


➤ **Case Report** ◀

Collapse and Occlusion of Balloon-Expandable Covered Stent in the Right Common Iliac Arteries Due to External Stress

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The patient previously underwent surgery for cervical cancer. She reported intermittent claudication, and computed tomography (CT) revealed total occlusion of the left iliac artery. We conducted endovascular treatment (EVT) using balloon-expandable covered stents (BECS). The patient underwent colostomy closure after EVT. The patient reported intermittent claudication beginning the day after the procedure. The CT showed a collapse of the distal side of the stent implanted in the right common iliac artery, accompanied by localized thrombo-occlusion. During open surgery, metal hooks typically affect the iliac artery; force transmission through the tissue may indirectly compress the iliac artery, leading to BECS failure.

Keywords: BECS fracture, EVT, ileal surgery

Introduction

Recently, endovascular treatment (EVT) has gained prominence as a preferred, lower-risk alternative to open surgery in managing aortoiliac occlusive disease that is attributed to device advances.¹ Specifically, balloon-expandable covered stents (BECS) exhibit promising results in addressing intricate lesions.² Furthermore, favorable outcomes are reported when using the Gore Viabahn Balloon-Expandable Endoprosthesis (VBX Stent-Grafts; W. L. Gore & Associates, Newark, DE, USA) in a kissing stent technique at the aortoiliac bifurcation.³ The iliac artery, experiencing diminished external stress coupled with the

typically concise nature of stenotic lesions within, contributes to the rarity of stent fractures involving BECS in this region. A case detailing a BECS fracture in the iliac arteries is presented herein after ileal surgery.

Case Report

The patient was a 54-year-old woman with no history of lifestyle-related diseases such as hypertension, hyperlipidemia, or diabetes and no history of smoking. She had cervical cancer and had previously undergone surgery and radiotherapy. One year ago, she underwent a partial small intestine resection and colostomy due to radiation enteritis-induced small intestine perforation. She reported intermittent claudication in her left leg after 10 minutes of walking approximately 1 month ago. Contrast-enhanced computed tomography (CT) revealed chronic total occlusion of the left iliac artery from the common iliac artery to the beginning of the external artery, with blood perfusion from the circumflex artery to the vessels below the external iliac artery (Fig. 1A). Subsequently, we conducted EVT to address this chronic total occlusion lesion.

The aortic diameter was narrow, and there was mural calcification in the right common iliac artery (Figs. 1B and 1C). Due to stenting only the left common iliac artery would risk impairing blood flow to the right side; stents were placed in both bilateral common iliac arteries using the kissing technique. We opted for BECS due to substantial arterial calcification and inserted a Viabahn VBX (W. L. Gore & Associates) 8 mm × 39 mm stent in the right common iliac, a Viabahn VBX 8 mm × 59 mm stent in the left common iliac, and added a Viabahn VBX 7 mm × 79 mm stent and an Epic (Boston Scientific, Marlborough, MA, USA) 8 mm × 80 mm stent to the left external iliac. The procedure was conducted without residual stenosis (≥30%) or complications, and the patient was discharged.


The patient underwent colostomy closure and ileal resection 2 months after EVT. Despite an uncomplicated surgery, the patient reported intermittent claudication in

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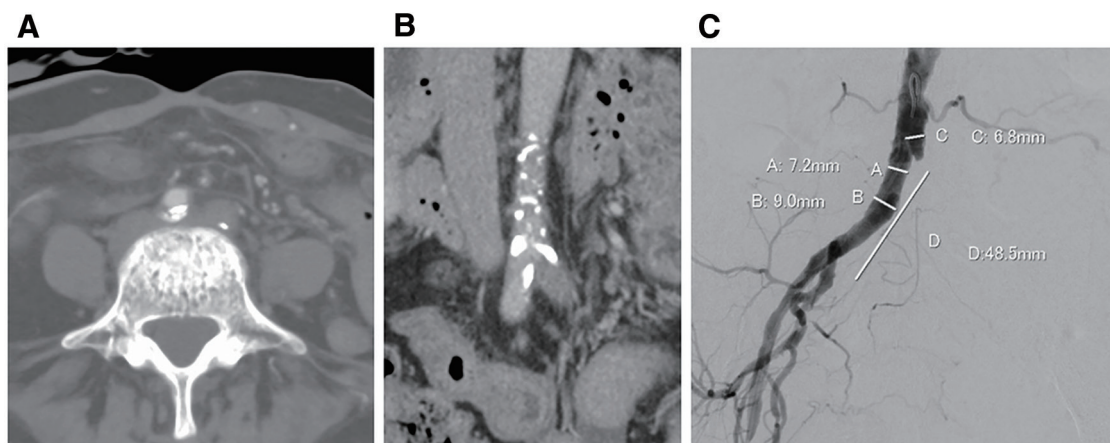


Fig. 1 (A) CT revealed chronic total occlusion of the left iliac artery from the common iliac artery to the beginning of the external artery. (B) CT shows the aortic diameter was narrow, and mural calcification was present in the right common iliac artery. (C) The angiography shows the aortic diameter was narrow. CT: contrast-enhanced computed tomography

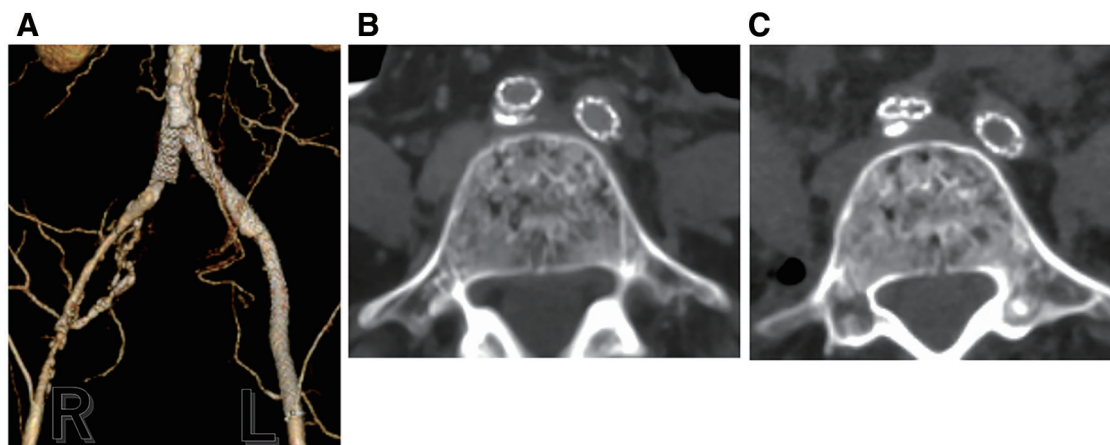


Fig. 2 (A) Three-dimensional representation of the outpatient follow-up computed tomography displays a Viabahn VBX 8 mm × 39 mm stent in the right common iliac, a Viabahn VBX 8 mm × 59 mm stent in the left common iliac, and a Viabahn VBX 7 mm × 79 mm stent and Epic 8 mm × 80 mm stent in the left external iliac. The distal segment of the Viabahn VBX stent within the right common iliac artery collapsed, which was accompanied by thrombotic occlusion of the lumen. (B) The pre-ileal surgery CT demonstrated unobstructed dilation of the stent in the right common iliac artery. (C) The post-ileal surgery CT, conducted 1 day later, revealed the collapse of the distal portion of the stent. VBX: Viabahn Balloon-Expandable Endoprosthesis; CT: contrast-enhanced computed tomography

her right leg beginning the day after the procedure. Deeming the pain not severe, she attributed it to an effect of surgery and discharged herself from our hospital. Two months later, the patient attended a cardiovascular outpatient clinic for post-EVT follow-up, at which time she reported continued intermittent claudication in the right leg. Ankle-brachial pressure index (ABI) measurements revealed a decrease from 0.9 post-procedurally to 0.61, prompting a contrast-enhanced CT. The CT demonstrated collapse of the distal side of the stent implanted in the right common iliac artery, accompanied by localized thrombo-occlusion (Fig. 2A). A review of previous images revealed that the pre-ileal surgery CT showed dilation without issues in the

right common iliac artery stent (Fig. 2B), whereas the post-ileal surgery CT demonstrated collapse of the distal side of the stent (Fig. 2C). Given these CT findings and the acute symptoms in the right lower extremity post-ileal surgery, we postulated that the stent in the right common iliac artery underwent compression during the ileal surgery.

To address the obstruction, EVT was performed again. The angiogram captures show localized thrombosis in the balloon-expandable covered stent within the iliac artery (Figs. 3A and 3B). Considering the completion of the ileal surgery and the unlikely recurrence of stent compression in the future, BECS was chosen for its high dilatation force. To prevent collapse in the left common iliac artery

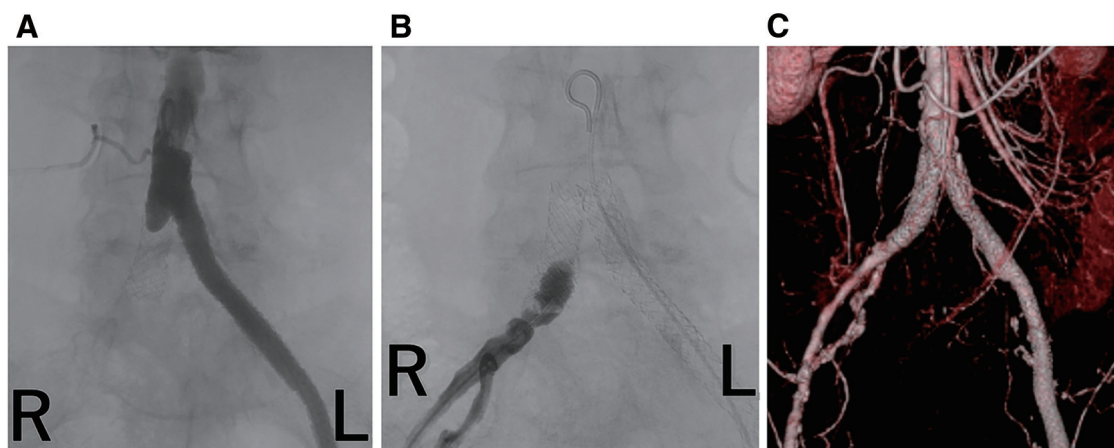


Fig. 3 (A) Progressive contrast of the right common iliac artery. (B) Retrograde contrast of the right common iliac artery. These angiograms capture the state during the second endovascular therapy, illustrating localized thrombosis in the balloon-expandable covered stent within the iliac artery. (C) Postoperative CT showed good blood flow in the right lower extremity. CT: contrast-enhanced computed tomography

during EVT and to safeguard against thrombus migration into the arteries, a Viabahn VBX 8 mm × 59 mm stent was implanted on the right side, and a Viabahn VBX 8 mm × 39 mm stent on the left side, deployed 1 cm central to the previous confluence using the kissing technique. The procedure concluded without residual stenosis or complications, the symptoms in the right lower extremity disappeared, and the postoperative ABI recovered to 0.91. Postoperative CT showed good blood flow in the right lower extremity (Fig. 3C). The patient was discharged and currently attends our outpatient clinic without any issues.

Discussion

Stenting the common and external iliac arteries can yield a sufficient acute increase in lumen size, leading to favorable long-term outcomes. However, a significant concern associated with stenting is the occurrence of stent fractures, often resulting from excessive lower limb movement or external compression and potentially leading to re-occlusion or re-stenosis. Notably, the reported fracture rate for stents in femoropopliteal artery lesions ranges from 13.8% to 37.2%, whereas that for iliac lesions is notably lower, at 5.1%.⁴ Iliac artery stents, being shorter and exposed to reduced external stress, have favorable outcomes. Similarly, positive results have been reported with BECS, as shown by Fujihara et al.,⁵ who reported a primary patency rate of 93.4% at 12 months and 95.3% freedom from target lesion revascularization in patients with complex aortoiliac artery disease.

Balloon-expandable stents (BES) are characterized by increased rigidity and higher radial force compared with self-expandable stents (SES).⁶ However, BES has the disadvantage of decreased flexibility and resistance to

external compression compared with SES.^{7,8} Instances of stent fracture with BES in the iliac artery are relatively uncommon. Ichihashi et al.⁹ reported a case involving BES fracture and collapse in the bilateral common iliac arteries due to shiatsu massage, a traditional Japanese technique. Sawhney et al.⁸ documented a case of kissing BES fracture resulting from extensive daily stretching and calisthenics, illustrating how vigorous exercise regimens can induce stent fractures. Given the structural similarities between BECS and BES, reports of BECS fracture in the iliac artery are also infrequent, with Kusumoto et al.¹⁰ reporting a case in a lean, elderly patient with a bent back.

In our case, BECS collapse occurred during ileal surgery, implying that surgical manipulation pushed the stent. During open surgery, metal hooks are typically used to retract surrounding tissue for visual field maintenance. Although these hooks seldom directly impact the iliac artery, force transmission through the tissue may indirectly compress the iliac artery, leading to BECS failure. Considering the potential complications, it may be prudent to perform EVT after ileal surgery in patients undergoing both procedures. In situations necessitating EVT first, the consideration of using SES rather than BECS may be warranted. Furthermore, given the occurrence of stent fracture possibly due to surgical manipulation, it might be critical to avoid applying retraction hooks or other devices that exert pressure on the iliac arteries during open surgery.

Conclusion

Ileal surgery poses a risk of BECS fracture in the iliac artery, emphasizing the need for surgeons to plan the surgical sequence and select appropriate devices thoughtfully.

Declarations

Ethics approval

Ethical approval by a research ethics committee was not required.

Informed consent

The patient consented to the publication of the case report.

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Author contributions

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