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Case Report

Iatrogenic Iliac Vein Compression Syndrome Caused Because of Inappropriate Length and Positioning of Vascular Graft

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Iliac vein compression syndrome (IVCS) can occasionally be iatrogenic; however, iatrogenic IVCS cases occurring because of inappropriate length and positioning of vascular grafts have not been reported. We present the case of an 80-year-old woman with iatrogenic IVCS resulting from kinked and overlapping limbs of a bifurcated abdominal vascular prosthesis for an abdominal aortic aneurysm. She complained of discomfort in her left leg immediately after aortic replacement. Venous stenting was effective for IVCS occurring because of compression of the vascular prosthesis. Iatrogenic IVCS occurred because of inappropriate length and positioning of the vascular graft and was considered a postoperative complication.

Keywords: iatrogenic iliac vein compression syndrome, vascular graft, venous stenting

Introduction

Iliac vein compression syndrome (IVCS) is caused by compression of the left common iliac vein (LCIV) between the right common iliac artery and spine.[1)] Venous compression owing to iatrogenic factors has been described.[2–6)] However, iatrogenic IVCS caused by kinked legs of a bifurcated abdominal vascular prosthesis after aortic replacement for abdominal aortic aneurysm (AAA) has never been described. We report a case of iatrogenic IVCS occurring because of inappropriate length of the vascular graft after aortic replacement for AAA. Venous stenting was effective for relieving vascular graft compression. The patient consented to publication of this report.

Case Report

In 2012, an 80-year-old woman underwent elective aortic replacement at another hospital with a 16×8 mm bifurcated abdominal vascular prosthesis for an infrarenal AAA measuring 53×50 mm. Computed tomography (CT) before Y-grafting showed that LCIV was not compressed by the aneurysm and other vascular (**Fig. 1A**). Although she was discharged 14 days after aortic replacement, she complained of discomfort and edema of her left leg, the cause of which was unknown; she was treated symptomatically with a leg compression stocking. CT after Y-grafting showed LCIV was compressed by vascular graft, but the IVCS caused by vascular prosthesis was not pointed out (**Figs. 1A** and **1B**). She continued to experience the symptoms and had CT or ultrasonography (US) every year at the same hospital until 2015. She stopped visiting the hospital, but her leg symptoms worsened, and she visited our hospital owing to claudication since 2017.

CT revealed a compressed LCIV by the bilateral kinked and overlapping branches of the bifurcated abdominal vascular prosthesis; the dilated native aneurysm wall filled with liquid covered the vascular prosthesis (**Fig. 1C**). On US, the peripheral vein was observed; however, the left iliac vein was not visible where the graft overlapped. US did not reveal varicose veins or iliofemoral deep vein thrombosis (DVT) but only left great saphenous venous insufficiency. Venography revealed venous obstruction with flow reversal in the left internal iliac vein, multiple left-to-right pelvic collaterals, and an enlarged ascending lumbar vein (**Fig. 2A**). The pressure gradient between the inferior vena cava (IVC) and left femoral vein was

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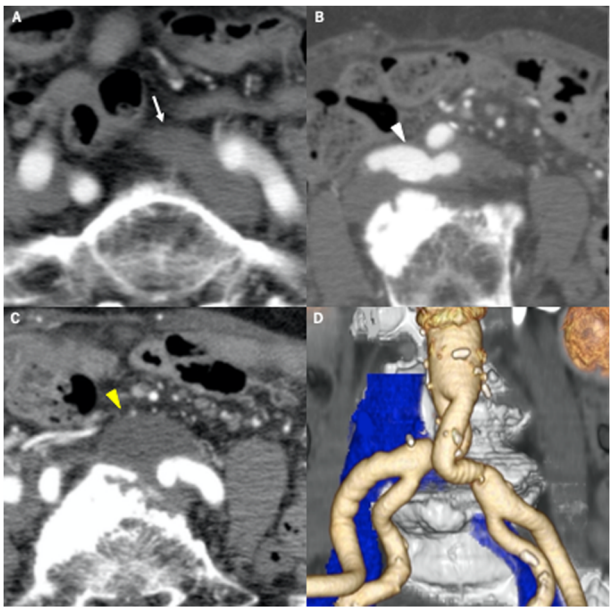

Fig. 1 Images of preprocedural examinations. Short-axis image before Y-grafting (**A**), short-axis images before venous stenting (**B**, **C**), and three-dimensional constructed image before venous stenting (**D**) of multidetector computed tomography. Left iliac common vein (LCIV) (white arrow) was not compressed before Y-grafting (**A**). Right branch of the bifurcated abdominal vascular prosthesis compressing the LCIV (white arrowhead) (**B**). Dilated native aneurysm wall filled with liquid covering the vascular prosthesis and also compressing the LCIV (yellow arrowhead) (**C**). Kinked and overlapping branches of the vascular graft. LCIV obstructed between the right branch of the vascular prosthesis and the spine (**D**).

3 mmHg in the supine position. The patient's symptoms were considered to be caused by IVCS occurring because of the kinked branches of the vascular prosthesis; she was scheduled for a percutaneous intervention.

A hydrophilic wire was crossed from the left femoral vein to the IVC, and intravascular ultrasound (IVUS) was performed, which showed wall thickening and intraluminal irregularities of the LCIV and extrinsic compression by the adjacent right arm of the vascular prosthesis (**Fig. 2A**). An 18 mm percutaneous transluminal angioplasty (PTA) balloon was gradually inflated from low pressure at the LCIV; fluoroscopy revealed partial balloon indentation at the LCIV, and venography revealed multiple left-to-right pelvic collaterals. A 10×80 mm S.M.A.R.T. Control stent (Cordis Corporation, a Cardinal Health company, Milpitas, CA, USA) was used because immediate recompression was observed after deflating the balloon. After dilatation, an 8.0×14 mm PTA balloon was used. Postoperative venography demonstrated resolution of the compression and absence of flow through the cross-pelvic collaterals (**Fig. 2B**). No postoperative pressure gradient was found between the IVC and left femoral vein. IVUS

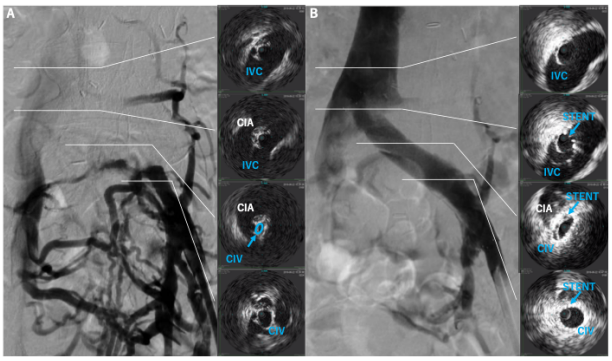

Fig. 2 Images of venography and intravascular ultrasound (IVUS) before and after stenting of the left common iliac vein (LCIV) (**A**, **B**). The preoperative venography via left femoral vein demonstrated left-to-right pelvic collaterals and an enlarged ascending lumber vein (**A**). IVUS showed wall thickening and intraluminal irregularity of the LCIV and extrinsic compression by the adjacent right branch of the vascular prosthesis prior to stenting (**A**). Postoperative venography showing the patent left iliac vein and diminished left-to-right collaterals (**B**). Even with the indentation in the middle of the stent, the lumen was wider than before stenting (**B**).
IVC: inferior vena cava; CIA: common iliac artery; CIV: common iliac vein

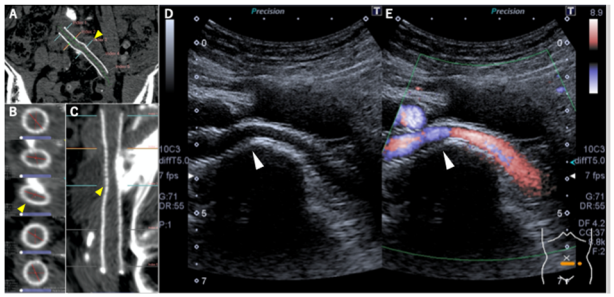

Fig. 3 Follow-up images 2 years after venous stenting by multidetector computed tomography (CT) (**A**–**C**) and ultrasonography (US) (**D**, **E**). CT showing a notch in the proximal third of the stent, matching the location of the graft limb impact (arrowhead). US image confirming blood flow without obstruction in the stent.

showed partial indentation where the graft limb had been compressing the vein, but the vessel diameter had expanded compared with that before venous stenting (**Fig. 2B**). On the next day, the leg edema improved, and other symptoms of discomfort disappeared. She was discharged with a prescription of edoxaban (30 mg daily). CT in 2019 showed that the venous stent was partially compressed (**Figs. 3A**–**3C**), but US confirmed blood flow through the stent and absence of thrombosis (**Figs. 3D** and **3E**); she remained asymptomatic.

Discussion

We learned that IVCS can be caused by both kinked and overlapped branches of a bifurcated abdominal vascular prosthesis after aortic replacement for AAA and that venous stenting can relieve venous compression caused owing to the vascular graft.

We believe that, in our patient, IVCS was caused because of inappropriate length of the vascular prosthesis used for aortic replacement. IVCS results from LCIV compression between the right common iliac artery and overlaying spine.[1] Sometimes, venous compression cases can be iatrogenic, with patients having undergone procedures for spinal fusion, endovascular aneurysm repair, arterial stents, horseshoe kidney, and vertebral pedicle screw insertion.[2–6] However, iatrogenic IVCS occurring because of a bifurcated abdominal vascular prosthesis for aortic replacement has never been reported. In our patient, the length of the vascular prosthesis was too long to fall into an appropriate position in an ideal shape, and both branches of the bifurcated abdominal vascular prosthesis were kinked and overlapped. CT after Y-grafting showed LCIV was not compressed by an aneurysm or other vascular, and she said that her symptoms appeared after Y-grafting (**Fig. 1A**). Therefore, IVCS caused by vascular graft and the compression force converged strongly on the LCIV. The length of the vascular prosthesis should be appropriate to prevent iatrogenic IVCS occurring because of the vascular graft. The dilated native aneurysm wall filled with liquid that covered the vascular prosthesis may have contributed to venous compression. Postoperative CT image indicated a "notch" in the middle of the stent, matching the location where the graft limb caused compression (**Figs. 3A**–**3C**). The graft kink corresponded with the anatomical compression site. Thus, the shape of the graft kink compression was limited to a notch, and any compression from the dilated aneurysm wall was wide. We were not sure why the liquid pooled inside of the aneurysm sac, but the aneurysm sac did not dilate and compress other vascular and the stent. US showed that the liquid was not exudates but transudates because US images inside of the aneurysm sac were cystic and clear, and proteins and various types of cell were not observed. We may understand what the liquid pooled if we punctured and aspirated the liquid, but percutaneous puncture and aspiration were high risk. In conclusion, the kinked and overlapped vascular graft was compressing the LCIV with more strength than the dilated native aneurysm wall. The vascular prosthesis itself may cause iliac vein compression. Most symptomatic venous compression cases result from chronic insults, with pressure on the vein leading to intimal hyperplasia over months and years and eventual acute or chronic thrombosis and edema.[7] Conversely, acute cases of edema and venous symptoms are usually owing to thrombosis and not mechanical compression.[8] Therefore, acute IVCS after abdominal aortic replacement using vascular graft can be missed if DVT is eliminated. Our patient complained of leg discomfort immediately after abdominal aortic replacement; we believe that acute IVCS should be considered a possible complication of aortic replacement with vascular grafts.

The venous stenting procedure was effective to relieve venous compression owing to the vascular graft. Usually, patients with anatomical IVCS do not respond well to conservative treatments,[9] and stent placement is often necessary. Although the long-term patency of venous stenting for IVCS occurring because of vascular grafts is unknown, stenting was necessary to resist the force of the kinked and overlapped vascular graft because balloon angioplasty was insufficient to reduce the compression. Here, the venous stent remained patent after 2 years, but a continuous follow-up is warranted. Our patient had received anticoagulation (edoxaban 30 mg/day) for 1 year after venous stenting. Previous study showed that anticoagulation was the preferred treatment during the first 6–12 months following venous stenting for a compressive iliac vein lesion.[10]

Conclusively, IVCS in our patient was caused by a kinked and overlapping vascular prosthesis, and venous stenting was effective in removing the deleterious vascular graft compression. Physicians should consider the possibility of IVCS in patients complaining of leg discomfort after vascular prosthesis placement is performed for AAA; they should consider using a stent to relieve the vascular graft compression.

Conclusion

Typical IVCS is caused because of an anatomic variant of the right common iliac artery compressing the LCIV against the vertebra, but we encountered the first case of iatrogenic IVCS caused because of inappropriate length of a vascular prosthesis after aortic replacement for AAA. IVCS can be a postoperative complication after abdominal aortic replacement. Venous stenting was effective for treating iatrogenic IVCS that occurred owing to vascular prosthesis compression.

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Informed Consent

Written informed consent was obtained from the patients for the publication of this manuscript and any accompanying images.

Disclosure Statements

The authors have no conflicts of interest to declare.

Author Contributions

Conception and design: YE, AT, MS
Analysis and interpretation: YE, MS
Data collection: YE, MS
Writing the manuscript: YE
Critical revision: all authors
Approval of the manuscript: all authors
Agreement to be accountable: all authors

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