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Case Report

Successful Aortic Banding for Type IA Endoleak Due to Neck Dilatation after Endovascular Abdominal Aortic Aneurysm Repair: Case Report

Yasushi Tashima, MD,[1,2] Koichi Tamai, MD,[1] Takehiro Shirasugi, MD,[1] Kenichiro Sato, MD,[1] Takahiro Yamamoto, MD,[2] Yusuke Imamura, MD,[2] Atsushi Yamaguchi, MD, PhD,[2] Hideo Adachi, MD, PhD,[2] and Toshiyuki Kobinata, MD[1]

A 69-year-old man with a type IA endoleak that developed approximately 21 months after endovascular abdominal aortic aneurysm repair (EVAR) of a 46 mm diameter aneurysm was referred to our department. He had impaired renal function, Parkinson's disease, and previous cerebral infarction. Computed tomography angiography showed a type IA endoleak with neck dilatation and that the aneurysm had grown to 60 mm in diameter. We decided to perform aortic banding. The type IA endoleak disappeared after banding and the patient was discharged on postoperative day 10. Aortic banding may be effective for type IA endoleak after EVAR and less invasive for high-risk patients in particular.

Keywords: aortic banding, type IA endoleak, EVAR

Introduction

Unsuitable anatomy of the infrarenal aortic neck is the most common reason for ineligibility of patients for endovascular abdominal aortic aneurysm (AAA) repair (EVAR) and subsequent surgical repair.[1)] Additionally, it frequently results in proximal attachment failure after EVAR and resultant type IA endoleak.[1)] If type IA endoleak is left untreated, it is associated with a high-risk of AAA expansion and rupture.[2)] Various endovascular methods for reinforcing the neck from the inside have been reported.[3)] Aortic banding is a feasible method for reinforcing the outside of the aorta with an external aortic band for type IA endoleak after EVAR.

[1] *Department of Cardiovascular Surgery, Kasukabe Chuo General Hospital, Kasukabe, Japan*
[2] *Department of Cardiovascular Surgery, Saitama Medical Center, Jichi Medical University, Saitama, Japan*

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Corresponding author: Yasushi Tashima, MD. Department of Cardiovascular Surgery, Kasukabe Chuo General Hospital, 5-9-4, Midori-machi, Kasukabe, Saitama 344-0063, Japan
Tel: +81-48-736-1221, Fax: +81-48-645-0621
E-mail: popscene42@hotmail.com

We report an aortic banding procedure that was successfully performed in a patient with increased neck diameter after EVAR, and subsequent appearance of a type IA endoleak and rapid expansion of the aneurysm.

Case Report

In January 2013, a 69-year-old man underwent EVAR of a 46 mm diameter AAA that had grown by 5 mm in 6 months. We used an Endurant stent graft (right main body: ENBF2516c145EJ, right ipsilateral leg: ENLW1620c93EJ, left contralateral leg: ENLW1616C124EJ; Medtronic Cardiovascular, Santa Rosa, CA, USA). Although intraoperative angiography did not show any endoleaks within the aneurysm sac, contrast-enhanced computed tomography (CT) after EVAR showed a type II endoleak from the inferior mesenteric artery (IMA), and attachment of the proximal landing was suspected to be insufficient because of an angulated neck. Follow-up CT in October 2014 showed a type IA endoleak with neck dilatation and that the aneurysm had grown to 60 mm in diameter. The case was referred to our department.

The patient had undergone coronary stenting at 65 years of age for a 90% stenosis of the left anterior descending artery #6. Furthermore, he had impaired renal function, a history of Parkinson's disease, and previous cerebral infarction, and consequently used a wheelchair in his activities of daily living (ADL). In addition, he was receiving anticoagulant therapy for chronic atrial fibrillation.

CT showed that the AAA had grown to 60 mm in diameter, and revealed a type IA endoleak with aortic neck dilatation extending into the IMA on the right side of the abdominal aortic neck (**Fig. 1**). Additionally, preoperative blood tests confirmed impaired renal function with a blood urea nitrogen level of 33.1 mg/dL, creatinine (Cre) level of 1.70 mg/dL, and estimated glomerular filtration rate (eGFR) of 32.2 mL/min/1.73 m^2. We believed that if we performed abdominal aortic grafting, the bare stent

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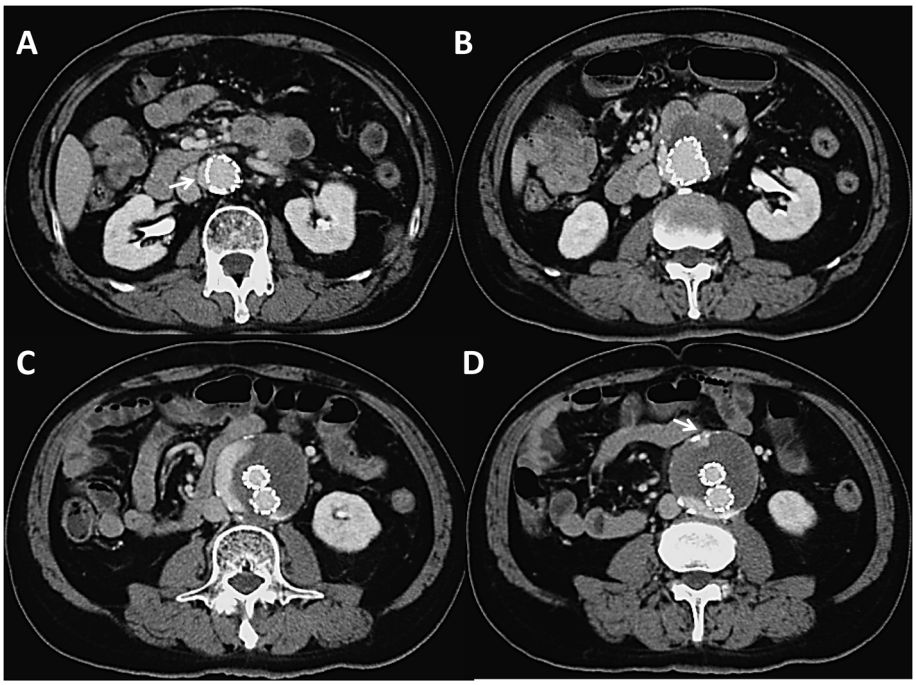

Fig. 1 Computed tomography shows a type IA endoleak with neck dilatation after endovascular abdominal aortic aneurysm repair (**A**→). The type IA endoleak extends into the inferior mesenteric artery (IMA) on the right side of the abdominal aortic neck (**B**, **C**, **D**→).

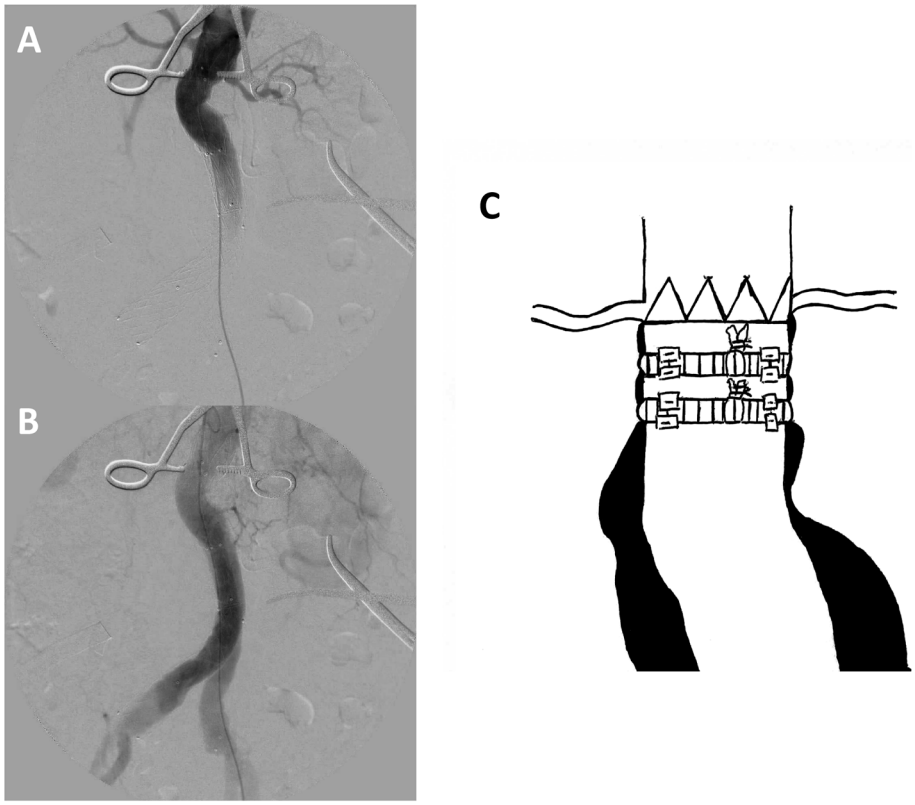

Fig. 2 Intraoperative angiography shows that the endoleak has disappeared after aortic banding (**A**, **B**). A schema showing aortic banding. The aortic neck is double-taped, and the root of each Teflon tape is double-ligated using 2-0 silk thread. The tape is secured to the aortic wall with 2-0 Wayolax (**C**).

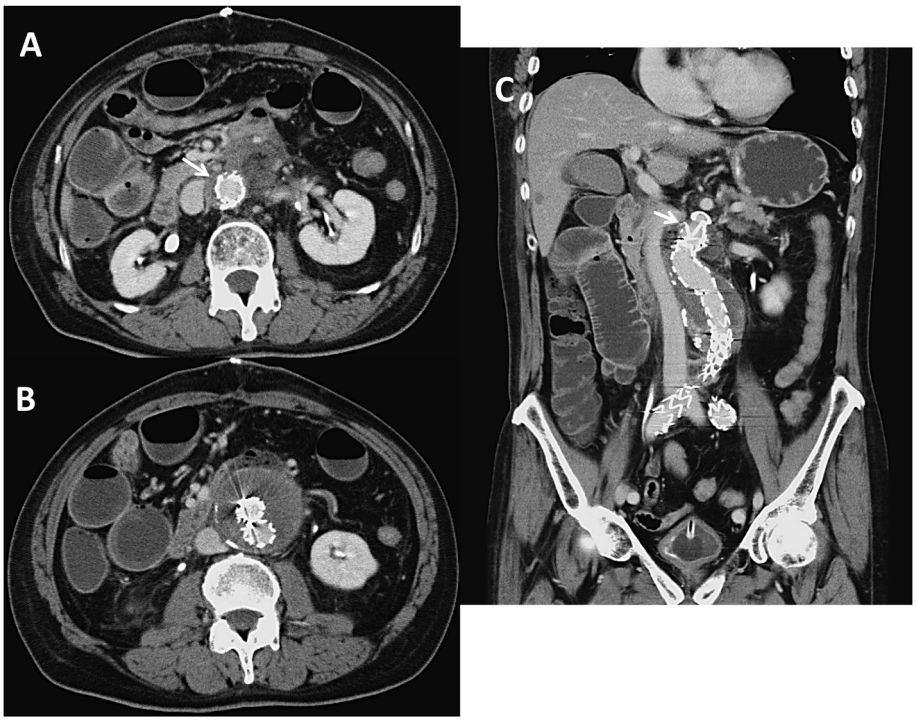

Fig. 3 Postoperative contrast-enhanced computed tomography shows the aortic banding region in an axial slice (**A**→) and coronal reconstruction (**C**→). The type IA endoleak has disappeared (**B**).

section of the Endurant stent graft would have protruded above both renal arteries. This would have necessitated abdominal aortic cross-clamping above both renal arteries, which we considered to have a high-risk for further deterioration of postoperative renal function. Moreover, the preoperative ADL score was low and aortic grafting was a high-risk procedure. Therefore, we decided to perform aortic banding.

We opened the abdomen by making a surgical incision in the central line. We identified and ligated the IMA. We double-taped the aortic neck with two rolls of Teflon tape and snared each tape with a tourniquet. A contrast media-using catheter was inserted through the right femoral artery and placed near the renal artery, and angiography did not show any endoleaks. We double-ligated the root of each Teflon tape with 2-0 silk thread. Using 2-0 Wayolax, we sutured and secured the tape to the aortic wall (**Fig. 2**). Further angiography confirmed the absence of endoleaks. The operation took 2 h and 5 min to complete.

The patient's progress was good following the banding. Postoperative blood tests showed no further deterioration in renal function and contrast-enhanced CT did not reveal any endoleaks (**Fig. 3**). Subsequently, because the patient was in good physical condition overall, he was discharged relatively quickly on postoperative day 10.

Discussion

EVAR is a rapidly growing treatment method for AAA because of its safety and minimal invasiveness.[4] Many patients have unsuitable anatomy of the infrarenal aortic neck.[2] Endoleak is a particular complication of EVAR, and includes type IA endoleak of anterograde blood flow remaining within the aneurysm sac from the aortic neck. If this endoleak is not treated immediately, the aneurysm sac may expand and rupture.[2]

In our case, a previous physician performed EVAR using an Endurant stent graft in the 25 mm diameter neck of the main body. Although intraoperative angiography did not show any endoleaks within the aneurysm sac, contrast-enhanced CT after EVAR showed a type II endoleak from the IMA. Attachment of the proximal landing was suspected to be insufficient because of an angulated neck. Contrast-enhanced CT approximately 21 months later showed that the AAA diameter was 60 mm with neck dilatation and the appearance of a type IA endoleak. We consider that the unfavorable neck anatomy and type II endoleak after EVAR caused the aneurysm and neck dilatation. Consequently, type IA endoleak might have occurred because of neck dilatation.

Previous reports have indicated a gradual growth in neck diameter over time following EVAR, and this may cause migration of the graft and endoleaks.[5] Therefore,

follow-up studies are required for monitoring neck diameters, in addition to measuring the maximum neck diameter of AAA.

Some reports have described management of type IA endoleak, and various endovascular methods for reinforcing the neck from the inside have produced some unsatisfactory results.[3,6] If re-intervention fails, surgical repair and removal of the endograft might be required. This may increase morbidity and mortality, particularly in frail patients. Reports on various endovascular treatments for type IA endoleak caused by expansion of the neck after EVAR have indicated that extravascular aortic banding is an effective option.[3,7] The above findings were considered in the case of our patient, who had poor preoperative renal function and used a wheelchair in his ADL. Moreover, he was receiving anticoagulant therapy for chronic atrial fibrillation. Therefore, we considered abdominal aortic grafting a high-risk procedure. If we had performed abdominal aortic grafting, the bare stent section of the Endurant stent graft would have protruded above both renal arteries, which, at a minimum, would have necessitated abdominal aortic cross-clamping above both renal arteries. We considered this procedure to have a high-risk for further deterioration of postoperative renal function. Therefore, we decided to perform aortic banding.

Aortic banding is divided into primary and secondary banding.[8] Similar to other methods such as fenestrated, debranching, and chimney EVAR, primary banding is used in patients with difficult neck characteristics (e.g., short neck, severe angulation, and inverted infundibular, hourglass, or bulge-shaped formations) for EVAR.[9] The first step is to ensure that aortic banding is performed according to a neck shape that is suitable for EVAR.

Secondary banding is an additional treatment for type IA endoleak after EVAR, as seen in our patient. Utíkal et al. reported that there were no endoleaks or other stent graft-related complications in two secondary banding cases during an average 3-year postoperative period.[8] Furthermore, Krajcer et al. reported good long-term results in five secondary banding cases during a postoperative period of 38 ± 20 months.[7]

Aortic banding does not require aortic cross-clamping and blockage of aortic branch blood flow. It allows the procedure to be performed while maintaining blood flow to the organs, including through the renal artery. Another advantage of aortic banding is negligible bleeding, although care is still needed when handling the lumbar arteries in the banding region. Furthermore, this procedure can be completed in a relatively short time. There are reports of aortic banding being used in mini-laparotomies and laparoscopic surgery, and in the retroperitoneal approach.[10] Therefore, aortic banding is considered a valid option when seeking an even less invasive approach to treatment, particularly in high-risk cases.[7,8]

Some of the disadvantages associated with aortic banding include its effect on the renal arteries and the risk of graft migration.[10] In cases of thrombus in the neck, banding has been shown to possibly result in migration of the thrombus to the renal arteries, while bands below the renal arteries may slip and cause stenosis.[7] Additionally, if the banding is too tight, it may lead to aortic stenosis, and the banding section may affect the bare stents. We used incremental banding in our patient, whereby we gradually tightened the banding using a tourniquet, while taking care not to make it too tight. There have been reports on performing banding while focusing an ecoprobe on the AAA to check for endoleaks.[11] However, our patient had an endoleak on the right side, thus making it difficult to focus an ecoprobe on that region. Therefore, we confirmed the endoleak through aortic angiography.

Conclusion

We successfully performed aortic banding in a patient in whom the neck diameter increased after EVAR, followed by the appearance of a type IA endoleak and rapid expansion of the aneurysm. Secondary aortic banding does not require aortic cross-clamping and is a less invasive approach than aortic grafting. Therefore, this method appears to be a valid treatment option, particularly in high-risk patients. However, the literature on aortic banding remains limited; consequently, there are no established long-term results. Therefore, more follow-up studies on aortic banding are required.

Disclosure Statement

None of the authors declare any conflicts of interest.

Author Contributions

Study conception: YT
Data collection: YT
Analysis: YT
Investigation: YT
Writing: YT
Critical review and revision: all authors
Final approval of the article: all authors
Accountability for all aspects of the work: YT

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