» **Case Report** «

A Rare Complication of Spinal Cord Ischemia Following Endovascular Aneurysm Repair of an Infrarenal Abdominal Aortic Aneurysm with Arteriosclerosis Obliterans: Report of a Case

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We herein report a case of a rare complication of spinal cord ischemia (SCI) following endovascular aneurysm repair (EVAR). Computed tomography showed stenosis and calcification of bilateral iliac arteries and a saccular aneurysm of the terminal aorta. Paraplegia occurred soon after balloon angioplasty of iliac arteries and EVAR. Cerebrospinal fluid drainage was not performed because the patient was on dual antiplatelet drugs. The patient was treated with intravenous methylprednisolone and naloxone; however, this did not improve his paraplegia. SCI after EVAR is extremely rare and unpredictable complication, however, physicians should be aware of SCI after EVAR in patients with atherosclerosis.

Keywords: spinal cord ischemia, endovascular therapy, abdominal aortic aneurysm, peripheral arterial disease

Introduction

Spinal cord ischemia (SCI) after endovascular aneurysm repair (EVAR) is rare with an incidence of approximately 0.21%.¹⁾ The causes of SCI are derived from occlusion of the greater radicular artery, prolonged aortic clamping, intraoperative hypotension, atherosclerosis, embolization and interference with the pelvic circulation. We herein

report a rare case of immediate-onset paraplegia following elective EVAR.

Case Report

A 75-year-old man complaining of intermittent claudication was admitted at our hospital. The patient has a previous history of hypertension, diabetes mellitus and hemodialysis due to diabetic nephropathy. A drug-eluting coronary artery stent was placed 2 months ago and dual antiplatelet therapy (DAPT) with aspirin and clopidogrel has been performed. The right ankle brachial pressure index (ABPI) was 0.92, 0.66 in the left leg. Computed tomography (CT) showed stenosis and calcification of the bilateral iliac arteries and a saccular aneurysm of the terminal aorta (Fig. 1). The left internal iliac artery was occluded. Elective EVAR was selected due to iliac stenosis with abdominal aortic aneurysm (AAA), which was the Trans-Atlantic Inter-Society Consensus II class D disease.

Under general anesthesia, endovascular treatment of the bilateral iliac arteries and EVAR using the Powerlink system (Endologix Inc, Irvine, Calif) were performed (Fig. 2). Anesthesia was induced with fentanyl, propofol and vecuronium and maintained with sevoflurane. The patient's initial blood pressure was 140/70 mmHg. During the operation, a mean blood pressure of 60 mmHg was observed. The operative time was 4h and 43 min and the amount of intraoperative bleeding was 370 ml. However, a transfusion was not performed because hemoglobin concentration was 9.8 g/dl. Postoperative ABPI of the left leg was improved to 0.94.

After awakening from anesthesia, the patient noted having bilateral lower extremity paraplegia. The neurological examination showed full muscle power over the upper limbs but no motor function below the T1 level with preserved sensory function. The patient was not able to undergo cerebrospinal fluid (CSF) drainage because the patient was

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Fig. 1 Computed tomography showed stenosis of the bilateral iliac artery and a saccular aneurysm of the terminal aorta.

Fig. 2 Endovascular treatment to the bilateral iliac arteries and endovascular aneurysm repair using the Powerlink system were performed.

Fig. 3 Magnetic resonance imaging showed high T2 signals in the spinal cord as myelopathy at the T12-L2 level.

on DAPT. Intravenous methylprednisolone (1000 mg bolus and 200 mg/day drip for 24h) and naloxone (1 µg/kg/h drip for 4 days) were administered. On the following day, magnetic resonance imaging (MRI) was performed, which showed high T2 signals in the spinal cord compatible myelopathy at the T12-L2 level (Fig. 3). Unfortunately, complete paraplegia remained and the patient was moved to another hospital in order to undergo rehabilitation.

Discussion

Paraplegia after EVAR is a rare complication, and an analysis of the Eurostar database of 2862 patients who

had undergone EVAR showed an incidence of 0.21% for SCI.¹⁾ The cause of SCI after EVAR is not clearly understood. Various factors may contribute to SCI, such as occlusion of the greater radicular artery, prolonged aortic clamping, intraoperative hypotension, atherosclerosis, embolization and interference with the pelvic circulation. In patients who undergo EVAR, intraoperative hypotension, embolism and interruption of the collateral circulation from the iliolumbar and internal iliac arteries may be relevant.

The spinal cord is supplied by two posterior spinal arteries and one anterior spinal artery. Sensory tracts are supplied from posterior spinal arteries such as posterior and inferior cerebellar arteries, vertebral arteries and posterior radicular arteries. Conversely, motor tract is supplied from anterior spinal arteries such as the anterior radicular artery (Adamkiewicz). This artery originates from the T5-T7 intercostal arteries in 7%, T8-T12 in 82%, and from the lumbar artery at the level of L1-L2 in 11% of all cases.²⁾

In the present case, CT showed a thick iliolumbar artery, therefore, the spinal cord may be partially supplied by collateral circulation from iliolumbar artery. Initially, severe arterial sclerosis was detected and the left internal iliac artery was occluded; thus, the iliolumbar artery contributed to the collateral circulation.

Another possible cause of SCI in the present case is perioperative hypotension. A previous report showed

that an intraoperative mean pressure of less than 70 mmHg was a significant predictor of SCI.³⁾ In the present case, a mean pressure of less than 70 mmHg was maintained for 2h, which may have caused SCI. Moreover, severe atherosclerotic change was observed in this patient, which may have worsened the circulation of the spinal cord.

In the present case, the procedure time was long because it was difficult to insert and remove the delivery system due to severe calcification. Final angiography showed no findings of dissection or rupture at iliac arteries as access site. Prolonged operative time and microembolism may be other contributing factors for SCI.

Regarding the treatment of SCI, CSF drainage, steroids, naloxone and maintenance of the blood pressure have been reported. CSF drainage is performed in order to decrease the cerebrospinal pressure thereby leading to an improvement of spinal cord perfusion.⁴⁾ Spinal cord perfusion pressure is the mean arterial blood pressure (MAP) minus the spinal fluid pressure; therefore, CSF drainage leads to the improvement of spinal cord perfusion. Steroids are used to suppress inflammation and reduce edema of the ischemic spinal cord.⁵⁾ Naloxone, an opioid receptor antagonist, reduces the risk of SCI through a potential mechanism of lowering excitatory amino acids such as glutamate in the CSF.⁶⁾ However, the effectiveness and mechanism of naloxone therapy for SCI is unclear and naloxone is currently used according to previous experience. In the present case, CSF drainage was not performed because of the risk of bleeding due to DAPT. Therefore, systemic a steroid and naloxone were administered, however, the patient's paraplegia did not improve. Despite the patient has oral administration of antiplatelet therapy, CSF should have been performed in this case.

The cause of SCI after EVAR is unclear because of extremely rare complication. The risk factors for SCI in the treatment of a thoracic aortic aneurysm are as follows: endograft coverage of T9 to T12; over 20 cm of coverage of the thoracic aorta; occlusion of the left subclavian artery;⁷⁾ prior repair of an infrarenal AAA;⁴⁾ renal dysfunction;⁸⁾ and a low perioperative mean arterial pressure (MAP) of less than 70 mmHg.³⁾ It is difficult to predict the development of SCI preoperatively.

There was no occurrence of SCI after EVAR in approximately 300 case of EVAR in our institution. Almost case of EVAR had been performed by only incision of bilateral groins and there was no complication of bleeding. Therefore, antiplatelet therapy was continued, considering the risk of thrombotic event in coronary stent. In the present case, possible prevention for SCI was to maintain the MAP and preoperative cessation of antiplatelet drugs considering the necessity of CSF drainage. Furthermore, preoperative informed consent is crucial regardless of

extremely rare complications in the treatment of AAA, as the occurrence of SCI could have serious adverse effects.

Conclusion

SCI after EVAR is extremely rare and unpredictable complication, however, physicians should be aware of SCI after EVAR in patients with atherosclerosis with atherosclerosis.

Disclosure Statement

The authors have no conflicts of interest to declare.

Author Contributions

Study conception: KM

Data collection: KM, TM

Analysis: KM, TM

Investigation: KM, TM

Writing: KM

Critical review and revision: all authors

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