Subtotal Petrosectomy and Eustachian Tube Obliteration for Life-Threatening Pneumocephalus and Cerebrospinal Fluid Leak

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Objective

The purpose of this study is to illustrate a case of pneumocephalus in which a patient presented with life-threatening pneumocephalus secondary to a lateral skull base defect without an identifiable CSF leak.

Introduction

- Spontaneous pneumocephalus is a rare, potentially life-threatening condition often secondary to a cerebrospinal fluid (CSF) leak.
- Surgical management of CSF leaks depends on the location of the dural and osseous defect.
- Imaging modalities such as thin-cut computed tomography (CT), magnetic resonance imaging (MRI) and CT cisternogram can aid in identification of a source of CSF leak.
- Surgical options include open or endoscopic approaches and often requires multidisciplinary management with neurosurgery and otolaryngology.

Illustrative Case

- Patient is a 76-year-old female who presented to an outside hospital with a two-year history of progressive headache, cough, ear fullness, and left facial pain. Her BMI was 15.43 kg/m^2.
- CT imaging revealed scattered pneumocephalus with concern for osseous defects in the left petrous temporal bone with opacification of the mastoid air cells.
- The patient was referred to our neurosurgery clinic where we performed an MRI and CT of the temporal bone. Imaging showed progression of pneumocephalus and dehiscence at the left petrous apex (Figure 2).
- The patient was admitted for further evaluation and CSF leak repair. During admission, she experienced gradual decline in neurologic exam where she became more somnolent. An emergency CT of the head was obtained which demonstrated significantly worse pneumocephalus (Fig. 1C and D).

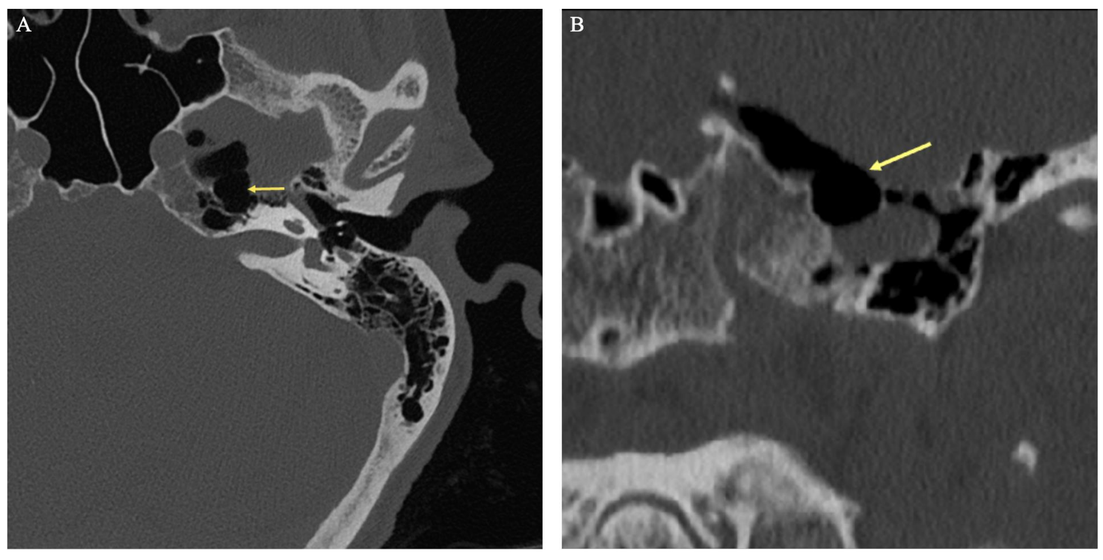

Figure 2. CT imaging of the temporal bone 1 week pre-operation. The yellow arrow on the coronal view (A) and axial views (B) depicts the skull base defect.

Surgical Approach

- Patient underwent a meato/canaloplasty with subtotal petrousectomy.
- The first step included obliteration of the external ear canal.
- Once the canaloplasty/meatoplasty was completed a mastoidectomy was performed with identification of the sinodural angle, epitympanum and facial nerve. After identifying appropriate landmarks, the stapes was separated from the incus, the tensor tympani was divided and the annulus, tympanic membrane and external ear canal squamous epithelium was cleared. The facial nerve was identified and left covered in bone at the vertical and tympanic segments
- After performing the mastoidectomy and petrousectomy the temporalis muscle was harvested and used to obliterate the Eustachian tube. The mastoid cavity was obliterated using an autologous fat graft harvested from the lateral thigh. The muscle and skin were closed in layers. The patient tolerated the surgery well without any immediate postoperative complications and had HB1 facial nerve function.

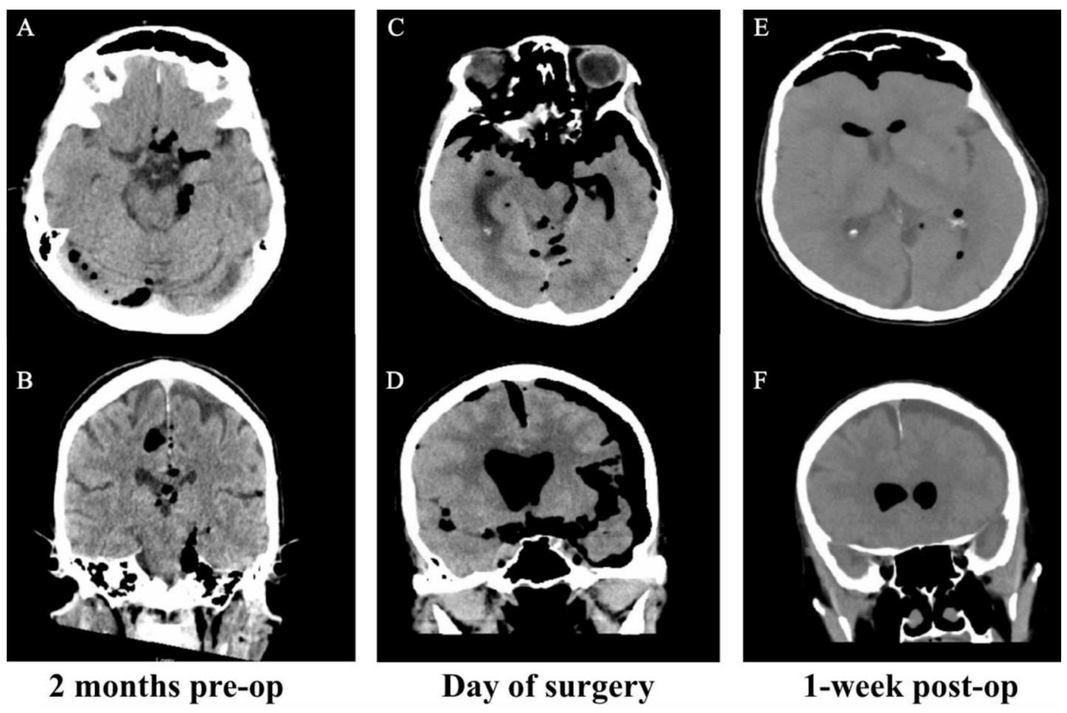

Figure 1. Axial and coronal sections of CT imaging without contrast 2 months preoperative (A and B), day of surgery (C and D), and 1 week post-operatively (E and F).

Discussion

- Approaches for surgically treating temporal bone or lateral skull base spontaneous CSF leaks traditionally include middle cranial fossa (MCF), transmastoid (TM), or a combined approach of the two.
- While traditional MCF approaches are effective at treating this pathology, we believed this approach was higher risk given our patients frail condition and the location of the defect in the petrous apex.
- Given the location of the defect and the relatively high risk of other surgical approaches for our patient, a subtotal petrousectomy and Eustachian tube obliteration was chosen as the ideal approach for this patient.

Conclusions

Middle fossa CSF leaks often present with otorrhea or rhinorrhea. The current case illustrates an uncommon presentation of life-threatening tension pneumocephalus secondary to a CSF leak through the petrous apex. Common surgical treatments for middle fossa defects include traditional mastoidectomy, Middle fossa craniotomy or combined approaches. The current case illustrates successful repair of a CSF leak through the petrous apex using a subtotal petrousectomy with obliteration of the external ear canal and eustachian tube.

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