Intramedullary gadolinium-DTPA enhancement in a patient with cervical spondylotic myelopathy and an associated vascular lesion

Case report

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Intramedullary enhancement of the cervical spinal cord is rare in chronic compression disease. An accompanying vascular lesion should be considered in such a case.

A 59-year-old man presented with severe cervical spondylotic myelopathy. Gadolinium-diethylenetriamine pentaacetic acid (Gd-DTPA) enhanced magnetic resonance imaging showed intramedullary enhancement at the C5-6 level, which was the most severely compressed level. A right ascending cervical arteriogram demonstrated a spinal arteriovenous fistula (AVF) fed mainly by the C-6 radicular artery and draining from the posterior medullary vein.

Surgery was performed to decompress the myelopathy and to obliterate the AVF. Postoperative MR imaging with Gd-DTPA enhancement showed immediate and complete disappearance of the previous enhancement. The intramedullary enhancement presumably resulted from the intraparenchymal hemodynamics due to the AVF.

Key Words * intramedullary enhancement * gadolinium-diethylenetriamine pentaacetic acid * cervical spine * cervical spondylotic myelopathy * arteriovenous fistula

Few gadolinium-diethylenetriamine pentaacetic acid (Gd-DTPA)-enhancement studies have been performed in patients with a chronic compressive lesion such as cervical spondylotic myelopathy (CSM). A high signal intensity area can generally be predicted and identified in patients with CSM.[7] We report the case of a patient in whom localized Gd-DTPA enhancement in the cervical spinal cord was demonstrated, and an accompanying dural arteriovenous fistula (AVF) was discovered in proximity to this enhancement. This case alerted us to look closely at abnormal Gd-DTPA enhancement to rule out the presence of an associated vascular lesion in patients with CSM.

CASE REPORT

This 59-year-old man presented with a 2-year history of progressively severe myelopathy.

Examination. On admission, the patient demonstrated hyperactive deep tendon reflexes, impaired discrete movement of his fingers on both sides, and spastic gait, which caused difficulties in his ability to

perform his daily living skills.

Fig. 1. Magnetic resonance imaging obtained in a 59-year-old man. Left: A T2-weighted sagittal image demonstrating a sharp-edged high signal intensity area within the spinal cord at the C5-6 level. Right: A Gd-DTPA-enhanced T1-weighted sagittal image revealing an enhanced intramedullary area at the C5-6 level.

Neuroimaging Examinations. Plain cervical x-ray films showed spinal canal stenosis and spondylotic changes at the C4-5, and C5-6, C6-7 levels. Magnetic resonance (MR) imaging demonstrated multilevel compression from C3-4 to C6-7, with maximum compression at C5-6. A T2-weighted MR image revealed intramedullary sharp-edged high signal intensity at the C5-6 level (Fig. 1 left). Gadolinium-DTPA was administered to identify the pathology in the high signal intensity area. The spinal cord segment corresponding to the high signal intensity area on T1-weighted imaging demonstrated obvious enhancement after Gd-DTPA administration (Fig. 1 right). Myelography and computerized tomography myelography revealed no additional information.

Fig. 2. A right ascending cervical arteriogram, anteroposterior view, showing a spinal AVF. Note that the C-6 radicular artery has a direct connection to the tortuous posterior spinal vein. A fistulous point is also demonstrated (arrow).

To rule out a tumor or vascular lesion, angiography was also obtained. A deep right cervical arteriogram demonstrated a spinal dural AVF (Figs. 2 and 3) at the C5-6 interspace root sleeve (Fig. 2 arrow) that was drained by the posterior spinal vein (Fig. 3 arrow). This dural AVF was thought to be a factor that increased the intraspinal pressure.

Fig. 3. Right ascending cervical arteriograms. Left: Anteroposterior view demonstrating the late arterial phase. An anterior spinal artery (arrowhead) can be clearly recognized. Right: Lateral view demonstrating an anterior spinal artery (arrowheads) and posterior spinal vein (arrow) along with the C-6 radicular artery (curved arrow).

Operation. Laminectomy was performed from C-4 to C-6 to decompress the spinal cord and a laminoplasty at C-3 and C-7 was also accomplished. A parasagittal dural incision was made on the right side and an AVF was found at the C5-6 level. Microvascular Doppler sonography was used to measure the flow direction and velocity. The flow direction was rostral and the velocity was 8 cm/second in the posterior spinal vein. A vascular connection to the dilated posterior spinal vein was located in the dorsal roots. A vascular clip was applied to this connection.

Fig. 4. Postoperative angiogram and MR image. Left: Anteroposterior view showing the late arterial phase. No AVF was present, although an anterior spinal artery can be seen (arrow). Right: Lateral view showing an anterior spinal artery (arrow).

Postoperative Course. The patient's postoperative course was uneventful. Angiography obtained in the 2nd postoperative week revealed no abnormal vascular lesion (Fig. 4). Magnetic resonance imaging performed in the 2nd postoperative week demonstrated no abnormal enhancement and the high signal intensity area on the T2-weighted image was unchanged (Fig. 5). The severity of the patient's sensory impairment and gait disturbance has decreased; however, 6 months postoperatively he still has spastic paraparesis with deep sensation impairment.

Fig. 5. Postoperative T2-weighted image demonstrating an abnormally high signal intensity area at the same level as the preoperative MR imaging.

DISCUSSION

Magnetic resonance imaging is widely used in the routine pre- and postsurgical evaluation of patients with CSM. According to Takahashi, et al.,[7] an increased signal intensity on T2-weighted images was observed in 99 (14.8%) of 668 patients. The frequency of this finding was directly proportional to the severity of clinical myelopathy and to the degree of spinal canal compression. Other investigators[3] studied patients with cervical canal stenosis and found that MR signal abnormalities were common in disc-related stenoses (six [33%] of 18 patients) and multisegmental cervical canal stenoses (three [37%] of 8 patients).

In terms of correlating MR imaging with pre- and postoperative clinical status in CSM, preoperative increased MR signal intensity is generally indicative of a worse prognosis[2,5]. Increased MR signal intensity appears to result from cord constriction caused by spondyloarthrotic protrusions and canal narrowness. Long-standing myelopathy seems to be important in producing such a MR signal alteration in cases of mild cord constriction, with mild or

moderate cervical spinal stenoses.[2]

An experimental study conducted in a canine model simulating cervical spondylosis presenting with delayed progressive myelopathy showed MR imaging changes.[1] The main histological changes corresponding to the MR imaging abnormality included loss of large motor neurons, necrosis, and cavitation. In cases treated surgically, postoperative improvement may be linked to MR imaging changes, indicating that the preoperative abnormal signal intensity does not always signify that the lesion is untreatable.[2,5]

Gadolinium-DTPA enhanced MR imaging has been used to reveal pathological changes in the chronically compressed spinal cord. Takahashi, et al.,[7] studied enhanced MR imaging in 10 cases and noted that one had definite enhancement and another had probable enhancement in the area in which high signal intensity was present. Matsuda, et al.,[5] also investigated pre- and postoperative changes of Gd-DTPA enhancement in a case of cervical disc herniation. Although Gd-DTPA enhancement was present in the spinal cord at disc level preoperatively, the enhancement effect disappeared 3 months postoperatively. The mechanism of contrast enhancement is not clear; however, blood-spinal medullary barrier or cavity formation within the compressed cord may lead to leakage of Gd-DTPA.

The differential diagnosis of CSM includes multiple sclerosis, spinal tumors, amyotrophic lateral sclerosis, spinocerebellar disease, and syringomyelia. Among these, multiple sclerosis is rare but important.[6] Meyer and Sandvoss[6] reported four cases in which the diagnosis was chronic spondylotic myelopathy. All of these patients underwent decompressive surgery, which resulted in a problematic postoperative course and a worsening of preoperative neurological deficits.

The technique of Gd-DTPA enhancement provides a better and more effective tool in the assessment of inflammatory and demyelinating myelitis, such as multiple sclerosis.[4,8] Delayed contrast enhancement (after 45-60 minutes) may be effective in detecting demyelinating lesions, such as multiple sclerosis, which were not visualized on an early image using Gd-DTPA enhancement.[4] In the acute phase of spinal cord infarction, Gd-DTPA enhancement may represent a true infarcted area, which has been demonstrated as diffuse abnormal enhancement of the affected spinal cord.[4]

In our case, a coexistent dural AVF should have accentuated the mechanism of the leakage of Gd-DTPA within the spinal cord by increasing the parenchymal pressure. We would like to emphasize that spinal angiography should be obtained in cases of CSM presenting with Gd-DTPA enhancement to determine whether a coexistent vascular lesion, such as arteriovenous malformation or an AVF can be identified.

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