Endovascular Treatment of Spinal Dural and Epidural Arteriovenous Fistula as Complication of Lumbar Surgery

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Spinal dural arteriovenous fistula is known to possibly complicate lumbar disc surgery. Delayed development of spinal dural arteriovenous fistula also has been reported as a rare complication after lumbar surgery. We report a case of postsurgically developed spinal dural/epidural arteriovenous fistula treated with n-butyl cyanoacrylate.

Key Words: Spine; Dural/epidural arteriovenous fistula; Lumbar spine; Embolization

As a complication of lumbar disc surgery, vascular damage and fistula formation are known to occur (1-3). Formation of spinal arteriovenous fistulas (AVF) also has been reported as a delayed complication developing after lumbar surgery (3). We experienced spinal dural/epidural AVFs that developed at the site of previous lumbar surgery and successfully treated it with n-butyl cyanoacrylate (Histoacryl®, B.Braun, Melsungen, Germany). To our knowledge, endovascular treatment of postsurgically developed spinal dural/epidural AVFs has not been reported so far.

CASE REPORT

A 48-year-old male presented with progressively aggravated buttock pain for three months. He had undergone metallic cage insertion and posterior interbody fusion for L3-L4 and L4-L5 disc herniation 3 years ago. Axial T1-weighted MR images showed tortuous flow-void structures at L2 and L3 levels, which suggest engorged epidural vein and AVF (Fig. 1A and B). Sagittal T2-weighted MR image of the lumbar spine demonstrated diffuse increased signal intensity at the conus medullaris (Fig. 1C). The right common femoral artery was accessed and a 5 Fr angiographic catheter (Cook, Bloomington, IL) was used for selective catheterizations of T4-L5 segmental arteries. Spinal angiography showed spinal dural and/or epidural AVFs in the left L3-4, which was supplied by dural branches of the left L3 and L4 iliolumbar arteries and drained into the perimedullary venous plexus and epidural vein (Fig. 2A and B). A Prowler-14 microcatheter (Cordis Endovascular Systems, Miami, FL) was coaxially advanced through 5 Fr angiographic catheter over an Agility 14 microwire (Cordis Endovascular Systems), and selective angiography was performed for the microcatheter to reach the fistula most distally (Fig. 2C). 30% mixture of N-butyl cyanoacrylate with lipiodol was injected through microcatheter to penetrate fistula into the venous side. After embolization, control angiogram showed complete obliteration of spinal dural/epidural AVFs. Clinical follow-up and angiogram were performed at 1, 3, and 12 months after treatment (Fig 3A and B). The
patient was free of symptoms except occasionally buttock pain.

DISCUSSION

Spinal AVFs can be classified by their relative position to the dura, representing a landmark (4, 5). Epidural AVFs are located in the epidural space, vascularized by dural or epidural branches of segmental arteries and drain primarily into epidural venous plexuses. Dural AVFs are embedded within the dura and fed by a dural branch or the dorso-spinal artery, in

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**Fig. 1.** Axial T1-weighted MR image shows serpentine signal void structures around the spinal canal and the left neural foramen of L3 (white arrow; A, B). Sagittal T2 weighted image shows diffuse high signal intensity in the conus medullaris (C).

**Fig. 2.** Anteroposterior and oblique angiograms of L3 and 4 iliolumbar arteries show a left L3-4 foraminal spinal dural/epidural arteriovenous fistula supplied by dural branches of those arteries (black arrow) and draining into perimedullary and epidural veins (A, B; white arrow). Selective angiogram via microcatheter confirms dural arteriovenous fistula with draining into epidural vein (C).
the region of the intervertebral foramen. They drain through spinal cord veins that may either pierce the dura far from a nerve root or accompany a nerve root. They reach the perimedullary venous plexuses, engorge the extrinsic and intrinsic veins and are thus responsible for a venous congestion resulting in myelopathy.

Epidural and dural AVFs usually present with paraparesis caused by progressive myelopathy and root pain or pain in the back, sensory disturbance and sphincter disorders follow. All these symptoms are slowly but continuously progressive in majority of patients (4, 5). Epidural and dural AVFs are small size-wise and considered an acquired lesion. The formation of spinal dural/epidural AVF with progressive myelopathy as a delayed complication of lumbar disc surgery seems to be closely related to excessive bleeding or injury to the surrounding structures and the formation of fibrous scar (1-3). In this case, posterior interbody fusion for L3-L4 and L4-L5 was performed 3 years ago and we proposed that introduced devices might have induced a thrombus formation or thrombophlebitis of the adjacent perimedullary or epidural veins around the nerve root of L3 and 4, leading to dural/epidural AVFs.

Spinal vascular diseases are characterized by their draining veins well depicted on MR imaging. The diagnosis is made when MR imaging identifies the draining veins as serpentine structures around the surface of the cord (4). In addition, the edema, ischemia, or venous infarction of the cord due to the venous congestion can be evaluated on MR imaging (4, 5). However, it is difficult to distinguish dural AVFs from epidural AVFs using MR imaging. Angiography is the gold standard for diagnosis, analysis and description.

Asakuno, et al (3). chose the surgical extirpation rather than endovascular embolization for the treatment of the dural AVF complicating lumbar disc surgery. Generally speaking, spinal dural AVF can be successfully managed with both endovascular treatment and surgery. In the endovascular management, the main objective of treatment of dural or epidural AVFs is the proximal occlusion of the draining vein as well as fistula (6). Clinical improvement is seen in the majority of cases, otherwise progression of the congestive myelopathy is arrested at least (6). Patients in whom proper selective catheterization cannot be performed or in whom the extra-spinal longitudinal anastomosis cannot be cleared safely to prevent accidental embolization to the anterior spinal artery are also not candidates for endovascular therapy.

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