รายงานผู้ป่วย

MRI evaluation of spontaneous CSF rhinorrhea: A case report

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Spontaneous cerebrospinal fluid (CSF) rhinorrhea is rare when compared with traumatic CSF rhinorrhea. Accurate localization of the site of leakage is essential for planning surgical treatment. We report a patient with spontaneous CSF rhinorrhea through a defect at the sphenoid sinus region detected by magnetic resonance imaging (MRI) and plain computed tomography. T2 weighted MR images are useful for the detection and localization of CSF leakage. MRI provides an accurate and noninvasive method for preoperative investigation of CSF rhinorrhea.

Key words: *CSF - Rhinorrhea, Magnetic resonance imaging.*

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พัชรี เลาประสพวัฒนา, สุกัลยา เลิศล้ำ, ทรงกลด เอี่ยมจตุรภัทร. การวินิจฉัยภาวะการรั่วซึมของน้ำหล่อเลี้ยงสมองและไขสันหลัง โดยการตรวจด้วยคลื่นสะท้อนในสนามแม่เหล็ก. จุฬาลงกรณ์เวชสาร 2542 ก.ย; 43(9): 665-71

การรั่วซึมของน้ำหล่อเลี้ยงสมองและไขสันหลัง (Cerebrospinal fluid leakage) จากบริเวณฐานกะโหลกศีรษะ มักมีการอักเสบติดเชื้อของระบบประสาทตามมา ทำให้เกิดอัตราการเจ็บป่วยและการเสียชีวิตสูงขึ้น การวินิจฉัยภาวะนี้ให้ได้รวดเร็วและถูกต้องแม่นยำจะทำให้การรักษาเป็นไปได้ทันท่วงทีและมีประสิทธิภาพ ในอดีตวิธีการวินิจฉัยภาวะ CSF leakage โดย Computerized tomographic cisternography และ Radionuclide cisternography เป็นวิธีการตรวจที่ยุ่งยาก อาจเกิดผลแทรกซ้อนจากการตรวจ ผู้ป่วยได้รับรังสี ในปัจจุบัน Magnetic resonance imaging (MRI) เป็นการตรวจที่สามารถแสดงให้เห็นตำแหน่งความผิดปกติของโรคได้แม่นยำ ทั้งยังไม่เกิดผลแทรกซ้อนจากการตรวจ ทำให้ได้ข้อมูลในการวินิจฉัย ภาวะ Cerebrospinal fluid leakage ที่สะดวก รวดเร็ว แม่นยำและปราศจากรังสี ซึ่งช่วยให้การรักษาเป็นไปได้ดียิ่งขึ้น

CSF rhinorrhea, which occurs wherever there is a bony defect in the skull base, can result from head trauma. tumor, infection, surgery or congenital defects (spontaneous).

Spontaneous CSF rhinorrhea is rare when compared with traumatic type.[1] CSF rhinorrhea is associated with morbidity (e.g., septic meningitis) and even mortality and often presents a diagnostic challenge, Accurate localization of the site of leakage is essential for planing surgical treatment, but localization of spontaneous leakage is much more difficult. Currently, computerized tomographic cisternography and radionuclide cisternography are used for evaluation of CSF leaks. There are many studies evaluating the role of MRI in the localization of CSF leaks.

MRI has a proven ability to demonstrate brain herniation into the temporomastoid component [2,3] and is also a highly effective means of evaluating fluid distribution.

We present a case in which spontaneous CSF rhinorrhea was shown by MR images and CT scan, and evaluale its usefulness for this rare condition.

Case Report

A 32-year old man suddenly experienced rhinorrhea from the right nostril for 20 days without history of head trauma or fever. The diagnosis of CSF rhinorrhea was made by MRI and additional plain CT scans in a coronal view. The MRI was obtained with a 1.5 Tesla magnetom unit (General Electic, Signa Horizon EchoSpeed) with sagittal view supine and prone position using SE (TR 440 ms/TE 8 ms), slice thickness 6/2 and 4/2 mm., respectively; axial view using SE (TR 440 ms/TE 8 ms), FSE (TR 3800 ms/TE 12 ms) and (TR 3800 ms/TE 108 ms), and FLAIR (TR 10002 ms/TE 172 ms) with slice thickness 6/2; coronal view in prone position using SE (TR 580 ms/TE 8 ms) FSE (TR 6000 ms/TE 168 ms), GR (TR440 ms/TE 18 ms), FSPGR (TR 11 ms/TE 2 ms) and SSFSE (TR 17052 ms/TE 516 ms) and (TR 17052 m/TE 557 ms) with slice thickness 3/0 mm.; T1 weighted images were obtained before and after admistration of intravenous Gd-DOTA.

The MR image revealed abnormal fluid collection in the right side of the sphenoid sinus with a small connection area between the paranasal sinus and the middle cranial fossa through a bone defect at the right lateral aspect of the sphenoid sinus, which was better seen in heavy T2 sequence. An abnormal widening of the subarachnoid space between the medial aspect of the tip of the right temporal lobe and the protrusion of the brain parenchyma (medial aspect of tip of the right temporal lobe) into the right side of the sphenoid sinus were demonstrated. Part of the herniated brain was well visualized by coronal SPGR images. Additional CT scans in a coronal view in a prone position with neck extension showed a bony defect at the right lateral wall of the sphenoid sinus with fluid collection.

At surgery, the dural tear and herniated gliotic brain tissue (pathologically confirmed) were identified through the bony defect at the right lateral wall of the sphenoid sinus corresponding with the MR imaging finding. Obliteration of the bony defect with fat and temporalis fascia was then performed for the treatment. The patient showed complete relief of the rhinorrhea after treatment.

Figure 1. Coronal unenhanced CT scan illustrates bone defect (arrow head) at right lateral wall of sphenoid sinus with evidence of soft tissue density lesion in right side of sphenoid sinus.

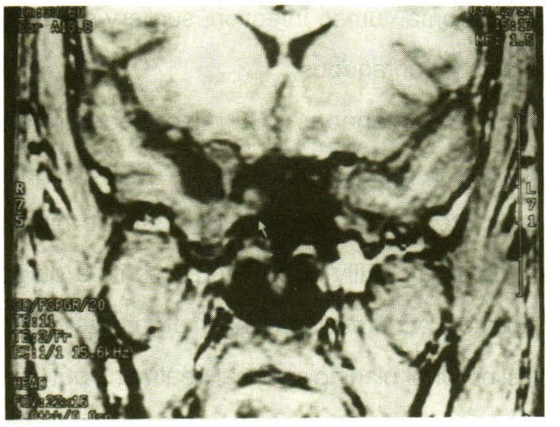

Figure 2. Coronal T1 weighted (SPGR) MR image reveals herniated medial aspect of right temporal lobe (arrow) through bone defect into right sphenoid sinus. Abnormal widening of subarachnoid medial to left temporal lobe is also noted.

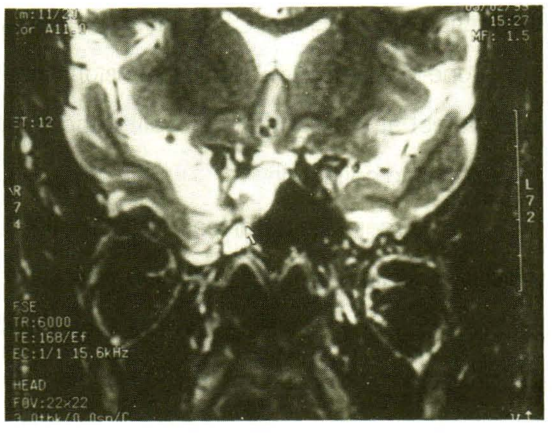

Figure 3. Coronal T2 weighted (FSE) MR image shows herniated right medial temporal lobe through bone defect into right side of sphenoid sinus. (arrow)

Figure 4. Coronal heavy T2 weight shows high signal intensity of CSF in widening sulci and part of herniated brain into sphenoid sinus. (arrow)

Discussion

CSF leakage has been classified into traumatic and nontraumatic groups on the basis of differences in clinical presentation and natural history. The major mode of presentation was rhinorrhea in spontaneous fistulae and recurrent meningitis in traumatic cases. Occult malformations of the skull base are rare anomalies. They are often not detected until they give rise to complications such as meningitis or cerebrospinal fluid rhinorrhea. Cephalocele is a condition of extracranial protrusion of intracranial contents through a bony defect.[4] It can be divided into congenital and acquired types. The congenital type (spontaneous) is usually a mid-sagittal defect in the calvarium and dura. If the defect contains only meninges and subarachnoid space, it is called a meningocele. If the defect contain brain as well, it is called an encephalocele.[4] Encephalocele is present in about one in every 4000 cases of all cephaloceles and 10 % occur in the basal skull. Basal cephaloceles can be grouped in to 5 major categories [4]: (1) Sphenopharyngeal group in this group, if the hemiated tissue only extends into the sphenoid sinus the subtype is termed transphenoidal. (2) Spheno-orbital group. (3) Sphenoethmoidal group. (4) Transethmoidal group and (5) Sphenomaxillary group. Our case was identified as sphenoidal encephalocele, a rare condition of the sphenopharyngeal type.

The cephalocele can present as a pharyngeal mass and act as a pathway for the development of CSF rhinorrhea and meningitis. Surgical repair is necessary for this condition, thus accurate localization of the site, and determination of the contents and extent of the lesion is necessary. Multiple methods are used to diagnose CSF rhinorrhea.

Currently, two commonly utilized techniques capable of demonstrating the abnormal flow of CSF through a defect in the skull base are CT cisternography (CTC) and radionuclide cisternography. Computed tomographic cisternography involves the intrathecal administration of noniodinated contrast material, after which the patient is positioned (prone with neck extended) so that the contrast material fills the skull base cistens, and then thin section CT scanning is performed. In case with active leakage, CTC can demonstrate the movement of the contrast material through a bony dural defect, however, this technique is cumbersome, invasive, and delivers a substantial amount of radiation to patient. Importantly, the diagnostic ability of CTC decreases in the face of an inactive leak, raising the real concern of false negative findings with an intermittent leak.[5-7]

Radionuclide cisternography is similar to CTC in that it involves the intrathecal administration of a radiophamaceutical (e.g., Technetium 99m) followed by imaging. The placement of nasal pledgets may, by differential radiocontamination, confer some limited localizing ability. [5,8] Radionuclide cisternography has some advantages over CTC in that it imparts a lower radiation exposure to the patient and also permits repeated examinations; however, like CTC, radionuclide cisternography is invasive and cumbersome and, in comparison to CTC, has substantially less spatial resolution and specificity.[9]

New MR image techniques have great sensitivity for observing the motion of fluid. Flow-sensitive MRI has been used to evaluate CSF flow in the head and spine, and to evaluate the presence of communication between CSF spaces. A full review of flow - sensitive MR image techniques discloses two techniques that have been found to be helpful in detecting very slow flow rates-slow flow MR (SFMR) and diffusion - weighted MR imaging. In both techniques, the sensitivity to flow can be controlled by the size and duration of large additional gradient pulses in the frequency encoding direction, usually at the expense ofincreased acquisition time. Additionally, in view of the inability of MRI to depict bony defects, CT scaning remains a useful adjunctive imaging modality.

We suggest that a simplier and easier technique to detect a small amount of CSF leakage is by using a heavy T2 technique. As the fluid is bright on T2WI, we can detect the leakage fluid but if a very small amount of fluid is present, the fluid may be missed due to obscuration by the adjacent tissue. Therefore, using the heavy T2 image is useful in such cases. The fluid SI on heavy T2 WI has brighter signal intensity than conventional T2WI. In this case, we used heavy T2WI to detect the CSF leakage, and the leaked fluid is easily seen in this technique. The bright signal from trapped cerebrospinal fluid or a herniated arachnoid in the dural-bone defect is noted on T2 images.

In MR images tissue discrimination is based on difference in longitudinal relaxation time (T1), transverse relaxation time (T2), and hydrogen density. But a better technique to see the grey-white differentiation of the brain tissue is the inversion recovery technique. This is used to be assured that the tissue apparent at the lesion is the brain parenchyma. Visualizing the continuity of brain into the dural and bony defect and the lack of dural covering are direct signs indicating encephalocele. We add CT imaging for detection of the bony defect which is the weak point of MR imaging.

Conclusions

The heavy T2 WI MRI technique is a simplier and easier technique for detection of a small amount of CSF leakage. Using of the inversion recovery technique for viewing of the herniated brain parenchyma and with visualization of the continuity of brain into the dural and bony defect without dural covering are direct signs indicating encephalocele. CT imaging is an additional image technique to see the bony defect. We recommend MRI as the first investigation in localizing CSF fistula because of the comparable accuracy to CTC, its noninvasive nature, and its nondependence on active leakage for a positive diagnosis.

References

1. Ommaya AK, Di Chiro G. Baldwin M, Penny backer JB. (1968) Nontraumatic cerebrospinal fluid rhinorrhea. J Neurol Neurosurg Psychiatry 1968 Jun; 31(3): 214-25
2. Nicklaus P, Dutcher PO, Hengerer AS, Kido DK, Nelson CN. New imaging techniques in diagnosis of cerebrospinal fluid fistula. Larygoscope 1988 Oct; 98(10): 1065-8
3. Kaseff LG, Seidenwurm DJ, Nieberding PH, Nissen AJ, Remley KR, Dillon W. Magnetic resonance imaging of brain hemiation into the middle ear. Am J Otol 1992 Jan; 13(1): 74-7
4. Som PM, Bergeron RT, Curtin HD, Reede DL. Head and Neck Imaging. 2nd ed. St. Louis: Mosby-Year Book, 1991
5. Flynn BM. Butler SP, Quinn RJ, Mc Laughlin AF, Bautovich GJ, Morris JG. Radionuclide cisternography in the diagnosis and management of cerebrospinal fluid leaks : the test of

choice. Med J Aust 1987 Jan 19; 146(2): 82-4

6. Dagi TF. CSF fistulas. Neurosurgery 1987 Jun; 20(6): 996-7

7. Chow JM, Goodman D, Mafee MF. Evaluation of CSF rhinorrhea by computerized tomography with metrizamide. Otolaryngol Head Neck Surg 1989 Feb; 100(2): 99-105

8. Park JI. Stretzow W. Friedman WH. Current management of cerebrospinal fluid rhinorrhea. Laryngoscope 1983 Oct; 93(10) 1294 - 300

9. Hasegawa M, Watanabe I, Hiratsuka H, Okumura T, Inanba Y. Transfer of radioisotope from CSF to nasal secretion. Acta Otolaryngol (Stockh) 1983 Mar - Apr; 95(3-4): 359-64