

Association of Temporal Bone Encephalocele and Chronic Otitis Media

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Introduction

Temporal bone encephaloceles are defects in the skull base bone, usually the tegmen mastoideum or tegmen tympani, which separate the middle cranial fossa (MCF) and the mastoid and the middle ear, respectively. Herniations can also occur through the defect. Though these encephaloceles may result from congenital abnormalities, they can also be acquired from spontaneous, iatrogenic, traumatic, neoplastic, and inflammatory processes such as chronic otitis media (COM).

The incidence of spontaneous encephaloceles has increased in recent years due to factors such as idiopathic intracranial hypertension. Other causes exist, namely chronic otitis media (COM) with and without cholesteatoma (Fig. 2A), which are associated with and perhaps unrecognized causes of middle fossa encephaloceles. COM can result from a myriad of ear problems including tympanic membrane perforation, multiple ear infections, cholesteatoma, Eustachian tube dysfunction, and more. Some patients with COM develop inflammation of the mastoid air cell system as well as slow demineralization of the temporal bone structures including ossicles and tegmen, which can eventually result in encephalocele and even a cerebrospinal fluid leak (CSF) (Fig. 2B). Despite this, there has been limited literature detailing these causes. Thus, this study aims to discuss the findings of encephaloceles and their associations with other illnesses, such as chronic otitis media, that may need further treatment intervention.





Fig. 2: A) Image showing presence of cholesteatoma in middle ear cavity. B) Image showing CSF leak presenting as middle ear effusion

Results and Interventions

- In this cohort of 55 patients, 67% of patients had findings of chronic otitis media and 22% of patients had cholesteatoma.
- 30% of encephaloceles were spontaneous origins while 16% were traumatic/iatrogenic.
- 16% of patients had prior tympanostomy tube removed at time of encephalocele repair surgery
- 92% of patients underwent an exclusively transmastoid approach for encephalocele repair whereas the combined and middle cranial fossa only approaches were sparingly used by this team.



Fig. 1: Encephaloceles of the temporal bone occur through the floor of the middle cranial fossa. These may penetrate the roof of the mastoid, the middle ear or the petrous apex.

Methods and Materials

• 51% had ear drum repair (tympanoplasty) simultaneous with encephalocele repair. 19% had ossicular chain reconstruction at the same time, often due to cholesteatoma erosion.



<u>Fig. 3:</u> A) Pie chart showing presence of chronic otitis media when encephalocele was diagnosed. B) Etiology of encephaloceles in our cohort.





- **Study:** Retrospective chart review of 55 patients (ages 3–83) with middle fossa encephaloceles who underwent surgical repair at a tertiary care facility.
- Period: November 2018 August 2024.
- **Condition:** Temporal bone encephaloceles that underwent repair. Association with chronic otitis media (COM) was evaluated.
- **Total Reviews:** 63 encephaloceles in 55 patients (8 patients had bilateral encephalocele).

Fig. 4: Case demonstrating identification of encephalocele with concurrent cholesteatoma intraoperatively. **A)** Pre-operative T2 weighted axial MRI highlighting mastoiditis/COM. **B-C)** Intraoperative photographs showing right ear after mastoidectomy with identification of middle fossa defect encephalocele. **D-E)** After multilayer defect repair including bone pate.

Discussion

In patients with middle fossa encephaloceles, the possibility of chronic otitis media (COM) should be carefully considered. In our study, COM was present in 67% of patients with encephaloceles, highlighting a significant association. While encephaloceles can occur spontaneously or idiopathically, skull base surgeons should recognize COM as a potential contributing factor as this has management implications. Chronic infection and prolonged inflammation can lead to erosion or thinning of the tegmen bone, increasing the risk of encephalocele formation and subsequent complications such as meningitis.

Our findings align with studies like those by Jeevan et al., which emphasize the importance of early suspicion of temporal bone encephaloceles, given their broad and often nonspecific symptoms.

The primary treatment for temporal encephaloceles is surgical repair of the skull base defect, typically involving a multidisciplinary team of neurosurgeon and neurotologist to perform multilayer closure. Main surgical approaches include transmastoid, middle cranial fossa (MCF), combined transmastoid/MCF approach. The high rate of association with COM and encephaloceles has implications for surgical approach selection (transmastoid approach vs middle fossa craniotomy alone), employment of simultaneous procedures (tympanoplasty and or ossicular chain reconstruction), and managing patient expectations about longterm management. This study has limitations including being retrospective as well as a bias of including patients who mostly presented to neurotology with otologic complaints. Accordingly, many patients were treated with transmastoid approaches and had additional otologic procedures. All lateral skull base surgeons should be aware of the association of middle fossa encephaloceles and chronic otitis media (COM).

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References

- Papanikolaou, V., Bibas, A., Ferekidis, E., Anagnostopoulou, S., & Xenellis, J. (2007). Idiopathic temporal bone encephalocele. Skull base : official journal of North American Skull Base Society ... [et al.], 17(5), 311–316. https://doi.org/10.1055/s-2007-986429
- 2. Jackler, R. K. (2020, August 20). *Temporal Bone Fractures, Encephaloceles, and Cerebrospinal Fluid Leaks*. Otologic Surgery Atlas.
- 3. Wind, J. J., Caputy, A. J., & Roberti, F. (2008). Spontaneous encephaloceles of the temporal lobe. *Neurosurgical Focus FOC, 25*(6), E11. https://doi.org/10.3171/FOC.2008.25.12.E11
- Pettersson, D. R., Hagen, K. S., Sathe, N. C., Clark, B. D., & Spencer, D. C. (2020). MR Imaging Features of Middle Cranial Fossa Encephaloceles and Their Associations with Epilepsy. *AJNR. American journal of neuroradiology*, *41*(11), 2068–2074. https://doi.org/10.3174/ajnr.A6798
- Jeevan, D. S., Ormond, D. R., Kim, A. H., Meiteles, L. Z., Stidh). Cerebrospinal fluid leaks and encephaloceles of temporal bone origin: Nuances to diagnosis and management. *World Neurosurgery*, 83(4), 560–566. https://doi.org/10.1016/j.wneu.2014.12.011