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Case Report

Transcranial and Epidural Approach for Spontaneous Cerebrospinal Fluid Leakage Due to Meningoencephalocele of the Lateral Sphenoid Sinus

Ryosuke Shintoku, Masahiko Tosaka, Tatsuya Shimizu, Yuhei Yoshimoto

Department of Neurosurgery, Gunma University Graduate School of Medicine, 3-39-22 Showa-machi, Maebashi, Gunma 371-8511, Japan

Abstract

We experienced a case of sphenoid sinus type meningoencephalocele manifesting as severe cerebrospinal fluid (CSF) rhinorrhea. A 35-year-old man became aware of serous nasal discharge 1 year previously, which had gradually worsened. The nasal discharge was diagnosed as CSF rhinorrhea. Head computed tomography (CT) showed several small depressions in the bone of the left middle cranial fossa, and the largest depression extended through the bone to the lateral sphenoid sinus. Head magnetic resonance imaging revealed that the meningoencephalocele projected to the lateral sphenoid sinus, through this small bone defect of the middle cranial fossa. We performed a combined craniotomy and epidural approach without intradural procedures using neuronavigation. Multiple meningoencephaloceles protruded into small depressions in the middle skull base. The small protrusions not passing through the sphenoid sinus were coagulated. The largest protrusion causing the CSF leakage was identified by neuronavigation. This meningoencephalocele was cut. Both the dural and bone sides were closed with double layers to prevent CSF leakage. The CSF rhinorrhea completely stopped after the surgery. In our case, identification of the leak site was easy with neuronavigation based on bone window CT. The epidural approach also has significant advantages with double layer closure, including both the dural and bone sides. If the site of CSF leakage is outside the foramen rotundum (as with the most common type of lateral sphenoid sinus meningoencephalocele), we recommend the epidural approach using neuronavigation for surgical treatment.

Keywords: *Epidural approach, neuronavigation, skull base meningoencephalocele*

Introduction

Skull base meningoencephalocele occurs in 1 of 35,000 births.[1] In particular, cerebrospinal fluid (CSF) leakage located in the lateral sphenoid sinus is exceptionally rare, and surgical repair presents several problems. Craniotomy and subdural and/or epidural approaches have been reported,[2] but intradural procedures may involve some invasiveness. The endoscopic transnasal approach has also been described, but leakage in the most lateral sites may not be easy to approach or manipulate under endoscopy.[3] We experienced a case of adult sphenoid sinus type meningoencephalocele manifesting as severe CSF rhinorrhea. We used a combined craniotomy and epidural approach without intradural procedures using neuronavigation to successfully repair the CSF leakage.

Case Report

A 35-year-old male first became aware of serous nasal discharge 1 year previously, which had gradually worsened. He was forced to remain in bed all day just before admission. He had no past medical or head trauma history. The nasal discharge was easily diagnosed as CSF rhinorrhea based on sugar contamination in the nasal discharge. Physical examination found no fever or neurological problems. Blood examinations indicated mild inflammatory response with white blood cell count 12,000/μl, and C-reactive protein level 2.81 mg/dl. CSF examinations found no abnormalities with cell count 2/mm^3, protein 23 mg/dl, and sugar 60 mg/dl. Head computed tomography (CT) showed several small depressions in the bone of the left middle cranial fossa [Figure 1]. The largest depression extended through the bone to the lateral sphenoid sinus [Figure 1]. Head magnetic resonance imaging revealed that the meningoencephalocele projected into the lateral sphenoid sinus, through this small bone defect of the middle cranial fossa [Figure 2].

The transcranial and epidural approach was planned. The neuronavigation

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Address for correspondence:
Dr. Ryosuke Shintoku, Department of Neurosurgery, Gunma University Graduate School of Medicine, 3-39-22 Showa-machi, Maebashi, Gunma 371-8511, Japan.
E-mail: ryosukeshintoku@gunma-u.ac.jp

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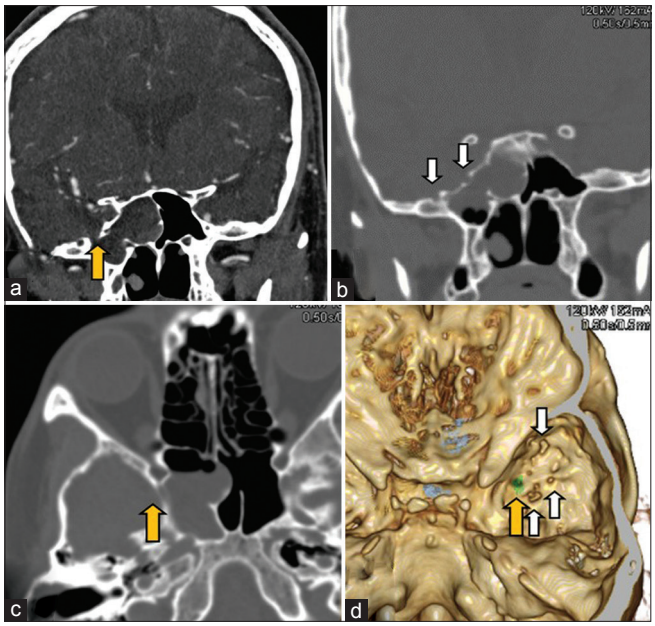

Figure 1: Preoperative coronal (a and b) and axial (c) computed tomography scans of the head showing some bone defects in the middle cranial fossa, including the largest bone defect. The true leakage site is indicated by the yellow arrow and pseudo bone defects by white arrows. Three-dimensional computed tomography reconstructed an image (d) the true leakage site (green mark and yellow arrow). Several other bone defects were observed (white arrows)

system (StealthStation™; Medtronic, Inc., Minneapolis, Minn., USA) and spinal drainage were positioned before the operation. After the right frontotemporal craniotomy, the middle cranial dura was removed from the skull base of the middle cranial fossa. Multiple meningoencephaloceles protruded into small depressions in the middle skull base [Figure 3]. The small protrusions not passing through the sphenoid sinus were coagulated. The largest protrusion causing the CSF leakage was identified by neuronavigation. This meningoencephalocele was cut. The dural defect was sutured watertight and sealed using fibrin glue. The bone defect was closed tightly with bone chips and fibrin glue. Both the dural and bone sides were closed with double layers to prevent CSF leakage.

The CSF rhinorrhea completely stopped after the surgery. However, he complained of severe headache, suspected to result from relatively high intracranial pressure. The intracranial pressure was controlled gradually, using spinal drainage which was removed at 6 days after surgery. Postoperative CT revealed that the encephalocele and the bone defect were repaired. He was discharged without CSF rhinorrhea, headache, or neurological symptoms.

Discussion

Encephalocele from the middle cranial fossa is typically associated with a defect on the lateral side of the foramen rotundum and vidian canal. CSF pressure and hydrostatic pulsatile forces may cause the development of multiple ovoid, small holes on the middle fossa at the sites of

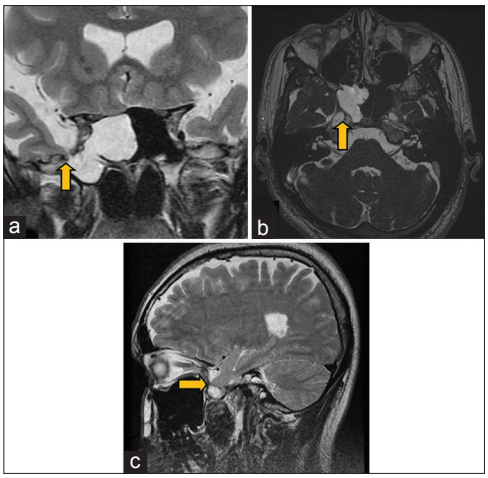

Figure 2: Preoperative coronal (a), axial (b), and sagittal (c), T2-weighted magnetic resonance images of the head showing the meningoencephalocele projecting into the sphenoid sinus from the largest bone defect (yellow arrow)

arachnoid villi with herniation of dura/arachnoid or brain tissue into the sinus.[4-6] Such pits or irregularities along the floor of the middle cranial fossa were found in 63% of patients.[4] Axial bone CT imaging of our patient clearly showed multiple ovoid bony defects in the greater wing of the sphenoid bone representing arachnoid pits due to aberrant arachnoid granulations [Figure 1].[4-6] At surgery, multiple small depressions were found in the middle skull base, but only one extended through to the sphenoid sinus and was related to the CSF leakage. Although all these multiple depressions must be considered intraoperatively as potential sites for CSF fistula, the true leak site may be unique as in our case. These tricky anatomical features of meningoencephalocele of the lateral sphenoid sinus could hinder identification of the true sites of CSF leakage during repair surgery, especially using the transcranial approach.

Meningoencephalocele may be repaired by various methods, including intradural and/or epidural approaches through craniotomy, and the endoscopic transsphenoidal approach.[3,5,7] The advantages and disadvantages of these three approaches remain controversial.[3,7-10] The combination of intradural and epidural approaches was often performed in early small case series.[2,5,11] Recently, the endoscopic approach has been described with various devices and modifications.[3,7,8,12,13] The endoscopic approach may provide easier access to midline lesions in the nasal cavity, but poses some difficulties in the approach to the lateral site of the sphenoid sinus.[3,7,8,12,13] Large nasal flap and the extended opening of the sphenoid sinus may not be less invasive than simple craniotomy and epidural procedures.[3]

The intradural or epidural approach is easy to perform since frontotemporal craniotomy is the most common approach in neurosurgery. Craniotomy and the intradural approach are frequently performed.[5,9,10] However, these approaches may

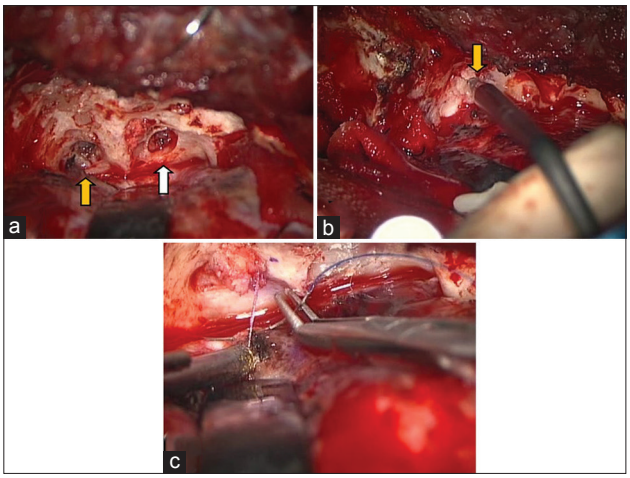

Figure 3: Operative photographs showing some depressions in the middle temporal skull base, with multiple meningoencephaloceles protruding into the holes of the middle skull base. The true leakage site is indicated by the yellow arrow, and pseudo bone defects by white arrows (a). The largest protrusion causing the cerebrospinal fluid leakage was identified by neuronavigation (b). The dural defect was sutured watertight, and sealed using fibrin glue (c)

cause the greatest invasiveness to the brain. In addition, the intradural route may pose problems for the multiple layer closure of bone defects.

The epidural approach is the least invasive method without intradural manipulations.[14,15] Multiple ovoid depressions may be found on the base of the temporal bone. However, only one pit is related to the CSF leakage as previously discussed. Therefore, recent neuronavigation methods based on bone window CT will be useful with the epidural approach. In our case, identification of the leak site was easy with neuronavigation based on bone window CT. The epidural approach also has significant advantages with double layer closure, including both the dural and bone sides.

Conclusions

If the site of CSF leakage is outside the foramen rotundum (as with the most common type of lateral sphenoid sinus meningoencephalocele), we recommend the epidural approach using neuronavigation for the surgical treatment.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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