Case Report

Spinal Cord Infarction after Transcatheter Embolization of Pelvic Arteriovenous Malformation

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An 80-year-old woman presented with abdominal and right lower limb pain. Radiological examination revealed pelvic arteriovenous malformations (pAVMs). Although transcatheter embolization was repeated, dilation of the common iliac vein worsened. Four sessions of embolization were performed for the internal iliac vein. Paraplegia gradually occurred a day after the final procedure. Magnetic resonance imaging revealed thoracic spinal cord edema and paraspinal vasodilatation, suggesting spinal cord infarction. Additional angiography revealed a radiculomedullary vein draining into the spinal canal from the pAVM; hence, surgical interruption was performed. Incomplete venous embolization of the pAVM caused spinal cord congestion and infarction.

Keywords: spinal cord infarction, pelvic arteriovenous malformation, embolization

Introduction

There are some reports on the treatment of pelvic arteriovenous malformation (pAVM) causing paraplegia and myelopathy, but to the best of our knowledge, no reports on spinal cord infarction following pAVM treatment exist.1,2) We report a case of spinal cord infarction following congestion owing to increased intradural venous flow after transcatheter embolization for pAVM.

Case Report

This report describes the case of an 80-year-old woman who complained of abdominal and right lower limb pain. Ultrasonography and computed tomography (CT) confirmed the diagnosis of pAVM, which had worsened despite several attempts of transcatheter arterial embolization (TAE), and she was referred to our hospital. Angiography revealed arteriovenous shunts between the branches of the right internal iliac arteries and internal iliac vein (Fig. 1a and 1b). We assumed that there were many shunt points in the wall of the internal iliac vein (Fig. 1c). Transcatheter embolization of the dilated right internal iliac vein was performed three times via the right femoral vein. As the dilated common iliac vein increased in size during observation, the fourth treatment was initiated. The blood pressure of the proximal right internal iliac vein was increased to 128/75 mmHg during the treatment. Embolization of the vein was successfully performed using detachable coils and a mixture of n-butyl-2-cyanoacrylate (NBCA) and lipiodol (Fig. 1d and 1e). Embolization of the right internal iliac vein was also successfully performed, but aortography revealed residual arteriovenous shunts from the right fourth lumbar artery, median sacral artery, and so on (Fig. 1f and 1g).

There were no symptoms immediately after embolization; however, paraplegia of both lower limbs and bladder and rectal dysfunction gradually developed the next day. Magnetic resonance imaging (MRI) revealed spinal cord enlargement up to third thoracic vertebra, high signal intensity in T2-weighted images, and fine vasodilatation around the spinal cord (Fig. 2a). We suspected an unexplained spinal cord infarction; therefore, we first performed steroid pulse therapy; however, the symptoms did not improve.

An additional angiography was performed, and a ra-
diculomedullary vein flowing back into the spinal canal was detected by the left internal iliac and median sacral arteriography (Fig. 2b and 2c). However, we could not access the shunts transcatheterically, and 7 days after embolization, surgical interruption of the intradural draining vein was performed to avoid aggravation of spinal cord congestion (Fig. 2d). The symptoms did not progress further, and the MRI findings of spinal cord congestion improved (Fig. 2e). Furthermore, lower limb paraplegia and bladder and rectal disorders partially improved.

Discussion

This case highlights spinal cord infarction due to a vein flowing back into spinal canal, resulting from spinal arteriovenous fistula-like condition, which developed after venous embolization for pAVM. The patient had pAVM with many shunts between the branches of the internal iliac arteries and internal iliac vein, which was classified as type II AVM according to the angiographic classification by Cho et al.3 We planned to embolize the internal iliac vein using a transvenous approach, as previous TAEs had not been effective. Transvenous embolization of the dominant outflow vein was successfully performed, but aortography revealed residual arteriovenous shunts from other arteries.

There is a report of focal bladder necrosis as an early complication after embolization of pAVM; however, to the best of our knowledge, no reports of spinal infarction as a complication exist.3 In the present case, a reflux vein into the spinal canal was not suspected because she
had no neurological symptoms until the last embolization for pAVM. However, when the contrast-enhanced CT findings prior to treatment were reviewed in detail, a fine vasodilatation in the lumbar spinal canal was suspected, and it appeared that one vessel continued to the expanded right internal iliac vein. We presumed that this vessel was a radiculomedullary vein, and the hemodynamics changed when the dominant outflow vein of the pAVM was embolized; hence, blood flow to the reflux vein increased, resulting in spinal cord congestion and infarction (Fig. 3).

We performed four sessions of staged venous embolization from the distal to the proximal internal iliac vein to avoid an abrupt change in pelvic venous hemodynamics, which could cause intestinal or urinary tract congestion and hemorrhage owing to increased venous pressure after embolization of the outflow vein. However, we did not expect spinal cord infarction as a complication after the venous embolization owing to the paucity of data regarding this rare condition. If we had noticed venous reflux into the spinal canal by careful interpretation of the preprocedural contrast-enhanced CT or angiography, we might have embolized the reflux vein before embolization of the right internal iliac vein. In the treatment of sinus-type dural arteriovenous fistulas like the cavernous sinus, venous embolization is the main treatment, and it is necessary to first embolize dangerous draining veins that may cause disastrous complications.4) Surgical interruption of the intradural draining vein could improve the spinal cord congestion and symptoms.5) The treatment strategy for the draining vein in this case is thought to be similar to that for spinal epidural arteriovenous fistula (AVF). It has been reported that 76.3% of the spinal epidural AVF were treated by endovascular therapy alone and 28.9% by surgical interruption or combination therapy, requiring multimodal treatment.6) In our case, it was difficult to understand the condition and no surgeon in our hospital had treatment experience regarding the condition; thus, it took a long time before surgical interruption could be performed. Treatment at an early stage could avoid the aggravation of symptoms and provide an early recovery. Hence, it must be kept in mind that following venous embolization of pAVM, venous flow into the patient’s residual outflow veins can increase, causing spinal cord infarction.

Conclusion

pAVM treatment can cause spinal cord infarction following venous embolization for pAVM. Careful interpretation of radiological examinations may provide a chance to avoid or treat this rare and complicated condition.

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Study conception: SW, HM
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Writing: SW
Critical review and revision: all authors
Final approval of the article: all authors
Accountability for all aspects of the work: all authors

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