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Case Report

Combined Middle Cranial Fossa Approach with Endoscopic Assisted Skull Base Repair of Pseudomeningocele and Tympanoplasty – A Case Report

Dr. Abhilash S.[1], Dr. Sanal Mohan[2]

[1] Postgraudate Student, Department of ENT, Travancore Medical College, Kollam, Kerala, India.
[2]Professor and HOD, Department of ENT, Travancore Medical College, Kollam, Kerala, India.

Corresponding Author
Dr. Abhilash S., Postgraudate Student, Department of ENT, Travancore Medical College, Kollam, Kerala, India.

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INTRODUCTION

The tegmen tympani is a bony plate that forms the antrum and the ceiling of the tympanic cavity. It divides middle ear air from the subarachnoidal area that houses brain and cerebrospinal fluid (CSF). This specific region of the temporal bone may be the source of a defect that causes CSF otorrhea, or CSF leakage, and may result in meninges and brain tissue herniation (meningoencephalocele). Infectious infections, traumatic traumas, congenital deformities, iatrogenic causes, cholesteatomas, neoplastic invasion of the skull base, and spontaneous causes can all result in temporal bone CSF leakage. Clinical signs are frequently vague. Patients may have headaches, tinnitus, hearing loss, auditory fullness, and imbalance.

Clinical examination may reveal middle ear effusion, otorrhea, rhinorrhea, and pulsatile movement of the tympanic membrane. Diagnosis of CSF otorrhea can be performed by β2-transferrin and β-trace protein analysis in the fluid suspected to be CSF. MRI and CT imaging are the most commonly applied modalities in the evaluation of encephalocele and suspected CSF otorrhea.[1] The surgical approaches of choice for the repair of tegmen tympani defects depend on the location and size of the bony defect, the status of the ossicular chain, and the experience of the surgeon. Most authors consider a transmastoid (TM) repair as the best surgical approach for the treatment of small tegmental defects. In fact, this minimally invasive surgical approach allows repair of the dehiscence without manipulation and elevation of the dura of the middle cranial fossa (MCF). However, when a large tegmen defect is found in association with CSF leakage, more invasive surgical techniques may be required. In this case we adopt an MCF approach.[2]

CASE

38 years old female patient presented to otorhinolaryngology OPD with intermittent right ear discharge for past 3 years and hard of hearings for past 2 years. Patient was apparently normal 3 years back then she noticed right ear discharge, which was copious in amount, mucoid, non foul smelling, non blood stained, occasionally mucopurulent. 2 years back patient underwent right tympanoplasty +cortical mastoidectomy for the above mentioned complaints. 6 months

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after surgery patient again developed right ear discharge. Which was intermittent, watery, non foul smelling, non blood stained. There was associated painless progressive hard of hearing right side which was noticed 2 years back.
Patient had one episode of high grade fever,vomiting,headache 1 year back and diagnosed as acute bacterial meningitis and treated with iv antibiotics and other supportive measures. No h/o ear pain, blood stained/foul smelling ear discharge,vertigo,tinnitus. No h/o diplopia, blurring of vision, deep orbital pain , facial weakness. No h/o nasal discharge/nasal obstruction.

CLINICAL EXAMINATION

Scar of previous surgery noted over right post auricular area. Medium sized central perforation present in pars tensa of right tympanic membrane. Edges of the perforation epithelialized and middle ear mucosa was normal. Clinically there was no bony erosion in external auditory canal or scutum. There was no mastoid or tragal tenderness. Fistula sign was negative.

Tuning fork test were done shows positive Rinne for 512 hz and 1024 hz and negative for 256 hz in right ear. Left ear Rinne positive for all three frequency. Weber test was lateralised to right ear. Absolute bone conductions was normal both sides. There was no facial nerve weakness bilaterally. Systemic examination and central nervous system examination shows no focal neurological deficit ,cranial nerves with in normal limits and no meningeal signs.

High resolution CT scan shows post right cortical mastoidectomy + tympanoplasty status. A bony defects in tegmen and lateral wall of right mastoid with hypo dense area replacing the mastoidectomy cavity which is continuous with middle cranial fossa suggestive of pseudomeningocoele. There was no significant abnormality in the left temporal bone. MRI also shows bony defects in tegmen and lateral wall of mastoid. Hypodense area replacing the mastoidectomy cavity, suggestive of pseudomeningocoele. Patient was diagnosis with right recurrent chronic otitis media ,mucosal ,inactive with mild to moderate conductive hearing loss and right pseudomeningocoele.

Image 1: Central perforation of right tympanic

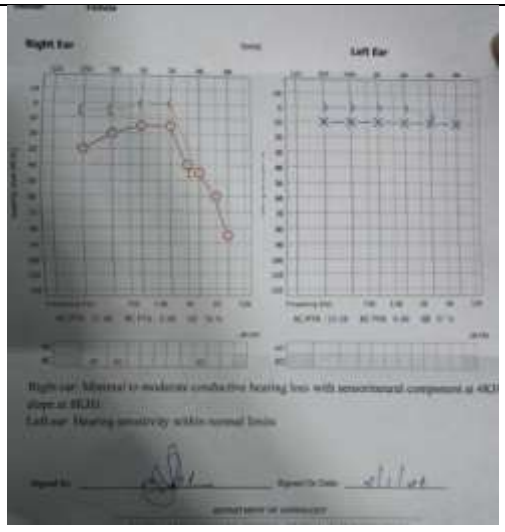

Image 2Pre Operative Audiogram

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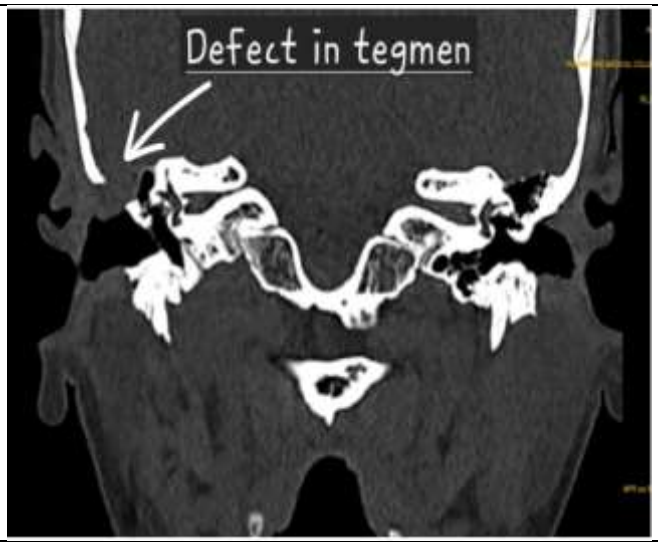

Image 2***Pre OP CT scan showing defect in tegmen***

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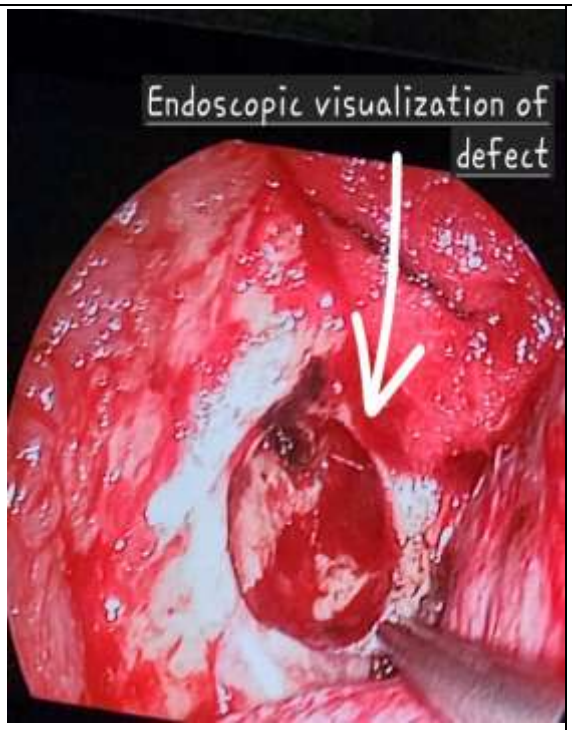

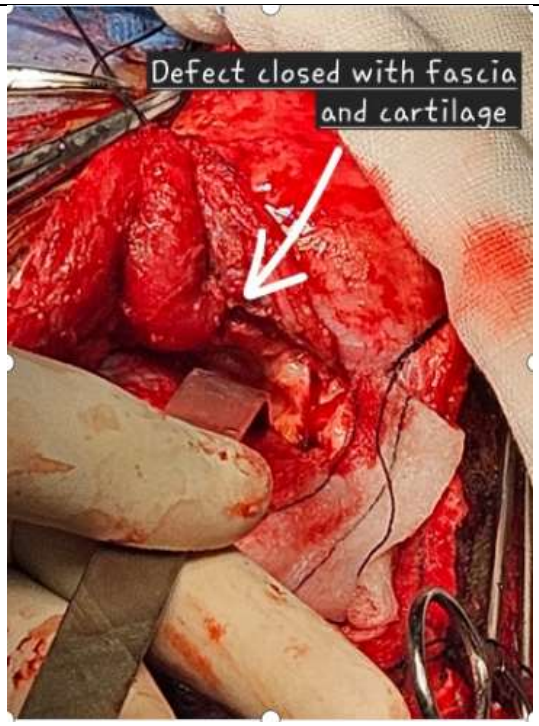

Intraoperative images

Patient admitted and routine investigations were done. Planned for an endoscope assisted sub temporal approach and repair of lateral tegmen tympani defect with septal cartilage and fascia lata + revision tympanoplasty under general anaesthesia. Initially septoplasty done, septal cartilage harvested and kept.Fascia lata harvested from right thigh. Then patient was repositioned to craniotomy position. Horse shoe shaped skin incision placed around the right ear. Temporalis muscle reflected. Right temporal craniotomy done Bone drilled to the temporal base. Dura reflected off the base.

Defect on tegmen identified. Dura with an arachnoid pouch was seen herniating into the defect. Endoscope was introduced and the dural defect was delineated and cut. Csf leaks with small area of gliotic brain was noted within the defect. Same delineated from defect and retracted. Fascia lata overlaid on the defect. Cartilage and another layer of facia placed above that. Bone fixed with 2 miniplates. Temporalis muscle sutured. Wound closed in layers with drain insitu. Revision mastoidectomy and type 1 tympanoplasty done with temporalis fascia graft.

Intra op and post op period was uneventful. Post op patient treated with iv inj Meropenem, inj Amikacin, inj Levipil, inj Dexona, inj Tramadol and other supportive measures. Ct brain follow up taken on post op day 2 shows hyper dense structures with tiny air foci noted filling the defect in the tegmen and the posterior part of right squamous temporal bone with intact ossicular chain.

DISCUSSION

Temporal bone CSF leakage is a challenging condition for the otolaryngologists in terms of diagnosis and management. It can be secondary to trauma, chronic ear disease, congenital malformations, infections, tumours, or surgical procedures that extend through or into the temporal bone.[3] Spontaneous CSF otorrhea is much less common. Some authors associate this condition with erosion of the posterior or middle cranial fossa by abnormal arachnoid

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granulations, encephaloceles, and increased intracranial pressure.[4] Patients with temporal bone dehiscence often present with middle ear pathology, and in particular, serous otitis media, otorrhea, headaches, imbalance, tinnitus, or conductive hearing loss.[5] In other cases, diagnosis can be made at the time of surgery, particularly when a mastoidectomy is required to treat infectious diseases or cholesteatomas.[6]

Generally, diagnosis is on the basis of the association of clinical signs and symptoms, fluid analysis in cases of frank CSF leakage, CT, and magnetic resonance imaging (MRI). In particular, MRI with t2-weighted sequences can help reveal the presence of CSF leakage.[7]

The most significant complication of persistent CSF otorrhea is meningitis, which may also be the initial presentation in some patients. Other serious complications include intracranial abscesses and seizures. Repair of the temporal bone dehiscence is the primary treatment to prevent these potentially devastating complications.[8] Surgical treatment of the mastoid/tegmen tympani defects associated with CSF leakage depends on the location and size of the bony defect, the status of the ossicular chain related to the hearing function of the patient, the association of middle ear/mastoid infection, and the experience of the surgeons. Several approaches for tegmen repair have been proposed by different authors, the tm approach, the middle cranial fossa approach, the combined approach, and the middle ear obliteration approach are the main ones described.

THE TRANS-MASTOID APPROACH

A common procedure is the trans-mastoid technique, which entails a mastoidectomy after a conventional postauricular incision. The tegmen is left exposed until the bone defect is identified during this treatment; if it is, the herniated brain matter is carefully removed by sectioning the hernia waist and using a bipolar forceps. A graft (cartilage, bone, fascia, or synthetic fascia) is placed through the bony defect using the underlay technique, interposing the graft between the dura mater and the superior edge of the tegmen, following the location of the defect on the tegmen and the removal of the herniation. Bone wax may be used to strengthen the reconstruction.[9]

The tm technique is widely adopted especially for small mastoid tegmental defects because this is a simple technique with good results,[10,11] but when a tegmen tympani defect is found at the level of the anterior epitympanum, ossicular chain removal is necessary to expose the defect area. Only in this way is it possible to obtain sufficient access for the repair. Moreover, when a large defect is found, the approach cannot guarantee enough space for successful repair of the defect. For these reasons, for the repair of large tegmental defects, other surgical procedures have been described, usually the middle cranial approach, the combined approach, or middle ear obliteration.

THE MIDDLE CRANIAL FOSSA APPROACH

Tegmen deficiencies anteriorly (on the anterior attic tegmen) can be accessed via the middle cranial fossa technique, which preserves the ossicular chain. Patients who do not have a middle ear or mastoid infection and have normal hearing function should be particularly candidates for this surgical approach.[12] In order to use this method, the temporalis muscle in the pre-trial region must be cut in order to reveal the temporalis squama bone. The zygomatic process is detected and a 4 cm × 4 cm craniotomy is required until the dura of the temporal lobe is exposed; then a temporal lobe retraction is necessary with a dissector to elevate the temporal lobe, exposing the superior surface of the tegmen until the tegmental defect is detected; a cartilage graft is then placed between the bony defect and the dura. Many authors advocate an

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middle cranial fossa approach as the initial approach for all defects.[13] however, this may lead to significantly greater morbidity due to the large craniotomy and temporal lobe retraction.

MIDDLE EAR OBLITERATION

Some authors consider middle ear obliteration to be the treatment of choice,[14] consisting of a tm subtotal petrosectomy, with removal of the external auditory canal skin, the tympanic membrane, the mastoid and the tympanic cavity mucosa with malleus and incus, and creation of an open cavity. This cavity is then obliterated with abdominal fat, and the eustachian tube is packed with a piece of muscle or cartilage. A blind sac closure of the external auditory canal is required in this operation; in this way, the middle ear and mastoid cavities are completely isolated from the external environment. Due to the nature of this method, it should only be used on individuals who have low hearing or in situations when there is no other option due to a significant brain herniation defect.

THE COMBINED APPROACH (TRANSMASTOID AND TEMPORAL (RANIOTOMY)

The TM method is paired with a craniotomy done at the temporalis squama level to create the combined approach. The temporal fossa can be accessed with a craniotomy, but brain matter can be taken during a mastoidectomy, allowing for the same kind of detection of the site of entrance and the site of the dural lesion as with a TM approach. This makes it possible to manage the intracranial and extradurally acting repair from above. Following the craniotomy, the dura of the temporal lobe is exposed. The dura mater surrounding the defect is elevated, allowing for the creation of a wide bed for the graft to be placed, and the site of the tegmen defect is identified from above. This is done with the aid of an elevator and a gentle surgical manoeuvre. The dura is positioned between the bone defect and a segment of temporal fascia. Bone wax is applied over the tegmental defect following mastoidectomy to help fortify the defect.

The majority of authors believe that the MCF method is the best surgical option for larger problems. However, it should be highlighted that in order to access the bone defects and obtain an adequate view of the tegmental defect area, a significant temporal lobe retraction along with an extensive craniotomy are necessary. Because of this, compared to other surgical approaches, the risk of problems during the postoperative period is excessively high. Though it is a simpler and safer procedure, some writers favor middle ear obliteration; nonetheless, this strategy necessitates closure of the external auditory canal with fat obliteration of the mastoid cavity following ossicular chain removal, which can lead to conductive hearing loss. Moreover, this approach requires MRI follow-up to detect the presence of an iatrogenic cholesteatoma.[15]

With the help of this combination technique, we were able to safely repair even the largest tegmen defects, allowing the dehiscence to be exposed through both the middle cranial fossa and the mastoid. We feel that a combined approach, which combines the benefits of the mcf and tm approaches, requires only a minicraniotomy, minimizes the risk of temporal lobe retraction, and provides excellent view and control of the site of repair of the tegmental defect through the mastoid cavity, could be tried when a large defect of the mastoid tegmen is found and the patient presents with normal hearing function. Because the combined approach allowed us to preserve the integrity of the ossicular chain this kind of approach can also be considered a minimally invasive procedure, preserving the ossicular chain and with good postoperative hearing.

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CONCLUSION

Based on our observations, even for individuals with significant tegmental abnormalities, a combination approach (mastoidectomy with temporal minicraniotomy) is the preferred course of treatment. The ability to manipulate the floor of the middle cranial fossa and access bone abnormalities anteriorly without requiring manipulation of the temporal lobe or ossicular chain are two benefits of this procedure.

REFERENCES

1. Tóth M, Helling K, Baksa G, Mann W. Localization of congenital tegmen tympani defects. Otol Neurotol. 2007;28(8):1120–1123. [PubMed] [Google Scholar]
2. Tóth M. Nagykovácsi, Hungary: Remedium; 2006. Tegmen; pp. 233–242. [Google Scholar]
3. Stenzel M, Preuss S, Orloff L, Jecker P, Mann W. Cerebrospinal fluid leaks of temporal bone origin: etiology and management. ORL J Otorhinolaryngol Relat Spec. 2005;67(1):51–55. [PubMed] [Google Scholar]
4. Stucken E Z, Selesnick S H, Brown K D. The role of obesity in spontaneous temporal bone encephaloceles and CSF leak. Otol Neurotol. 2012;33(8):1412–1417. [PubMed] [Google Scholar]
5. Connor S EJ. Imaging of skull-base cephalocoeles and cerebrospinal fluid leaks. Clin Radiol. 2010;65(10):832–841. [PubMed] [Google Scholar]
6. Kutz J W Jr, Husain I A, Isaacson B, Roland P S. Management of spontaneous cerebrospinal fluid otorrhea. Laryngoscope. 2008;118(12):2195–2199. [PubMed] [Google Scholar]
7. Leonetti J P Marzo S Anderson D Origitano T Vukas D D Spontaneous transtemporal CSF leakage: a study of 51 cases Ear Nose Throat J 20058411700, 702–704, 706 [PubMed] [Google Scholar]
8. Gacek R R, Gacek M R, Tart R. Adult spontaneous cerebrospinal fluid otorrhea: diagnosis and management. Am J Otol. 1999;20(6):770–776. [PubMed] [Google Scholar]
9. Markou K, Goudakos J, Franco-Vidal V, Vergnolles V, Vignes J R, Darrouzet V. Spontaneous osteodural defects of the temporal bone: diagnosis and management of 12 cases. Am J Otolaryngol. 2011;32(2):135–140. [PubMed] [Google Scholar]
10. Oliaei S, Mahboubi H, Djalilian H R. Transmastoid approach to temporal bone cerebrospinal fluid leaks. Am J Otolaryngology. 2012;33(5):556–561. [PubMed] [Google Scholar]
11. Rao A K, Merenda D M, Wetmore S J. Diagnosis and management of spontaneous cerebrospinal fluid otorrhea. Otol Neurotolgy. 2005;26(6):1171–1175. [PubMed] [Google Scholar]
12. Ramalingam K K, Ramalingam R, SreenivasaMurthy T M, Chandrakala G R. Management of temporal bone meningo-encephalocoele. J Laryngology Otol. 2008;122(11):1168–1174. [PubMed] [Google Scholar]
13. Sanna M, Fois P, Russo A, Falcioni M. Management of meningoencephalic herniation of the temporal bone: personal experience and literature review. Laryngoscope. 2009;119(8):1579–1585. [PubMed] [Google Scholar]
14. Semaan M T, Gilpin D A, Hsu D P, Wasman J K, Megerian C A. Transmastoid extradural-intracranial approach for repair of transtemporal meningoencephalocele: a review of 31 consecutive cases. Laryngoscope. 2011;121(8):1765–1772. [PubMed] [Google Scholar]

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15. Pappas D G, Hoffman R A, Holliday R A, Hammerschlag P E, Pappas D G, Swaid S N. Evaluation and management of spontaneous temporal bone cerebrospinal fluid leaks. Skull Base Surg. 1995;5(1):1–7. [PMC free article] [PubMed] [Google Scholar]