From the Southern Association for Vascular Surgery

Hypogastric artery thrombectomy for spinal cord ischemia following fenestrated endovascular aortic repair

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ABSTRACT

Spinal cord ischemia can be a devastating complication after thoracoabdominal aortic surgery. We report a case of a 56-year-old woman who had undergone multiple prior thoracic aneurysm repairs with an increase of a visceral segment aneurysm to 6 cm. The aneurysm was repaired using a physician-modified four-vessel fenestrated graft and iliac branch device. Postoperatively, she developed weakness in her right leg. Computed tomography angiography showed an occluded right hypogastric artery. We proceeded with aspiration thrombectomy with complete resolution of her right leg weakness within hours postoperatively. Our findings have illustrated the important role of hypogastric arteries in the development of spinal cord ischemia. (J Vasc Surg Cases Innov Tech 2022;8:413-6.)

Keywords: Aortic aneurysm; Fenestrated endovascular aortic repair; Hypogastric artery occlusion; Spinal cord ischemia; Thrombectomy

Spinal cord ischemia (SCI) can be a devastating complication after thoracoabdominal aortic surgery, especially for patients who develop permanent paraplegia or paraparesis. Several intraoperative factors can increase the risk of SCI, including a prolonged operative time, difficult anatomy, longer aortic stent graft coverage, and intraoperative hypotension.[1-4] Specifically, for patients with longer aortic stent graft coverage, occlusion of the intercostal arteries and collateral network around the spinal cord will result in a higher risk of SCI.[4-6]

The development of SCI is not fully understood. Hypogastric artery occlusion, although more commonly associated with buttock claudication or erectile dysfunction, has also been associated with symptoms of SCI in cases of bilateral occlusion during aortoiliac aneurysm repair.[7,8] Preserving the collateral circulation from the femoral and external iliac vessels in cases of hypogastric embolization or occlusion will decrease the risk of the development of SCI.[9-11] Unilateral hypogastric occlusion will not typically result in SCI owing to adequate perfusion from the pelvic collateral vessels.

In the present report, we have described the case of a patient who had developed ipsilateral paralysis owing to hypogastric occlusion after endovascular repair of a thoracoabdominal aortic aneurysm. She was successfully treated with revascularization of the hypogastric artery. The patient provided written informed consent for the report of her case details and imaging studies.

CASE REPORT

A 56-year-old woman with prior aortic dissection and aneurysmal degeneration that had been previously treated with open ascending and descending thoracic repair and endovascular arch repair with thoracic endovascular aortic repair had presented for her annual follow-up examination and imaging studies. Computed tomography (CT) angiography demonstrated an increase of the visceral segment aneurysm to 6 cm. The prior dissection was unchanged, originating just superior to the left renal artery, with one lumen extending to the right common iliac artery and the other extending to the left common iliac artery. The bilateral hypogastric arteries were patent. She was asymptomatic at that time, and the physical examination findings were unremarkable. Her medical history included type 2 diabetes mellitus, hypertension, coronary artery disease, pulmonary embolus with inferior vena cava filter placement, combined systolic and diastolic congestive heart failure (ejection fraction, 48%), and obstructive sleep apnea (noncompliant with continuous positive airway pressure therapy). Her additional surgical history included coronary artery bypass grafting. Owing to the size of her aneurysm and her medical comorbidities being prohibitive for open surgical repair, she elected to proceed with repair using a physician-modified four-vessel fenestrated graft and iliac branch endoprosthesis (IBE).

On the back table, a 36- × 137-mm Zenith fenestrated endovascular stent graft (Cook Medical Inc, Bloomington, IN) was modified using preoperative CT measurements, as previously

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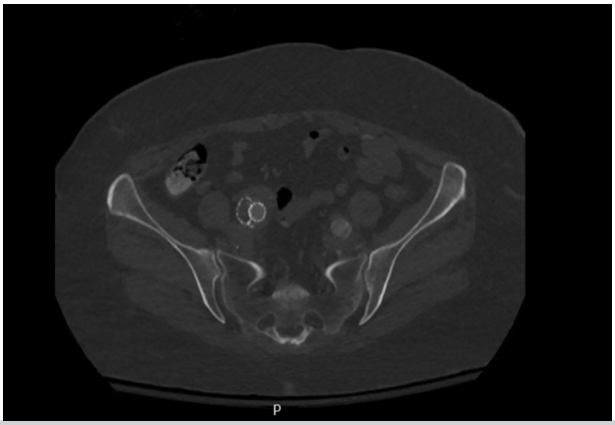

Fig 1. Computed tomography (CT) scan after fenestrated endovascular aortic repair showing an occluded right internal iliac stent.

described.[12,13] The patient was then placed under general anesthesia; a lumbar drain had been placed preoperatively. Using bilateral percutaneous femoral access, intravascular ultrasound guidance was used to ensure true lumen navigation and a Gore excluder iliac branch endoprosthesis (W. L. Gore & Associates, Flagstaff, AZ) was placed to the right hypogastric artery. The flow was somewhat sluggish in the diseased hypogastric artery. However, vessel patency was preserved and no endoleak seen. The repair continued with placement of the fenestrated device, with preservation of the celiac artery, superior mesenteric artery, and bilateral renal arteries. Finally, the fenestrated thoracic endovascular aortic repair and IBE were bridged with a bifurcated Excluder device (W. L. Gore & Associates) and appropriate limb extensions. A completion angiogram showed filling of all branches, patent bilateral hypogastric arteries, and no endoleak. She tolerated the procedure well and was taken to the intensive care unit in stable condition.

Postoperatively, she was extubated and remained hemodynamically stable, with movement in all extremities. However, over the next few hours, she had developed weakness of right hip flexion compared with the left. She had intact distal pulses in both lower extremities, and she did not have any associated sensory changes or pain. Our rescue protocol for SCI was immediately initiated, which includes maintaining the mean arterial pressure >100 mm Hg, oxygen saturation at 100%, hemoglobin >10 g/dL, and cerebrospinal fluid drainage of 15 mL/h. She had not experienced any associated hypotensive episodes, and our routine postoperative protocols had been followed appropriately (hemoglobin ≥10, oxygen saturation at 100%, mean arterial pressure of 80-100 mm Hg, and lumbar drain pressure at 10 mm H_2O, with a maximum drainage of 10 mL/h). Given the intraoperative concern of her right hypogastric flow, a CT angiogram was obtained, which showed an occluded right hypogastric artery with a patent left hypogastric artery (Fig 1). The prior aortic arch repair was stable with proximal aortic stent coverage extending into the patent innominate and left subclavian arteries. Postoperative changes of the fenestrated endovascular aortic repair were noted with proximal stent coverage to the T5 vertebra. We determined that endovascular intervention for her occluded right hypogastric artery would be the best option to relieve her symptoms. She was taken to the operating room within 12 hours after initial symptom onset.

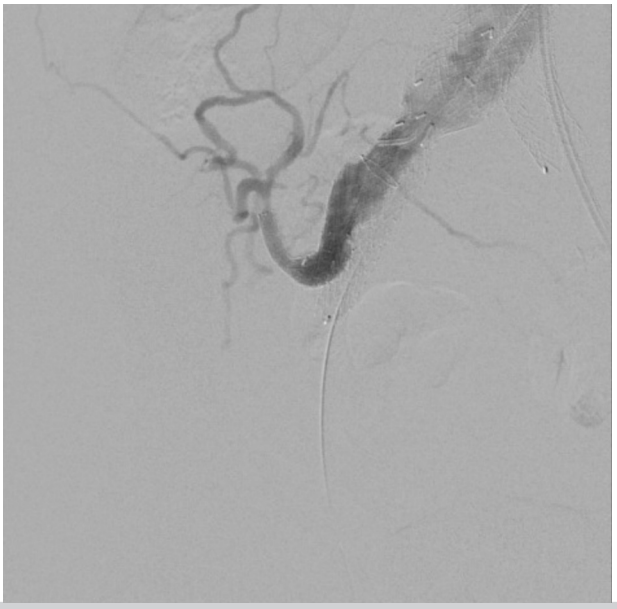

Fig 2. Completion angiogram showing the right hypogastric artery after thrombectomy.

Via percutaneous left femoral access, the right hypogastric artery was selectively cannulated, and an Indigo CAT8 aspiration catheter (Penumbra, Alhambra, CA) was passed across the lesion with a return of clot and improved flow. We extended the right hypogastric stent with a 10-mm self-expanding, bare metal stent for a presumed kink in the original stent. The entire stented segment was then treated with 10-mm balloon angioplasty with improved flow found on angiography (Fig 2). We still found some preferential flow down the external iliac artery; however, we decided against further aggressive attempts at salvage owing to the lack of a clear cause of the flow discrepancy. She tolerated this procedure well.

Postoperatively, she had experienced complete resolution of her right leg weakness within hours. On physical examination, she had a full range of motion and full strength on right hip flexion. At the 1-month follow-up examination, she had not experienced any further weakness in her right leg, and CT angiography demonstrated continued successful repair with a patent IBE (Fig 3).

DISCUSSION

A hypogastric collateral arterial supply to the spinal cord has been frequently discussed as vital to preventing SCI after long segment aortic replacement. However, few reports of direct implications exist. In one case report, Misselhorn et al[2] described a similar case in which thrombectomy of an occluded hypogastric artery had resulted in slow resolution of lower extremity weakness over a few months. In a larger retrospective analysis of

Fig 3. Three-dimensional computed tomography (CT) angiography reconstruction at 1 month postoperatively.

134 patients who had undergone fenestrated endovascular aortic repair, only 1 patient had developed persistent paraplegia that was concerning for SCI, presumably owing to coverage of the intercostal arteries by the endograft. One other patient in their cohort had experienced transient neurologic symptoms postoperatively that had resolved without intervention.[14]

Other mechanisms of SCI include occlusion of the artery of Adamkiewicz (greater radicular artery), which is thought to provide significant blood flow to the thoracic and lumbar spine. Several groups have suggested that preoperative identification of the artery of Adamkiewicz can be helpful to allow for selective reattachment of spinal cord-supplying arteries, which could decrease the risk of SCI.[15-17] Regarding other recognized important arterial supply during long segment aortic coverage, our patient had patent subclavian/vertebral arteries bilaterally with antegrade flow and known patent intercostal arteries in the region of her prior open repair.

Although the focus of discussion was the mechanism of SCI, the present case is notable for early thrombosis of the Gore IBE device (W. L. Gore & Associates). Although uncommon, other studies have suggested that early thrombosis might be associated with factors such as open surgical access or diseased anatomy.[18,19] In the present patient, the distal hypogastric artery had had evidence of atherosclerotic disease and, in retrospect, would have been best treated with stent expansion during the index procedure based on the intravascular ultrasound findings and angiographic appearance of sluggish flow.

CONCLUSIONS

Our patient experienced complete resolution of her neurologic symptoms after thrombectomy of the unilateral hypogastric artery occlusion. Our findings have shown that the mechanisms of SCI might not be fully understood, especially the role of hypogastric arteries in spinal cord perfusion.

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