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## Case Report

# Iliac neck dilatation causes rupture of abdominal aortic aneurysm previously treated with endovascular aortic aneurysm repair<sup>☆</sup>

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## ABSTRACT

A 78-year-old male had undergone endovascular aortic aneurysm repair (EVAR) 7 years prior to presentation. Although the sac was stable 6 months ago, the patient presented with shock at arrival, and CT showed aortic rupture with rapid expansion due to type Ib endoleak caused by iliac neck dilatation (IND). The aneurysm sac was excluded using an endovascular strategy. Bell-bottom iliac limbs can cause IND associated with type Ib endoleak. Additionally, the risk of rupture is high when re-expansion of an aneurysm occurs after sac regression after EVAR. Therefore, close follow-up is mandatory for patients with IND after EVAR.

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## Introduction

Endovascular abdominal aortic aneurysm repair (EVAR), along with open surgery, is the standard treatment for abdomi-

nal aortic aneurysms (AAA) in most patients with suitable anatomy and reasonable life expectancy. However, 25%–40% of patients with AAA treated with EVAR have common iliac artery aneurysms (CIAA) [1], and the management of these patients is still controversial [2]. Although commercially avail-

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able iliac limbs have various sizes to accommodate a wide range of iliac morphologies, there is a potential risk of iliac neck dilation (IND) which may affect the long-term outcomes of EVAR [3]. In this report, we describe the rapid expansion of a previously excluded AAA resulting in a rupture due to a type Ib endoleak, which is defined as an inadequate seal at distal end of the stent-graft caused by IND [4].

## Case report

A 78-year-old male had undergone EVAR on the right side using an Endurant device (Medtronic, Minneapolis, MN) with a bell-bottom iliac limb (24 mm) 7 years ago. His medical history includes postchemotherapy for lung cancer and surgical clipping for subarachnoid hemorrhage. The clinical course was uneventful with the sac stable 6 months prior to presentation. However, the patient was urgently admitted to our hospital and presented unconsciousness with a blood pressure of 68/40 mm Hg, a heart rate of 90 bpm, a respiratory rate of 30/min, and SpO<sub>2</sub> of 90% (in room air). His hemoglobin level and platelet count were 8.4 g/dL and  $104 \times 10^3/\mu\text{L}$ , respectively, and he received 2 units of RCC and 2 units of FFP.

Contrast-enhanced computed tomography (CT) revealed a massive hematoma surrounding the rapidly expanded AAA (Fig. 1). Retrospective evaluation of the CT scans showed that the size of the AAA decreased after EVAR (55 mm–37 mm). The AAA was dilated to 39 mm 6 months ago and the size at rupture was 45 mm. The size of the iliac neck on the right side gradually expanded over time. In the last follow-up, the legs were raised from 26 mm to 28 mm and the endograft retracted (Fig. 2). The rupture was determined to be a result of a type Ib endoleak from the leg float.

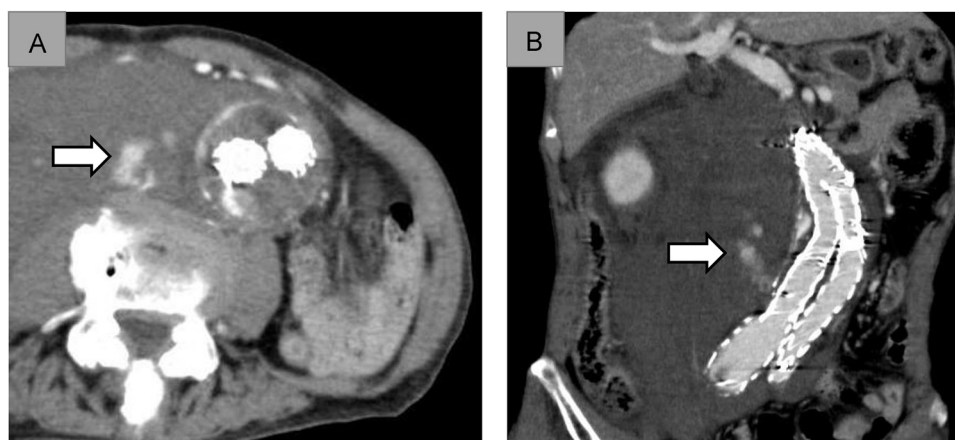
Open surgery was deemed to be high risk due to his frailty, so emergency EVAR with iliac extension and internal iliac artery embolization was performed.

Under general anesthesia, 2 Excluder extensions (W.L. Gore & Associates, Inc., Flagstaff, AZ) were placed in the right leg of the main body and the right external iliac artery in the

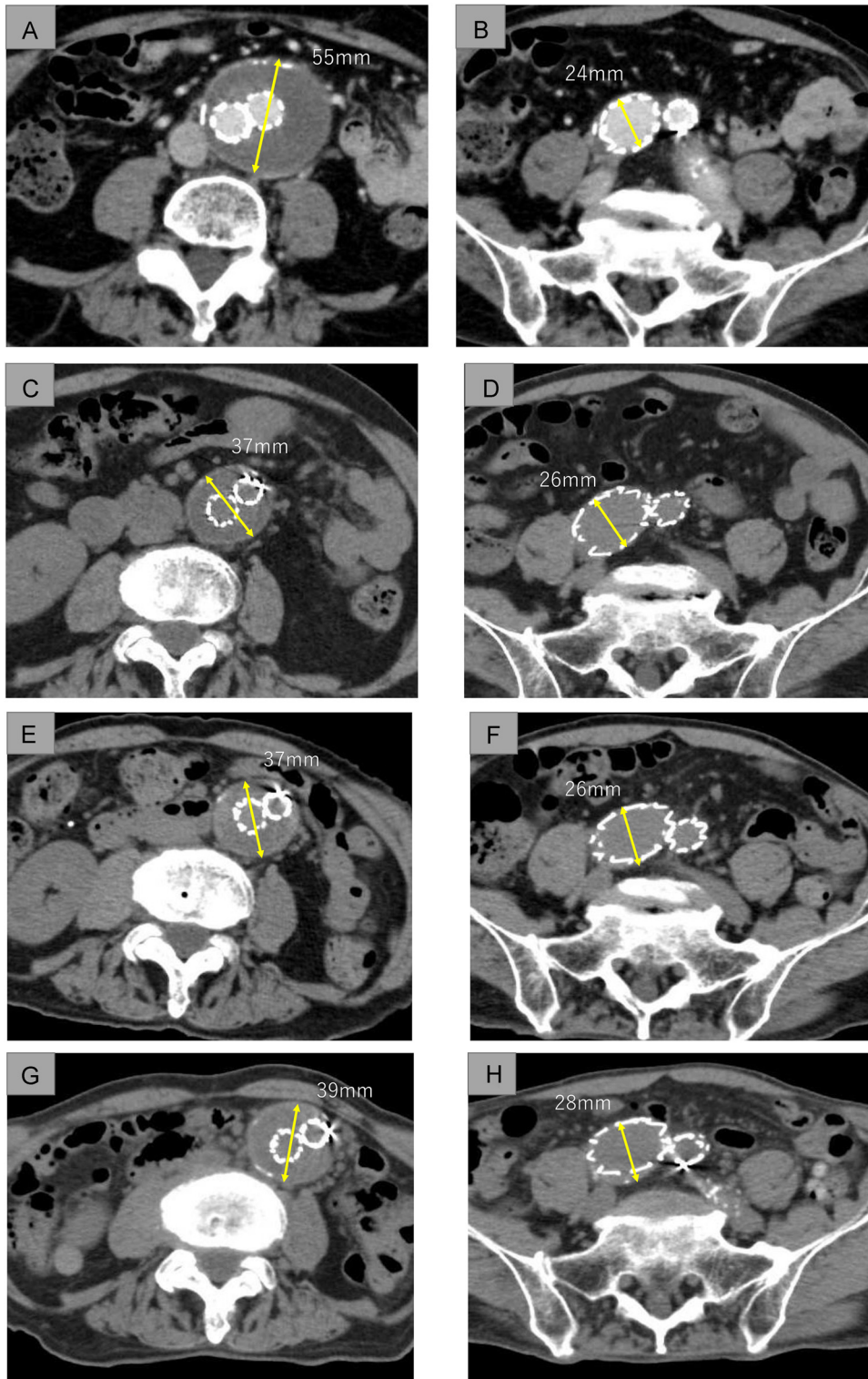
hybrid operating room (Fig. 3). The right internal iliac artery was difficult to cannulate; therefore, it was embolized with 50% n-butyl-cyanoacrylate-lipiodol mixture after the leg was completed using a 4F-Cobra catheter (Medikit, Tokyo, Japan) placed near the origin of the internal iliac artery. Completion angiography showed sac exclusion without endoleaks. His hemoglobin level and platelet count were elevated to 11.2 g/dL, and  $147 \times 10^3/\mu\text{L}$ , respectively, 4 hours after the operation. The postoperative course was uneventful, and the patient is currently being followed up on as an outpatient.

## Discussion

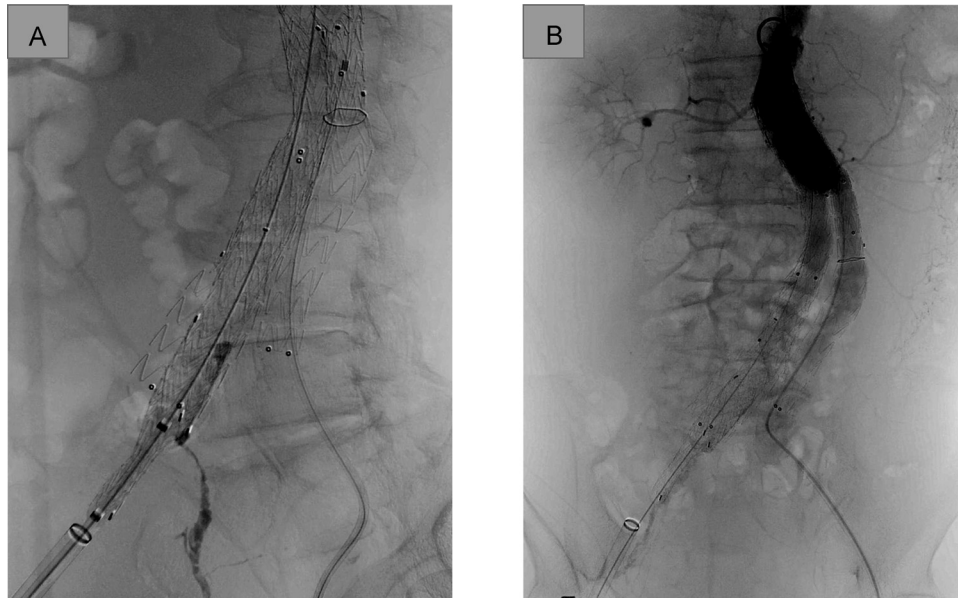
The current case report highlights a late type Ib endoleak induced by IND after EVAR. The commercially available iliac limb has a diameter of 28 mm, allowing for placement in CIA up to 25 mm in diameter. However, bell-bottom iliac limbs can result in late type Ib endoleaks, causing IND. A comparative study consisting of 239 iliac limbs from 128 patients, 61 iliac limbs were  $\geq 20$  mm in diameter and 178 were  $< 20$  mm in diameter, found that type Ib endoleaks were significantly higher in patients  $\geq 20$  mm diameter iliac limbs (18% vs 3.9%,  $P = .001$ ) [5]. Another study showed that type Ib endoleak occurred in 16.1% of patients with the bell-bottom type, whereas it occurred in 7.7% without the bell-bottom type [6]. This may be due to the relatively strong radial force associated with the bell-bottom type. Therefore, EVAR with a bell-bottom type may not be preferable for patients with a long-life expectancy, and using iliac branch devices or external iliac extension may produce better outcomes if anatomically feasible [5]. A recent study found that patients whose AAA sac diameter regressed to  $\leq 40$  mm after EVAR presented a very low rate of re-expansion, reintervention, or rupture, and most of the sac re-expansion occurred at least 3 years after reaching  $\leq 40$  mm in sac diameter [7]. In the current case, however, sac regression (37 mm) was observed 5 years ago, but a rapid AAA expansion occurred due to a secondary type Ib endoleak. This resulted in a rupture despite the aneurysmal sac diameter not



**Fig. 1** – Preoperative CT shows a ruptured AAA that measures 45 mm in diameter with massive hematoma (A) and endoleak (B) outside the aneurysm.



**Fig. 2 – (A) AAA 7 years ago; (B) iliac artery 7 years ago; (C) AAA 5 years ago; (D) iliac artery 5 years ago; (E) AAA artery 2 years ago; (F) iliac artery 2 years ago; (G) AAA 6 months ago; (H) iliac artery 6 months ago. The size of the AAA treated with EVAR increased after sac regression (55 mm → 37 mm → 37 mm → 39 mm). The diameter of the right iliac neck increased beyond the iliac limb diameter (24 mm → 26 mm → 26 mm → 28 mm).**



**Fig. 3 – (A) An excluder extension (14.5 mm x 14 cm) was deployed into the right leg of the main body. An excluder extension (10 mm x 7 cm) was then deployed into the right external iliac artery with glue embolization of the right internal iliac artery. (B) Completion angiography shows a successful AAA exclusion without endoleaks.**

reaching the AAA diameter immediately after the EVAR. The lack of data regarding the timing of rapid expansion or rupture means that close follow-up is mandatory, and early reintervention may solve this issue. Although EVAR is the standard procedure for treating anatomically suitable infrarenal AAA, physicians should be aware of this potentially lethal clinical scenario.

## Conclusion

Bell-bottom iliac limbs can cause IND associated with type 1b endoleak. Additionally, the risk of rupture is high when re-expansion of an aneurysm occurs after sac regression after EVAR. Therefore, close follow-up is mandatory for patients with IND after EVAR.

## Author contributions

MF: Data collection; MF, YO: Manuscript preparation; Critical review and revision: all authors; Final approval of article: all authors; Accountability for all aspects of the work: all authors.

## Patient consent

Written informed consent was obtained from the patient for the publication of this case report and any accompanying images.

## Ethics approval

All procedures were performed in accordance with the ethical standards of the institution and the 1964 Helsinki Declaration.

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