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Case Report

Detection of Surgery-related Spinal Cerebrospinal Fluid Leakage Using Magnetic Resonance Myelography

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Detection of cerebrospinal fluid leakage or exact localization of leakage site after spinal surgery is difficult on conventional imaging studies. We report two patients with surgery-related spinal CSF leakage detected on magnetic resonance (MR) myelography. They presented with severe headache after spinal surgeries, lumbar discectomy and excision of spinal meningioma, respectively. The sites of spinal CSF leakage in the patients were detected accurately on MR myelography, and the patients recovered from the postoperative CSF leakage after being treated with an epidural blood patch or reoperation. MR myelography may be effective in demonstrating the exact site of surgery-related spinal CSF leakage.

Index words : MR myelography · Spinal CSF leakage · Spinal surgery · Cerebrospinal fluid leakage

INTRODUCTION

An incidental dural tear resulting in cerebrospinal fluid (CSF) leakage is a complication of spinal surgery, with a reported incidence of between 0.3% and 16% (1, 2). The patient is likely to experience symptoms of CSF hypovolemia, including postural headache plus nausea, vomiting, pain or tightness in the neck or back, dizziness, diplopia, photophobia, tinnitus, and/or blurred vision. The usual treatment of CSF leakage consists of drainage of the CSF through a subarachnoid catheter (3) and surgical repair of the dural tear (4), although an epidural blood patch may also be used (5). To provide appropriate treatment, it is essential to detect the exact site of CSF leakage. Among the diagnostic modalities used to determine the site of CSF leakage are magnetic resonance (MR) imaging, computed tomographic (CT) cisternography, and radioisotope cisternography. Here, we describe two patients with surgery-related CSF leakage in whom the leakage sites were accurately detected on MR myelography.

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CASE REPORTS

Patient 1

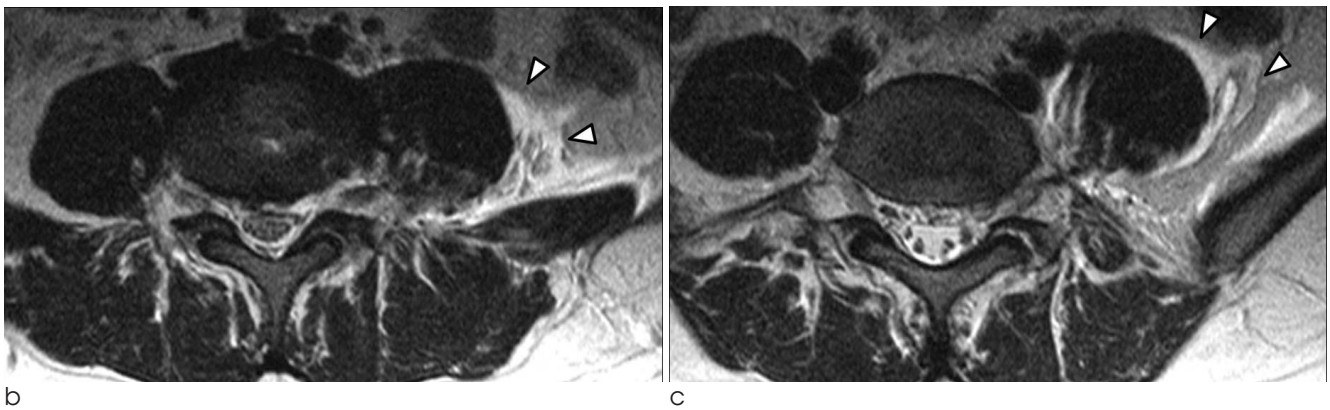
A 28-year-old woman developed severe headache accompanied by nausea and vomiting one day after a lumbar discectomy at L4-5 level for an intervertebral disc herniation. Spinal MR imaging showed a hyperintense T2 signal at the discectomy site, suggesting postoperative changes (Fig. 1a). Axial T2 weighted images of conventional MR showed left paravertebral fluid collection (Fig. 1b, c), but failed to detect exact

leakage site. MR myelography was performed to detect possible CSF leakage using a 2-dimensional (D) turbo spin echo (TSE) technique on a 1.5-T scanner (Gyroscan Intera, Philips Medical Systems, Best, the Netherlands). The scanning parameters were summarized in the table. MR myelography showed a small, hyperintense CSF leakage site at the left lateral aspect of the L4 level. We also observed diffuse hyperintensity in the left paravertebral area along the muscle bundles, representing local fluid accumulation secondary to CSF leakage (Fig. 1d). The patient was promptly treated with an epidural blood patch targeted to the leakage site. Her symptoms were relieved by the next day, and she was discharged without further events.

Patient 2

A 64-year-old woman was admitted due to an orthostatic headache that developed after spinal surgery. Six months earlier, she had undergone surgery to remove a spinal intradural extramedullary mass at the T11-12 level, which was pathologically confirmed as a meningioma. After the operation, she developed orthostatic headache, suggesting postoperative CSF leakage. She underwent two additional operations, but her symptoms did not improve. She was therefore admitted to our institution. A physical examination and laboratory tests showed no significant abnormal findings. Spine MR revealed a localized fluid collection at the previous operation site with a compression fracture of the T12 superior aspect. The patient underwent MR myelography to detect the leakage site, with 2D TSE and 3D balanced turbo field echo

Fig. 1. Patient 1, a 28-year-old woman who developed orthostatic headache after endoscopic lumbar discectomy at the L4-5 level.
a. T2-weighted sagittal image shows a focal hyperintense lesion (arrow) at the discectomy site at L4-5, with most changes being postoperative.
b, c. L4-5, L5-S1 level axial T2-weighted images show left paravertebral fluid collection (arrowheads) but fail to visualize exact leakage site.
d. 2D TSE coronal MR myelography shows the CSF leakage site (arrows) at the left side of the L4 level with paravertebral fluid collection (arrowheads) along the left paravertebral muscles.



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(BTFE) images obtained on the same 1.5-T scanner as in Patient 1. Detailed scanning parameters are summarized in the table. 2D TSE images and a maximum-intensity projection 3D BTFE rotational view showed the position of the fistula site in relation to the thecal sac and pseudomeningocele. Axial-reconstructed 3D BTFE images showed that the exact site of the fistula was in the left posterolateral aspect of the thecal sac at the T12 level (Figs. 2a-d).

A repeat operation at the T12 level confirmed the dural defect in the left posterolateral aspect of the thecal sac at the T12 level, corresponding to the position of the fistula on MR myelography (Fig. 2e). The defect was sealed using an artificial dura. The patient's headache was relieved after the operation, and her clinical course was uneventful.

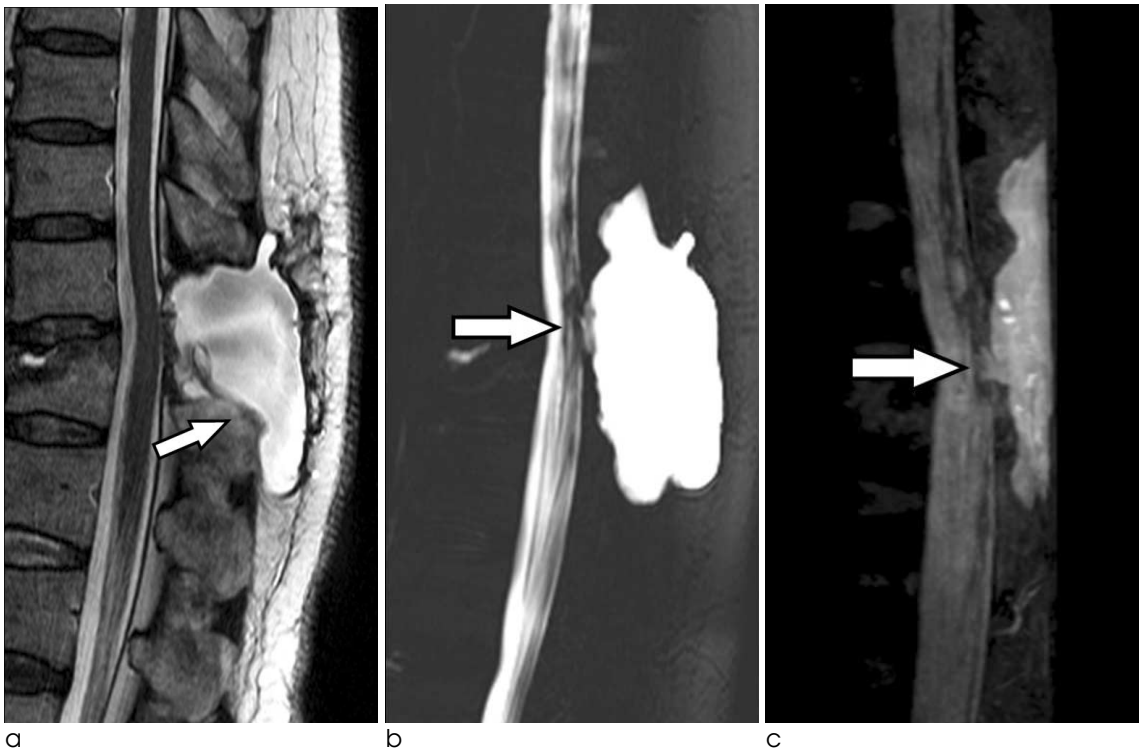

Fig. 2. Patient 2, a 64-year-old woman with orthostatic headache after resection of an intradural meningioma. (**a**) Postoperative T2-weighted sagittal image shows extradural fluid collection (arrow), but not the exact site of communication. 2D TSE sagittal (**b**) and MIP image of 3D BTFE MR myelography (**c**) show communication at the T12 level (arrow). (**d**) Axial reconstructed 3D BTFE image showing the defect on the left side of the thecal sac. (**e**) Intraoperative photograph of patient 2 shows that the dural defect (arrowheads) was located on the left side of dural sac and measured about 20 mm in length. The spinal cord is visible through the defect (Direction; H: head, F: foot).

Table 1. MR Scanning Parameters of 2D TSE and 3D BTFF Sequences

	2D TSE	3D BTFE
TR (msec)	8,000	5.1
TE (msec)	1,000	2.5
Slice thickness (mm)	50	0.5
Slice number	1	60
Field of view (mm)	270	250
Matrix size	512	512
TSE factor	256	256
Number of acqusition	1	2
Slice orientation	Coronal	Coronal
Acquisition time	72 sec.	4 min. 9 sec.

Note.— TSE = turbo spin echo, BTFF = balanced turbo field echo, TR = repetition time, TE = echo time

DISCUSSION

We performed MR myelography to detect possible CSF leakage in 2 patients with severe headaches after spinal surgeries. We found that MR myelography successfully identified the exact location of the leakage site or communication with a pseudomeningocele.

Postoperative detection of a dural tear may be difficult. The diagnostic techniques used to detect these sites are MRI, CT, CT cisternography, and radionuclide cisternography.

The basic principle of MR myelography is enhancement of the CSF signal by suppression of the adjacent tissue signal. MR myelography eliminates the signal from epidural fatty tissue because of its extremely long echo time and effective fat suppression (6, 7). MR myelography was useful in detecting CSF leakage in patients with spontaneous CSF hypovolemia (8).

We used a TSE sequence for 2D images and a BTFE sequence for 3D images. No MR contrast material was used for both sequences. In Patient 1, thick slab 2D TSE MR myelography clearly demonstrated the fistula site. However, in Patient 2, 2D TSE MR myelography demonstrate the fistula level, but could not clearly visualize its exact location, making 3D images necessary. 3D BTFE revealed better delineation of anatomic structures, with axial-reconstructed images clearly showing that the fistula site was on the left side of the thecal sac.

Several case reports have described the use of MR myelography to detect CSF leakage in patients with spontaneous CSF hypovolemia (9, 10). MR myelography has several advantages compared with RI cisternography and CT myelography. It is a noninvasive technique, there is no radiation hazard, and it can be performed easily within a short examination time. The false negativity of RI cisternography is relatively high than CT myelography (11). Contrast material should be used in CT myelography however, MR myelography is no need to use contrast material. In addition, MR myelography may show specific structural information of ligamentous integrity and spinal cord derangement (12). In cases with CSF leakage after spinal surgery, it is very important to determine the exact site of leakage for proper management. In our patients, MR myelography provided valuable information about the leakage sites, and both of them could be treated successfully.

CONCLUSION

We have shown that MR myelography is useful in detecting the exact site of surgery-related CSF leakage or dural defect in patients with CSF hypovolemia after spinal surgeries. MR myelography appears to be a safe, useful and practical tool to detect postoperative CSF leakage in the spine.

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자기공명척수조영술을 이용한 수술 후 척추 뇌수막액 누출 평가

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척추 수술의 합병증으로 뇌척수액 누출이 발생할 수 있는데 이를 영상학적으로 진단하는 것은 어려움이 있다. 이 연구에서는 자기공명척수조영술을 이용하여 척추 수술 후 뇌척수액 누출을 확인하였던 두 환자의 증례를 보고하고자 한다. 두 환자는 각기 요추 추간판 절제술과 척추 수막종 제거술을 받은 뒤 심한 두통을 호소하였다. 두 환자의 자기공명척수조영영상에서 척추 뇌수막액 누출 부위가 확인되었고, 이에 대해 환자들은 각각 epidural blood patch와 재수술을 받았다. 이 두 사례에서 자기공명척수조영술은 척추 뇌수막액의 누출 부위를 정확히 보여주었고, 척수강과 가성수막류 (pseudomeningocele) 사이의 교통로를 잘 나타내주었다. 척수 수술 후 뇌수막액 누출을 확인하기 위한 검사로 자기공명척수조영술이 유용한 것으로 생각된다.

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