate proximal and distal seal zones with secure fixation and adequate component overlap are also important, even in re-EVAR.

Moreover, postoperative evaluation seems even more important in re-EVAR cases than in first-time surgery cases. In particular, this experience reconfirmed the efficacy of abdominal ultrasonography. In the second EVAR, the endoleak undetected by intraoperative DSA was identified by abdominal ultrasonography one month later. Moreover, abdominal ultrasonography is considered a minimally invasive procedure that does not require the use of contrast medium in patients with chronic renal failure. We were able to confirm the disappearance of the endoleak in real time by performing pre- and postoperative evaluations. These results suggest that abdominal ultrasonography may be effective in determining the success or failure of EVAR.

4. Conclusions

We reported a case of type IIIb endoleak with stent fracture that was difficult to treat. This very rare complication was successfully managed after repeated EVAR. In order to properly treat this complication, the proximal and distal seal zones must be adequate, fixation must be secure, and the components must sufficiently overlap.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

CRediT authorship contribution statement

Shogo Oyama: Conceptualization, Data curation. **Shingo Ohuchi:** Writing – review & editing, Writing – original draft. **Yuki Horie:** Writing – original draft. **Takanori Harima:** Methodology, Writing – original draft.

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