

Monoparesis after Graft Replacement of Non-Ruptured Abdominal Aortic Aneurysm

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A 67-year-old man was admitted with a saccular aneurysm of the abdominal aorta. Preoperative CT revealed cylindrical calcification of the abdominal aorta and the patent internal iliac arteries (IIAs). At the elective surgery, a cylinder-shaped and severely calcified intimal layer was found, and the lumbar arteries were totally occluded. Hypotension caused by the loose iliac clamp due to severe calcification continued for 15 minutes and long-time cross clamp was necessary. Monoparesis of the left lower extremity and dysuria occurred postoperatively. Spinal MRI revealed small infarction at the Th10 level. Symptoms improved and he could walk with a cane and within a few months no urinary catheter support was needed. Thoracic spinal cord infarction after abdominal aortic aneurysm (AAA) surgery and a severely calcified abdominal aorta indicated the importance of the blood flow in the IIA as the significant source of spinal blood supply. To prevent spinal cord injury (SCI) which is rare but significant complication of AAA surgery, understanding of the spinal blood supply, quick surgery, and complete revascularization of pelvic arteries are important. (*Ann Thorac Cardiovasc Surg* 2006; 12: 376–8)

Key words: abdominal aortic aneurysm, spinal cord injury, monoparesis

Case Report

A 67-year-old man was admitted with the diagnosis of a saccular aneurysm of the abdominal aorta. He had a history of hypertension, hyperlipidemia, and diabetes, which had been medically treated for 16 years. He had undergone off-pump coronary artery bypass grafting using the bilateral internal thoracic arteries one year previously. He was diagnosed as having mild peripheral arterial disease in the carotid arteries and bilateral calf arteries. He had no abdominal symptoms but CT revealed a saccular aneurysm, 39 mm in diameter, located 30 mm below the left renal artery and another fusiform aneurysm, 29 mm in diameter, just below the inferior mesenteric artery

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(IMA). The cylindrical calcification was observed inside both of the aneurysms (Fig. 1). Bilateral internal iliac arteries (IIAs) were calcified but patent.

At operation, an epidural tube was inserted between L1 and L2 and general anesthesia was induced. Through a median laparotomy two aneurysms were exposed. After systemic heparinization, the bilateral common iliac arteries, IMA and infrarenal abdominal aorta were clamped. When the abdominal aorta was longitudinally opened, a cylinder-shaped and severely calcified intimal layer was exposed. This cylinder had multiple perforations and upper saccular aneurysm was filled with organized thrombus. No back flow was detected from the lumbar artery. The clamp of the severely calcified right common iliac artery was loose and aortic occlusion with balloon catheter was attempted. However, rupture of the balloon occurred and finally cross clamp was achieved with an instrument. During this procedure, hypovolemic hypotension around 70 mmHg continued for 15 minutes and was recovered by blood transfusion. The aorta was replaced with a bifurcated woven graft (18×9 mm,

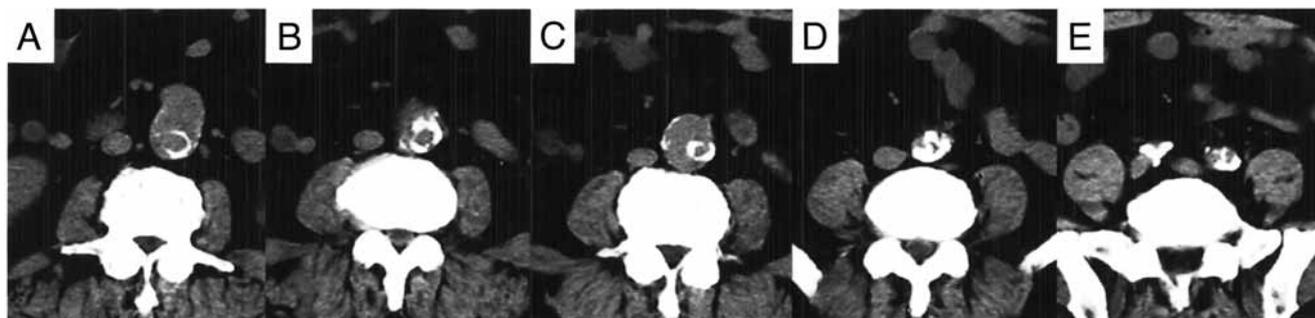


Fig. 1. Abdominal CT.

Saccular (A) and fusiform (B) aneurysms, cylindrical calcification in abdominal aorta (A, B, C) and severely calcified aortic bifurcation and common iliac arteries (D, E) are observed.

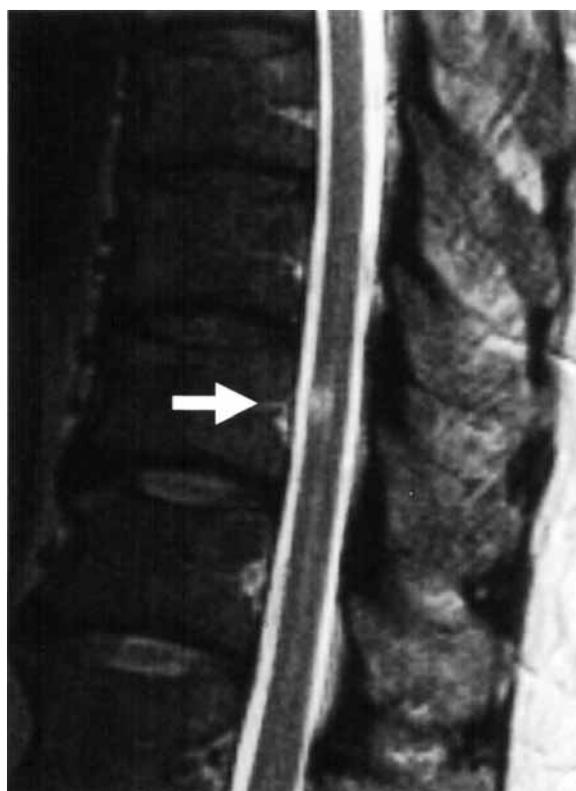


Fig. 2. Spinal MRI.

Small infarction at Th10 level (arrow) is visualized. No epidural or subdural hematoma is detected.

GelsofPlus, Vascutek (Sulzer Vascutek Ltd.), Renfrewshire, Scotland, UK). Bilateral limbs of the graft were anastomosed to common iliac arteries by the end-to-end fashion. IMA was reconstructed by the end-to-side anastomosis to the left limb of the graft. As all anastomotic sites were severely calcified and thickened, it was

necessary to remove calcified intima and this was time-consuming. The cross clamp of the left graft limb was released 91 minutes after the aortic clamp and the right limb was released 39 minutes after the left limb. No back flow from the lumbar arteries was observed even after the reconstruction of the bilateral iliac arteries.

Postoperatively he was lucid and respiratory and circulatory conditions were stable. The urinary catheter was removed on the second day but he could not micturate. When he started ambulation on the fourth day, he could not raise his left leg, but movement of the right leg was normal. The epidural infusion of ropivacaine and fentanyl was discontinued immediately before ambulation, and he was observed for 12 hours but the monoparesis of the left lower extremity did not improve. Babinski reflex was positive on the left foot. Spinal MRI revealed a small infarction at the Th10 level but no epidural or subdural hematoma (Fig. 2).

The monoparesis improved favorably and he could walk with a cane a month after surgery. The dysuria continued for two months but finally he could be weaned from the urethral catheterization.

Discussion

Since the first report by Adams and van Geertruyden in 1956,¹⁾ 70 cases of spinal cord injury (SCI) after surgeries for abdominal aortic aneurysm (AAA) have been reported in English.²⁾ Recently, SCI following endovascular abdominal aneurysm repair have been also reported.^{3,4)}

The SCI after AAA surgery is a rare complication and Gloviczki et al. reported the incidence is 0.1% after elective and 1.4% after emergency surgery.⁵⁾ We have encountered SCI after AAA surgery in only this single patient

among 796 elective surgeries for infrarenal AAA in the last nine years. Similar incidence (0.13%) to that of the previous report after elective surgery was detected. Emergency surgery has been considered as a risk factor of SCI. Among seven Japanese cases⁶⁻¹¹⁾ including our case which have been reported, five (71%) were after the surgery for ruptured AAA.¹⁰⁾

SCI after aortic surgery is multifactorial, however, the primary cause of SCI after AAA is an alteration in blood supply to the spinal cord.²⁾ In this case, the most obvious operative finding was severe calcification of the infrarenal aorta and the common iliac arteries. This caused 1) total occlusion of all of the infrarenal lumbar arteries, 2) hypotension due to incomplete clamp of the iliac arteries, and 3) delay of the release of iliac cross clamp.

The blood supply of spinal cord can be classified into intrinsic and extrinsic systems.¹²⁾ Three longitudinal arteries, one anterior spinal artery and two posterior spinal arteries, are the intrinsic system. Eight segmental medullary arteries, which supply the anterior spinal artery, are the extrinsic system. In cases where the cervical and thoracic medullary arteries, and the longitudinal arteries are not diseased, the infrarenal aortic clamp would not cause SCI. If the intrinsic and/or the extrinsic systems are affected, the alteration in spinal blood flow is unpredictable.

In this case, the spinal cord infarction occurred at the Th10 level, the infarction was localized and symptoms were relatively mild and favorably recovered. The lumbar arteries were totally occluded in the infrarenal aorta, and extraordinarily long aortic and iliac clamp time was required. Bilateral internal thoracic arteries, which is the possible blood source of medullary arteries, have been utilized for coronary artery bypass. These facts suggest that; 1) the pathology in the blood supply of thoracic spinal cord was compensated by minor but significant collateral flows from the caudal portion, 2) occlusion of the lumbar arteries resulted in significant blood supply from the IIAs to the spinal cord, 3) interference with IIAs resulted in thoracic SCI.

Picone et al. described that IIA devascularization, hypotension, and pelvic embolization may lead to SCI as the result of interference of pelvic blood flow.¹²⁾ Although no distinct limit of aortic clamp time has been defined,¹³⁾ clamp time of 45 minutes is considered as a safe limit.²⁾ In this patient with diseased blood supply of the spinal cord, long-time cross clamp and hypotension were possible causes of SCI.

In conclusion, to prevent SCI, which is a rare but seri-

ous complication of AAA surgery, profound understanding of spinal blood supply, quick surgery, and complete revascularization of pelvic arteries are mandatory.

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