Endoscopic Repair of Tegmen Defects via Keyhole Middle Fossa Craniotomy: A Single-Center Case Series

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Introduction

Tegmen defects of the temporal bone can lead to cerebrospinal fluid (CSF) otorrhea, encephaloceles, or pneumocephalus, resulting in meningitis, conductive hearing loss, and chronic middle ear effusion[1].

Objective

1. To assess the feasibility and outcomes of endoscope-assisted keyhole craniotomy for tegmen defect repair.
2. To evaluate recurrence and complication rates following this minimally invasive approach.

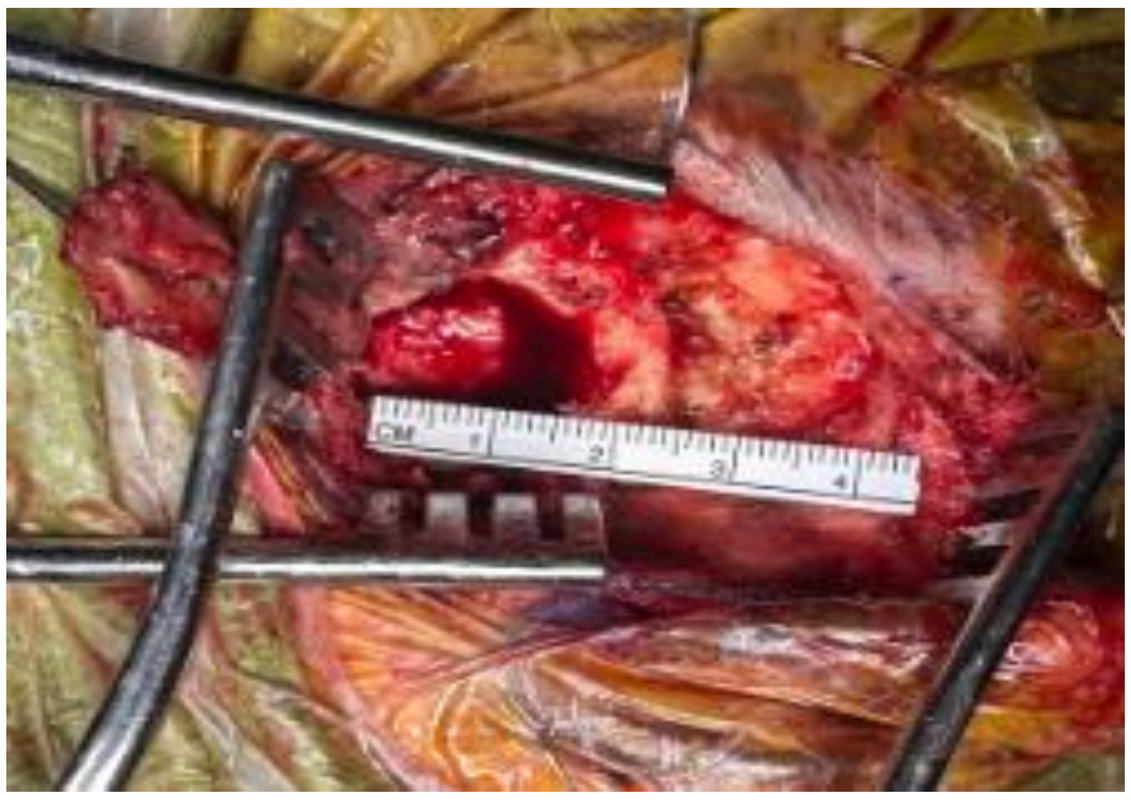

Figure 1. Keyhole middle fossa craniotomy.
Intraoperative photograph showing the 2 cm keyhole craniotomy exposing the middle fossa floor. The temporalis muscle flap has been reflected superiorly.

Methods and Materials

A retrospective single-center chart review of adult patients who underwent endoscopic mini-craniotomy for tegmen repair between December 2021 and July 2025 was performed. Preoperative evaluation included audiometry, high-resolution temporal bone computed tomography (CT), and contrast-enhanced brain magnetic resonance imaging (MRI); beta-2 transferrin was sent selectively. The standardized operative technique included a 2–3 cm extradural temporal keyhole craniotomy, endoscopic inspection (0° and 30°) to identify dural defects, multilayer dural repair (with dural substitute onlay), autologous bone chips and bone pate for tegmen reconstruction, and rotational temporalis flap, with coverage of the cranial defect with a small titanium external ventricular drain (EVD) plate. Lumbar drains were placed in all patients intraoperatively prior to craniotomy.

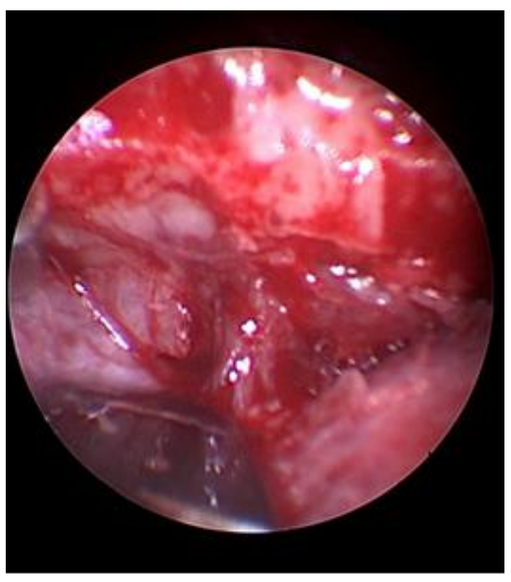

Figure 2. Temporal encephalocele.
Close-up intraoperative photo demonstrating a temporal lobe encephalocele protruding through a defect in the tegmen.

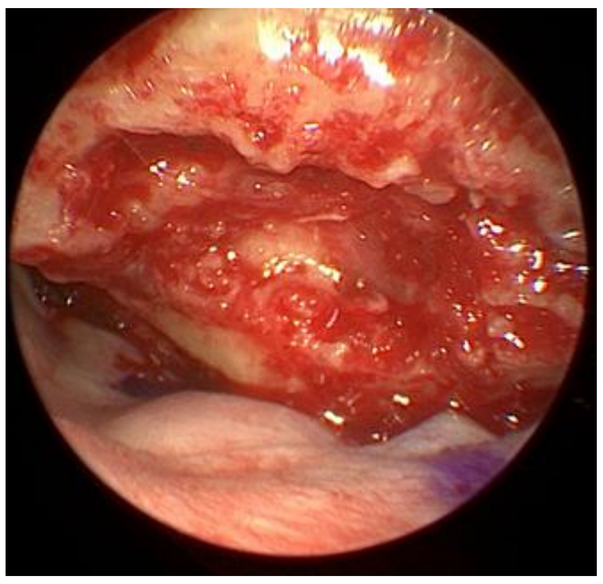

Figure 3. Dural repair.
Intraoperative image showing multilayer dural reconstruction using dural substitute onlay.

Results

Twenty-four patients (mean age 58.4 ± 13.2 y; range 24–84 y) were included. CSF otorrhea was the most common presenting symptom, seen in 18 patients (75%). Eleven right (46%), 9 (38%) left, and 4 (17%) simultaneous bilateral MCF repairs were performed. Mean operative time was 138.0 ± 66.1 minutes (range 78–383 minutes); mean hospital length of stay (LOS) was 4.96 ± 1.85 days (range 3–11 days). At last follow-up, none of the patients had recurrent symptoms. One patient required removal of hardware for control of an extracranial infection; this was the only significant complication in the series. Three other patients had mild postoperative events. No permanent neurologic deficits occurred postoperatively.

Presenting symptom	Frequency (%)
Otorrhea	18 (75%)
Middle Ear Effusion	12 (50%)
Hearing Loss	19 (79%)

Table 1. Frequency of presenting symptoms in middle fossa craniotomy patients.
Derived from subjective presenting symptoms upon initial clinical evaluation.

Discussion

Principal findings: We observed a high rate of clinical leak control at last follow-up (100%), acceptable mean operative time (~138 min), modest hospital LOS (~5 days), and no permanent neurologic sequelae. Using a stricter time-based endpoint (dry ≥3 months) reduced the apparent success to 54%, emphasizing how outcome definitions affect reported results.

Complications and mitigation: Our clinically significant postoperative event rate (19%) reflected mostly transient, manageable problems — superficial incision drainage, transient otorrhea managed with lumbar drain replacement, fungal otitis externa, and one brief wound debridement/readmission. Lumbar drain use (100%) appeared safe in our cohort and likely reduces routine drain-related morbidity. Key mitigation strategies include precise preoperative imaging review, intraoperative endoscopic inspection of the entire tegmen region, and consistent multilayer reconstruction techniques.

Limitations: This is a retrospective single-center study with variable follow-up and outcomes derived largely from chart language. Surgeon selection bias for the keyhole approach may also limit generalizability. Prospective, standardized outcome collection (including objective testing and prespecified time endpoints) and multicenter comparative studies are needed.

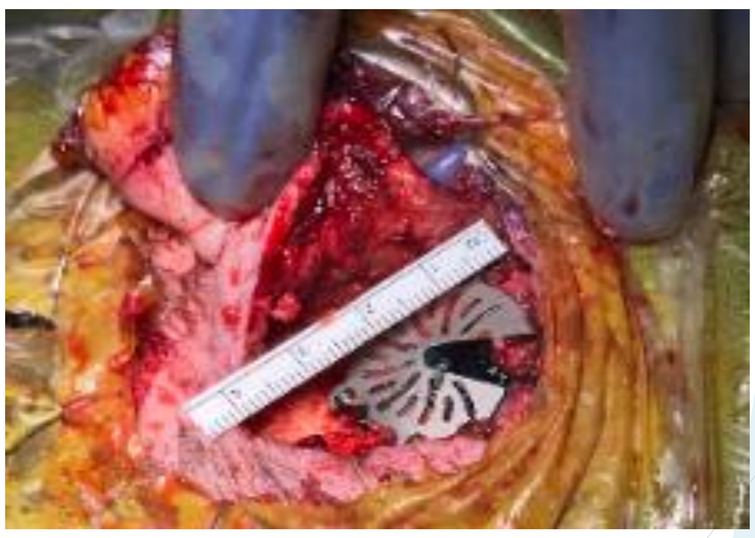

Figure 4. Repair augmented with external ventricular drain (EVD) placement.
Intraoperative photograph demonstrating multilayer repair with external ventricular drain (EVD) in place.

Conclusions

Endoscopic keyhole-craniotomy for repair of tegmen dehiscence provides a safe, minimally invasive, and effective approach with favorable operative times, hospital LOS, and clinical outcomes[2,3,4].

Contact

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