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Case Report

Our Experience in the Management of CSF Otorrhea: A Transmastoid Approach with Middle Ear Cavity Obliteration and a Middle Cranial Fossa Approach

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ABSTRACT

In this report, we present two cases of patients with cerebrospinal fluid (CSF) otorrhea who underwent surgical repair through either a transmastoid or middle cranial fossa approach. In our first case, a 34-year-old male after head trauma with conductive hearing loss and a House-Brackmann grade 2 facial palsy was found to have a soft tissue mass protruding through his right tympanic membrane. Radiological examination revealed a wide tegmen tympani defect. He underwent surgery via a transmastoid approach with repair of the defect and blind sac closure of the external auditory canal after middle ear cavity obliteration. Our second case involved a 50-year-old female who had developed chronic clear otorrhea following tympanostomy tube placement. Radiological evaluation revealed a tegmen tympani defect and CSF fistula. She underwent a middle cranial fossa approach in which a multilayer closure technique was performed. These two cases illustrate that the type of surgical approach for the CSF otorrhea repair depends on the location and size of the defect and hearing status. We recommend a multilayer closure to ensure proper resolution of the defect.

KEYWORDS: Cerebrospinal fluid, Mastoid, Mastoidectomy, Middle cranial fossa, Otorrhea

INTRODUCTION

Otorrhea is a possible complication after head trauma; however, a spontaneous or iatrogenic cerebrospinal fluid (CSF) leak is also a possibility that often presents inconspicuously. In most of these cases, otorrhea is resolved either spontaneously or with conservative management only. Friedman et al. (7) reported that surgical intervention was required in just 12% of their patients with a CSF leak. Still, persistent cases, especially in those that have gone through an initial otorrhea-related surgery, are challenging to surgeons due to the difficulties in finding a novel surgical approach and technique that can repair the defect. This is compounded by the increased risk of meningitis and intracranial complications as CSF leak continues. In this report, we aim to share our clinical experience in managing CSF otorrhea with two different surgical approaches. All procedures contributing to this work were performed after the patients signed the informed consents.

CASE REPORTS

Case 1

A 34-year-old male presented with right-sided hearing loss and facial asymmetry after a fall from balcony 25 years

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prior. Since the event, he had been experiencing intermittant episodes of clear otorrhea, but did not complain of this on current admission. On otoscopic examination, a fluctuant whitish mass protruding into the external auditory canal (EAC) was seen. Pure tone audiogram (PTA) demonstrated a mixed type of hearing loss with a 48-decibel (dB) average sound pressure level (SPL) threshold and an 18 dB air-bone gap (ABG). He also had a House-Brackmann grade 2 peripheral facial palsy. Temporal bone computed tomography (CT) and magnetic resonance imaging (MRI) findings revealed a large tegmen tympani defect and cranial meningocele herniation on the right.

A transmastoid approach was decided upon. Upon initial investigation after postauricular incision, the antrum was full of soft tissue (encephalocele) that was gently cauterized and excised. The canal wall was then taken down and we found that the incus and the superstructure of the stapes were absent. Multiple defects of the tegmen tympani and tegmen mastoideum were present. A tragal cartilage perichondrium graft and bone pâté were used as the first layers for the reconstruction (Figure 1). Laterally, a cellulose-covered tragal cartilage graft was laid. Fibrin glue was injected between the two layers. The cavity was then obliterated with abdominal fat and a musculoperiosteal flap and the EAC was closed blindly. No intraoperative or postoperative complications or sensorineural hearing loss were experienced. During a 48-month follow-up, no relapse was observed. Pre- and postoperative radiological studies (Figure 2A, B) proved that the defects were successfully closed.

Case 2

A 50-year-old non-obese female was referred to our department because of a persistent clear otorrhea after the placement of a right tympanostomy tube for the treatment of otitis media with effusion. PTA was done showing a mean air conduction threshold of 27 dB SPL and a 22 dB ABG. Temporal bone CT and MRI confirmed the diagnosis of a tegmen tympani defect and CSF fistula.

A middle cranial fossa approach was preferred and a 4x4 cm craniotomy was created. A 2x1 cm bone defect of the tegmen tympani and several defects of the middle cranial fossa dura were encountered. Brain tissue protruding into the epitympanic space was carefully cauterized and removed. A fascia graft was first overlaid for the repair, then a 2x1 cm cortical bone graft figured for the defect frame was tucked in to fit the defect (Figure 3). A second layer of fascia graft was then used to cover the bone graft underneath the dura. Fibrin glue was injected and gelatin sponge strips were placed above. There were no intraoperative or postoperative complications or sensorineural hearing loss. During a 15-month follow-up, no relapse was observed. Pre- and postoperative radiological studies demonstrated that the defects were successfully closed (Figure 4A, B).

■ DISCUSSION

The tegmen tympani is the most common location for an otogenic CSF fistula due to a defect in the bone (5). Head trauma is the most frequent etiology for most adult cases, whereas spontaneous leakage is the second most common cause (5). A refractory unilateral serous otitis media, conductive hearing loss, clear otorrhea following ventilation tube insertion, and the sensation of aural fullness should alert the physician to this possible condition.

A few theories have been suggested in the pathophysiology of spontaneous CSF otorrhea; congenital defects, arachnoid granulations eroding the bone (8), and CSF pulsations related to intracranial hypertension or obesity leading to a bony erosion, which necessitates measuring the opening pressure during lumbar puncture, are all viable possibilities that explain the sudden occurrence of otorrhea (1). Since both of our cases did not present with the features of intracranial hypertension, such as papilledema, ventricle dilatation on radiological evaluation, and obesity, we did not perform preoperative lumbar drainage.

β2-transferrin positivity in otorrhea fluid is a sensitive and specific diagnostic tool (11) that was present in both patients. High-resolution temporal bone CT imaging has a sensitivity of > 90% (13), and T2 weighted MRI has a similar sensitivity (75%–90%) and is often used to further elucidate the adjacent soft tissue structures (3,13). Both of these imaging modalities were capable of identifying the bony defects and herniation apparent in our cases.

To the best our knowledge, traumatic leaks, especially if they are small, tend to heal spontaneously or by conservative management only. However, our first patient had undergone several conservative procedures during the 25-year period following his traumatic event, which did not control the leak. Moreover, the inability to stop the fluid escape initiated the emergence of an encephalocele with a simultaneous cholesteatoma, which required a more aggressive surgical management strategy. On the other hand, our second patient, who had been followed by another medical center before admission to our department, had still experienced unfavorable results. Surgical management was thus inevitable.

The surgical approach in the management of CSF otorrhea is an important factor to ensure better overall outcomes, and the selection depends on the following principles: hearing status, status of the ossicular chain and the middle ear, size, and location of the defect, and the surgeon’s experience. In addition, the ability to provide an adequate exposure of the defect is necessary for a sufficient repair (12).

The transmastoid approach has been reported as the most familiar and comfortable route for otolaryngologists (5,11,13), and is accepted to be sufficient by itself for most cases (8,11). It allows sufficient access to the posterior fossa or lateral tegmen tympani fistulas; however, the medial tegmen tympani can be underexposed necessitating the removal of parts of the ossicular chain (9). In anterior, multiple, or large defects, the transmastoid approach does not guarantee permanent cessation of the leakage (9). Middle ear obliteration may also supplement this technique to provide an additional safety measure (2) to patients with a nonserviceable hearing level or a large encephalocele (9), which was seen in our first case.

Middle fossa craniotomy has become popular in treating medial, anterior, multiple, or significant defects (7). Hearing preservation, wider exposure, and lower recurrence rates are important advantages that this approach has compared with the transmastoid one. However, this technique requires advanced surgical experience and has limitations for posterior fossa fistulas. Complications include postoperative seizures, venous infarction, and geniculate ganglion or greater superficial petrosal nerve injury (11). In our second case, a middle fossa craniotomy approach was preferred considering the anterior extension of the defect and almost normal hearing status of the patient.

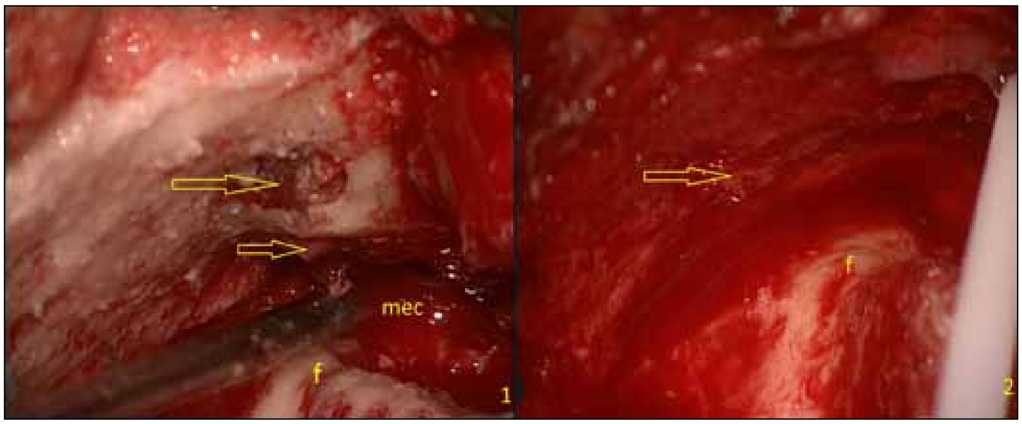

Figure 1: Intraoperative surgical image of case 1. The two yellow arrows indicate the defects of the tegmen tympani in Picture 1 (right inferior corner). The yellow arrow in Picture 2 (right inferior corner) shows the defect being closed using bone pâté and tragal perichondrium. (**f:** Facial nerve mastoid segment, **mec:** middle ear cavity).

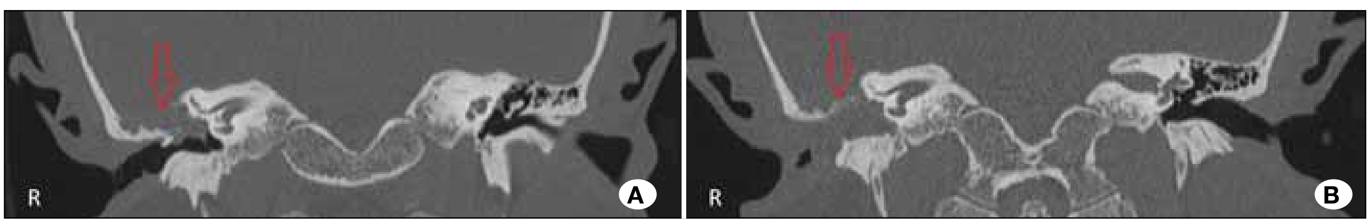

Figure 2: High-resolution coronal temporal CT presenting pre- **(A)** and postoperative **(B)** views of the tegmen tympani defect for case 1. Red arrows in Picture "a" and "b" indicate the bony defect and the successful surgical closure, respectively. (**R:** right).

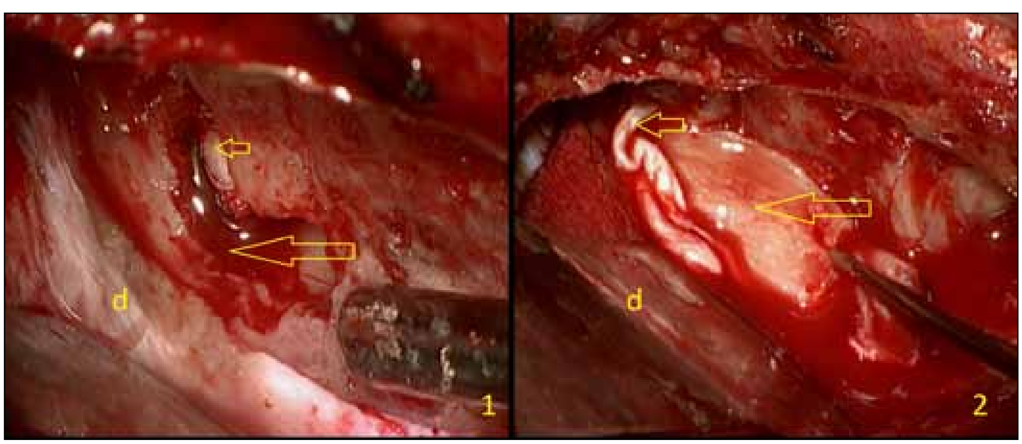

Figure 3: Intraoperative surgical view of case 2. The small yellow arrow at the top refers to the incus and the big yellow arrow at the bottom indicates the defect of the tegmen tympani in Picture 1 (right inferior corner). The small and the big yellow arrows at the top and bottom point at the temporalis fascia and cortical bone grafts, respectively, in Picture 2 (right inferior corner). (**d:** Dura mater)

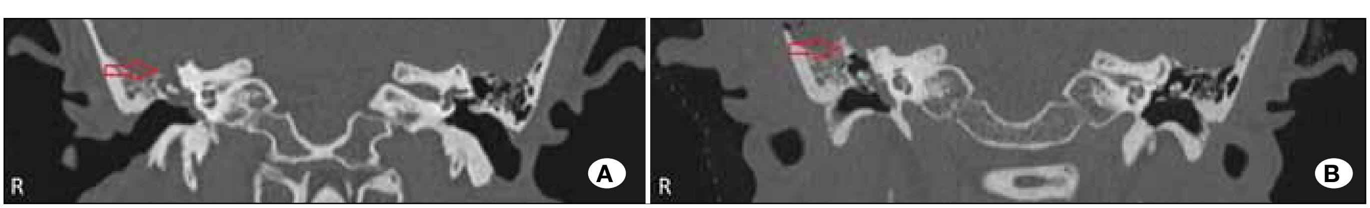

Figure 4: High-resolution coronal temporal CT presenting pre- **(A)** and postoperative **(B)** views of the tegmen tympani defect for case 2. Red arrows in Pictures "a" and "b" indicate the bony defect and the successful surgical closure, respectively (**R:** right).

A combined approach (transmastoid and mini-craniotomy) has been suggested to include the advantages of both techniques and at the same time eliminate the disadvantages (2,5,9,12). Regarding the various techniques, a retrospective series of 55 patients operated for CSF otorrhea indicated no significant differences in the recurrence rates (10).

Cortical bone, bone pâté, septal or auricular cartilage, fascia lata, temporalis muscle, fascia of the temporalis muscle, abdominal fat, and artificial biocompatible materials, such as bone wax, hydroxyapatite cement, and fibrin glue, have all been used for this type of repair (4,6,12,14). The prevailing view supports a multilayer closure consisting of different sorts of autologous tissues (4).

■ CONCLUSION

In accordance with the current literature (5), we found that the use of two or more different supporting graft layers combined with tissue adhesives can increase the success rate of the repair to nearly 100%.

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