Preoperative MR Diagnosis Of Spinal Subdural Empyema-Secondary to Osteomyelitis and Epidural Empyema

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Only few cases of spinal subdural empyema has been reported in the literature and the preoperative diagnosis is much less. Due to the advance of magnetic resonance imaging techniques, we reported a 75 years old female with spinal subdural empyema. She was a diabetic patient and received laminectomy, complicated with vertebral body osteomyelitis about 15 years ago at the 4th and 5th vertebral body of lumbar region (L4/5). She is a victim of cervical cancer and currently suffered from leukocytosis, high fever and then low back pain for several weeks. Magnetic resonance imaging clearly depicts the picture of osteomyelitis at L4/5 with mixed epidural and subdural abscess. The subdural lesion extended upwardly from L4 to T11 (the 11th vertebrae of thoracic spine) level. Laminectomy and durectomy were performed soon and clearly revealed the picture of long segment subdural abscess. Post-operation recovery course is fine.

Key words: Magnetic resonance imaging, Osteomyelitis, Subdural empyema

There have been only few cases of spinal subdural empyema (SSE) reported clinically in the literatures [1-2]. SSE is described as intrathecal suppurative infection, between the outermost layer of the meninges, the dura, and the arachnoid. SSE is the least common localized central nervous infection and its exact incidence is unknown [3]. It is confined to the subdural space and may either be loculated or confluent within this space [2]. SSE has been recognized as a distinct entity since 1928 [2]. Due to the more fulminant nature and high index of severe sequel, early diagnosis is urgent and important.

The etiologies of SSE include hematogenous spread from other region, direct spread into the subdural space from the infected CSF, hematogenous inoculation during the course of meningitis, secondary infection after spinal surgery, local invasive interventions, diminished resistance of the patient to infection (diabetes mellitus, alcoholism, tumors) [4]. Other procedures such as epidural anesthesia, discography, and lumbar puncture are also reasonable possible causes of SSE.

CASE REPORT

This 75 years old female had received an operation at the 4th and 5th vertebrae of lumbar spine (L4/5) and then suffered from the complication of osteomyelitis 15 years ago. The patient was quite well and free from any symptoms/signs of sepsis or local tenderness after intensive treatment. Recently, the patient suffered from cervical cancer. She developed low back pain and fever while receiving chemotherapy. Therefore, the patient came to our hospital for help.

At admission, the patient presented with high fever (38.8°C), leukocytosis (15360/mm³) and weakness in both lower limbs. Magnetic resonance...
imaging (MRI) was performed to investigate the spine. The pulse sequences included the pre-contrast sagittal T1-weighted image (T1WI), T2-weighted images (T2WI), axial T2WI, and post-contrast axial /sagittal T1WI. The heterogeneous enhancing pattern of L4, L5 vertebral bodies, loss its discal space, and focal epidural fluid collection were clearly demonstrated. The subdural lesion extended from L4 to T11 level (Fig. 1), in which the conus medullaris and cauda equina nerve were surrounded. Marked contrast enhancement of cauda equina nerves and the membrane, the dura matter, could be well demonstrated. Clustering and clumping appearance of the cauda equina nerve and widening of the cerebral

**Figure 1.** Post-gadolinium TIWI MRI axial section a, sagittal section b. (TR/TE/Nex/Matrix: 466/10/3/256 × 192): Fluid collection was seen within the subdural space, which extended from L4 to T11 with thickened and prominent enhancing membrane, the dura matter (arrow). Clumping enhancing pattern of cauda equina nerve could be due to arachnoiditis (double arrows). Osteomyelitis of L5 (thin arrow) and focal epidural abscess (double thin arrows) were also seen.

**Figure 2.** Axial section MRI T2WI (4000/101/3/256X192): Clustering and clumping appearance of the cauda equina nerves (arrow) was noted. The space between the dura and cauda equina nerve increased.

**Figure 3.** Operative findings of laminectomy and duroctomy: Inflammatory process of the cauda equina nerve with turbid abscess fluid was identified intrathecally, confirmed the diagnosis of spine subdural empyema.
spinal fluid (CSF) space was noted, which could be due to arachnoiditis (Fig. 1, 2). Due to the longitudinal extension fashion, rim-enhanced pattern, and nearly complete confined to subdural space from L4 to T11 level, we make the pre-operative imaging diagnosis of osteomyelitis with epidural abscess at L4/5 level and extensive subdural abscess from L4 to T11 level (Fig. 2). Laminectomy and durectomy were performed (Fig. 3), and the findings well correlated with the pre-operative imaging diagnosis. The subdural empyema did not involve the spinal cord. Post-operative course was uneventful. The fever subsided and the leukocytosis disappeared. Then she was transferred to the department of Physical Therapy for further rehabilitation.

**DISCUSSION**

Similar to the more common epidural counterpart, suspicion of spinal subdural empyema (SSE) should be aroused when a febrile patient with recent history of infection, presenting with back or neck pain. The physical examination of SSE is characterized by diffuse motor and sensory deficits. The clinical triad is fever, neck pain or back pain, and spinal cord compression. This triad applies to 18 of the 47 cases reviewed in one report [5]. The CSF study may reveal pleocytosis and initial pressure elevation. In the past, metrizamide myelography was the only imaging modality of choice [6-7]. It can support the diagnosis of CSF block, which is consistent with the findings of SSE [8-9]. The myelographic findings of multiple filling defects or flaws involving several levels of spine would reinforce the diagnosis of spinal subdural empyema and would be exceptional in spinal epidural empyema.

Nowadays, spinal puncture is not an accepted method to diagnose spinal abscess, as it involves the risk of seeding deeper meninges layers with extrathecal pus. Definitive diagnosis could be established only at the time of surgery or autopsy.

Traditionally, it is difficult to differentiate the epidural from subdural abscess by imaging study, because both of them are presented as extra-axial collections in the spinal canal. With the advance of imaging modality, it is now easier to differentiate the spine subdural and epidural lesion right now. The subdural lesion can extend in the potential space-subdural space-in the more longitudinal fashion. Epidural abscess is usually localized and may extend along the neuroforamen to the perivertebral and paravertebral regions. Besides, it usually accompanied osteomyelitis. SSE may be associated with osteomyelitis as well, usually secondary to systemic sepsis.

In our case, the patient received operation about 15 years ago and once suffered from osteomyelitis at that time. Since then, she had been quite well and did not suffer from any symptoms of spinal cord compression or sepsis or low back pain. Therefore, the presenting event is more likely to be isolated without any connection with the event 15 years ago.

Local fluid collection within the subdural space was clearly depicted from the MR images. The lesion had thick and marked enhancing membrane-the dura matter-which surrounded the cauda equina nerve (Fig 1a, 1b). Since the patient had cervical cancer, intrathecal metastasis should be included in the differential diagnosis. According to the current images, no evidence of intrathecal soft tissue lesion could be detected. Therefore, the diagnosis of metastasis is much less likely. The pattern of contrast enhancing of the nerves could be due to arachnoiditis. In the reporting case, the MR imaging findings include longitudinal extension L4 to T11 of the lesion, rim-enhanced pattern, and nearly complete localized within subdural space. According to these findings, we made the pre-operative imaging diagnosis of SSE and were verified surgically.

This patient suffered from diabetes and received pelvic surgery for cervical cancer. As the patient is the immune-compromised, she is more likely to be infected. Besides, the local dura is more vulnerable than usual due to previous operation. Once osteomyelitis and epidural abscess developed, it could easily spread to the subdural space, either upwardly or downwardly due to the weakness of the dura. Osteomyelitis most likely originated from systemic sepsis due to high fever and leukocytosis prior to the event.

The SSE can be classified into three groups. Primary SSE refers to suppuration subsequent to hematogenous spread; secondary SSE refers to iatrogenic contamination; and tertiary SSE refers to the local extension of an abscess [5]. Our case could be categorized as the tertiary SSE since it developed by local extension of osteomyelitis and epidural abscess. In our case, osteomyelitis is more likely to be originated from the systemic sepsis.

Surgical drainage followed by appropriate antibiotic therapy is the treatment opinion for SSE. Barthels et al [10], after reviewing 45 SSE patients, stressed the need for immediate surgical decompression and drainage for spinal abscess.
From a histological perspective, among six cases in which autopsy was performed [11], there was no inflammation of the spinal cord. Similar to the reporting case, no significant evidence of spinal cord lesion could be detected in the images nor during surgically.

CONCLUSION

We present a patient with pre-operative magnetic resonance imaging diagnosis of SSE. The images clearly depict the fluid collection within the subdural space with longitudinal extension, thickened and marked contrast enhancement of the dura matter. Besides, the contrast enhancement of the cauda equina nerve could be due to arachnoiditis.

The diagnosis of SSE depends on the high index of suspicion. Contemporary, MR image is useful in confidently to differentiating SSE from epidural abscess.

REFERENCE

術前核磁共振影像診斷脊椎下硬腦膜膿瘍

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文獻中只有少數脊椎下硬腦膜膿瘍被報告，而手術前的診斷更少。本文病例為一75歲女性，為子宮頸癌患者，因為高燒不退，白血球升高且下背疼痛來求診。病患本身為糖尿病患者，於15年前接受腰椎第四節與第五節手術併發骨髓炎。目前核磁共振影像可見腰椎第四節與第五節骨髓炎，且有上硬腦膜，下硬腦膜膿瘍。下硬腦膜膿瘍由腰椎第四節延伸到胸椎第十一節。經由椎板切除術及硬腦膜切開術證實，確實為下硬腦膜膿瘍。

關鍵詞：磁振造影，骨髓炎，下硬腦膜膿瘍