Endoscope Assisted Subcochlear Approach for Symptomatic Petrous Apex Effusion

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Abstract: Petrous apex effusions are rare disorders and usually occur in the petrous apex (PA) having well-aerated cells and it may present with several symptoms or can be diagnosed incidentally on imaging methods obtained for another reason. If there are persistent symptoms despite the conservative treatment in symptomatic patients, a surgical attempt can be considered. In patients with favorable hearing levels and with the well-pneumatized petrous bone, PA cells may be effectively drained through subcochlear or supracochlear approaches by preserving patient's hearing levels. In this case report, the authors presented a severe symptomatic patient with petrous apex effusion who did not respond to conservative treatment and petrous apex drainage was performed via the subcochlear approach.

Key Words: Drainage, headache, infections, petrous apex

The petrous bone is a part of the temporal bone and about 33% of petrous bones contain pneumatized cells.[1,2] Petrous apex(PA) may be affected by acute infections, effusions, mucoceles, cholesterol granulomas, cholesteatoma and neoplasms. Petrous apex effusion, unilaterally or bilaterally, is a disorder rarely seen.[3] Patients with PA effusion may be asymptomatic(leave-me-alone lesions) detected on imaging methods incidentally.[4] Symptomatic patients can have headache, decreased corneal reflex, diplopia, facial paresthesia, hearing loss, vertigo, pressure sensation and facial spasms. Correct diagnosis entails a complete head and neck examination and imaging tools, magnetic reasons imaging (MRI) and computed tomography (CT).[5]

Symptomatic patients can be treated with conservative approach whereas surgery is considered if conservative treatments fail. Subcochlear approach is one of available routes for accessing to the PA region. Endoscopes could also assist to drain PA effusions.

In this case report, we aimed to present a symptomatic PA effusion case successfully treated with endoscope assisted microscopic subcochlear approach.

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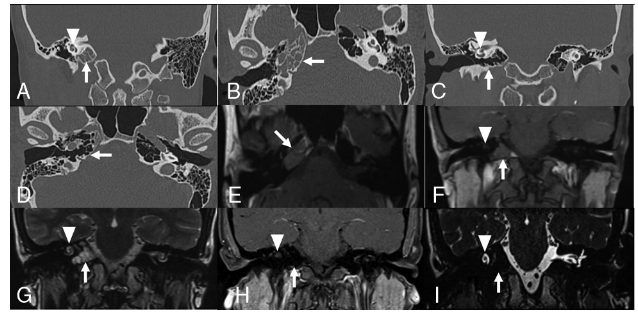

FIGURE 1. The preoperative views of the effusion on coronal (A) and axial (B) sectioned temporal CT. The postoperative views of the drained cells on coronal (C) and axial (D) sectioned temporal CT. The view of petrous apex effusion on T1-weighed images with contrast of MRI (E). The preoperative views of the effusion on coronal sectioned T1 (F) and T2 (G) weighed MRI. The postoperative views of the drained cells on coronal sectioned T1 (H) and T2 (I) weighed MRI. White arrowhead: cochlea, white arrow: petrous apex cells.

CLINICAL REPORT

A 20-years-old female patient was admitted with the complaints of the right retroorbital pain, hemifacial spasm and numbness for nine months. She had no any additional disease. A complete head and neck examination was performed. Corneal reflex loss and facial hypoesthesia were detected on the right side. Bilateral otoscopic examination was normal and other head and neck examinations were unremarkable. On blood count assessment, the white blood cells and C-reactive protein were within normal ranges. Audiometric evaluation was normal. The PA cells were filled with a hypodense lesion without expanding and eroding on CT. T1 and T2-weighted images of MRI showed hypointense and hyperintense lesion in the PA cells, respectively. The lesion did not have any contrast enhancement on T1-weighted images (Fig. 1). Along with the present findings, we considered to be PA effusion in the patient. The patient was given 1000 mg amoxicillin clavulanic acid twice daily and 1 mg/kg methylprednisolone for 14 days. The patient exhibited no clinical improvement and surgical treatment was planned.

Subcochlear approach was planned as treatment method because the patient had favorable hearing levels. Anatomic relations among facial nerve (FN), the jugular bulbus (JB), the cochlea and the carotid artery (CA) on CT images were also a suitable route for reaching the PA. After induction of anesthesia, facial nerve monitoring (Medtronic Xomed Inc., Jacksonville, FL, USA, NIM-Response3.0; nerve integrity monitoring system) was set up and the electrodes were placed into orbicularis oris and oculi muscles. A retroauricular insizyon was performed afterwards mastoid cortex was exposed and the skin of the external auditory canal (EAC) was elevated from the posterior part of the bony canal. After a crescent incision to the canal skin, the tympanic membrane was visualized. A tympanomeatal flap was elevated off the bone of the EAC. Tympanic anulus was elevated and the middle ear was entered via middle ear mucosa. The area inferior to the cochlea, anterior to JB and posterior to CA was opened with a small-sized diamond drill. After dissection of the PA cells, pure clear colored entrapped liquid leakage from the PA cells was seen. To ensure a better close vision to the PA cells and to drain the deep cells, a 0°, 14 cm in length and 3 mm in diameter telescope was used and deep PA cells were drained with the use of ear picks under endoscopic visualization (Fig. 2). This region was enlarged and the existing effusion within PA was completely drained. The obtained fenestra below to the cochlea was large enough to drain the PA cells, thus a stent for drainage was not placed between the PA cells and the middle ear cavity. Any complication was not seen during and after operation.

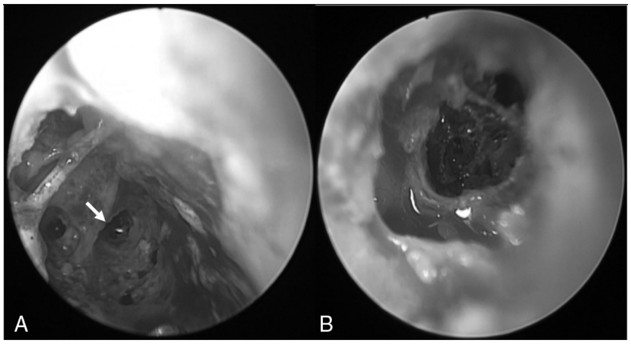

FIGURE 2. The endoscopic view of surgical route running petrous apex under cochlea (A, white arrow) and the opened petrous apex cells (B) during subcochlear approach.

The patient completely recovered from her complaints and control CT imaging one month after the surgery was normal. No recurrence of the symptoms was observed on the first-year control visit.

DISCUSSION

Petrous apex effusions can present with several symptoms whereas they may be sometimes diagnosed incidentally on imaging methods obtained from another reason. The PA effusions may lead to hearing loss, headache, vertigo, pressure sensation and facial spasms.[5] Asymptomatic patients should be followed up along with serial imaging tools. Symptomatic patients can be treated with antibiotics and steroids.[3] If the symptoms persist despite conservative treatments, a surgical attempt can be considered. Sometimes the trapped fluid in the PA may remain as an occult infection. Middle ear and mastoid region infections are thought to be the main source of PA effusions. The latent infection in the PA region may proceed to meninges or cavernous sinus by tracking the preformed ways. Intracranial spread of this occult infection may cause meningitis, abducens nerve paralysis and cavernous sinus thrombosis. For this reason, the symptomatic PA effusions should be appropriately treated to prevent the further life threatening complications.[5]

Imaging modalities have some properties depending on the lesion type in the PA. Both CT and MRI may enable surgeon to make a correct diagnosis for PA lesions. Effusions can be seen as hyperintense lesions on T2-weighed images and iso/hypointense lesions on T1-weighed MRI.[6] Additionally, effusions on T1-weighed images do not show any contrast enhancement. It is important to distinguish effusion from lesions similar to effusion on MRI. Cholesterol granulomas have a high signal intensity in both T1 and T2-weighed images of MRI but they do not have contrast enhancement; however, it can be seen that the bony erosion is present on CT images. Cholesteatomas have the similar findings with cholesterol granulomas in both MR and CT except for a low signal intensity on T1-weighed images. Cephalocele and mucoceles may have similar radiological features on MRI as compared to PA effusions. However, cephalocele and mucoceles can lead to a notable bony expansion or erosion on CT unlike PA effusions. Neoplasms can present as iso/hypointense lesions on T1 and hyperintense lesions on T2-weighed MRI images, but they may exhibit a high contrast enhancement on T1-weighed images. Additionally, neoplasms may erode bone thus the destroyed bony trabeculae may be seen on CT images.[5] Therefore, a thorough radiological evaluation is mandatory to make a correct preoperative differential diagnosis of the PA lesions. In our patient, the preserved and non-expanding air cells were present on the CT imaging, and high signal intensity on T2 and low signal intensity on T1-weighed images of MRI were seen without contrast enhancement with a preliminary diagnosis of the PA effusion.

Many surgical procedures have been defined for accessing the PA.[5] The most appropriate procedure to drain the PA cells may change depending on various factors. These factors are anatomical relations among the vital structures around PA, hearing status of the patient and experience of the surgeon. If the patient has favorable hearing thresholds, subcochlear, infralabyrinthine, retrolabyrinthine, middle cranial fossa (MCF) and transsphenoidal approaches can be used to access the PA region.[5] On the other hand, translabyrinthine or transcochlear approach may be used for accessing the PA region in the presence of an unfavorable hearing.[7] Middle cranial fossa approach preserves the hearing levels of the patient; however, it needs a craniotomy and may rarely cause cerebral edema and dural injury. Additionally, MCF is not suitable to access the inferiorly localized PA lesions. Translabyrinthine or transcochlear route entails sacrification of the present hearing. Subcochlear way enables inferiorly approach to the PA region among the CA, JB and the cochlea.[8] Subcochlear way may have some limitations because the presence of high JB may prevent surgical attempt. Additionally, superiorly situated solid lesions in PA are not suitable for subcochlear route.[9] Fluid lesions use gravity forces to drain elsewhere from a site; therefore, inferiorly approaching to the PA region is the most logical way for fully draining the trapped effusion. Inferior approach provides the opening of the PA cells and the trapped effusion drains to the middle ear and mastoid region in the normal anatomical position when the patient is standing. However, 16.7% of patients who were undergone subcochlear approach had the obstruction of the surgical fenestra by the fibrous tissue.[10] Scopel et al proposed that endoscopic transsphenoidal approach(ETA) provides larger window than subcochlear one to drain PA cells and has lower recurrence rates. However, ETA includes undesirable conditions, including abducens nerve paralysis, vidian nerve injury and trauma to the eustachian tube.[9]

Microscopes, endoscopes or combination of both can be used to access the PA cells. The benefit of the endoscope assisted PA drainage is that it enables a close view of the deep PA cells in a deep and narrow tunnel from the hypotympanum in the subcochlear surgical route. We used the microscopic approach initially to obtain a larger view of the surgical region. After creating the subcochlear window effectively, we used endoscope to visualize and drain the deep PA cells. The most useful route should be chosen based on the anatomic relations, hearing status, PA pneumatization, lesion location and surgeon's skill and experience for surgical approach to the PA lesions.

CONCLUSION

Petrous apex effusions should be treated with surgical drainage in symptomatic patients when the conservative treatment options fail. Subcochlear approach, preserving the patients' hearing status, is an effective and minimally invasive route for PA effusions. Endoscopic assistance provides visualization of the deep PA cells and an effective drainage for PA effusions.

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