Scientific Research Publishing

Voice of the Publisher, 2026, 12(3), 584-590
https://www.scirp.org/journal/vp
ISSN Online: 2380-7598
ISSN Print: 2380-7571

Middle Ear Cholesteatoma Complicated by Posterior Fossa Empyema: A Case Report and Review of Practical Management Strategies

Ichraq Horrane, Razika Bencheikh, Tarek Dahan, Moad El Mekkaoui, Zakaria El Hafi, Zakaria Arkoubi, Mohammed Anas Benbouzid, Leila Essakalli

Department of Otorhinolaryngology, Head and Neck Surgery, Hospital of Specialties, Mohammed V University, Rabat, Morocco
Email: ichraqhorrane@gmail.com

How to cite this paper: Horrane, I., Bencheikh, R., Dahan, T., El Mekkaoui, M., El Hafi, Z., Arkoubi, Z., Benbouzid, M. A., & Essakalli, L. (2026). Middle Ear Cholesteatoma Complicated by Posterior Fossa Empyema: A Case Report and Review of Practical Management Strategies. *Voice of the Publisher, 12,* 584-590.
https://doi.org/10.4236/vp.2026.123032

Received: February 3, 2026
Accepted: September 25, 2026
Published: September 28, 2026

Abstract

Cholesteatomatous chronic otitis media (COM) remains a significant health problem in developing regions, where delayed diagnosis predisposes patients to extensive bone destruction and intracranial complications. We report the case of a 38-year-old male with an approximately 9-year history of untreated left otorrhea (onset ~2009), progressive hearing loss, and previous cerebellar abscess and subdural empyema. High-resolution CT revealed bilateral cholesteatoma with extensive erosion of the mastoid, posterior fossa plate, and sinus plate, associated with a stable 11-mm posterior fossa empyema. The patient underwent canal-wall-down mastoidectomy with complete removal of cholesteatoma and reconstruction of the posterior fossa defect. No immediate neurosurgical intervention was indicated. This case illustrates the destructive potential of neglected cholesteatoma and highlights essential principles for safe surgical management of advanced disease.

Keywords

Cholesteatoma, Chronic Otitis Media, Posterior Fossa Empyema, Mastoidectomy, Otogenic Intracranial Complications

1. Introduction

Cholesteatoma is an aggressive form of chronic otitis media characterized by keratinizing squamous epithelium capable of progressive osteolysis and extension into critical temporal bone structures. Despite advances in diagnostic imaging and

otologic surgery, cholesteatoma continues to account for a significant proportion of intracranial infections in low- and middle-income regions, where patients often present late and with complications: because of its aggressive growth, invasive nature, and the potentially fatal consequences of intracranial spread, acquired cholesteatoma remains a cause of morbidity and death among those without access to advanced medical care (Kuo et al., 2015). In Morocco, complications of chronic otitis media, although less frequent since the advent of antibiotics, continue to occur at a substantial rate (Abada et al., 2009).

Posterior fossa empyema remains one of the most severe consequences of neglected otitis media. In a meta-analysis of 28 studies comprising 1650 patients with otogenic brain complications, mortality approached 11 per cent, and two-thirds of patients had a known history of chronic otitis media (Gkrinia et al., 2024); otogenic intracranial suppuration continues to carry appreciable morbidity even in the imaging era (Duarte et al., 2018). This case provides practical insight into the evaluation and management of extensive cholesteatoma associated with a chronic intracranial collection.

2. Case Report

A 38-year-old man from Sidi Kacem, Morocco, presented for evaluation of dangerous chronic otitis media of the left ear. His symptoms began approximately 9 years prior (onset ~2009) with persistent purulent otorrhea, followed by progressive hearing loss, otalgia, and an episode of facial paralysis. He had a history of cerebellar abscess and posterior fossa empyema drained in 2018, secondary to left-sided mastoiditis.

On admission, he was alert, afebrile, and in good general condition. Otoscopy revealed purulent otorrhea and a polyp occluding the entire left external auditory canal. Examination of the scalp showed a chronic occipital wound with pus discharge. Vestibular testing demonstrated normal gait and no spontaneous nystagmus, though a horizontal rotatory right nystagmus was triggered by Valsalva maneuver. Nasal endoscopy and the rest of the ENT examination were unremarkable.

High-resolution CT of the temporal bones showed left cholesteatomatous chronic otitis media, with extensive left mastoid destruction, sinus plate erosion (**Figures 1-3**), and a stable 11-mm subdural empyema in the posterior fossa (**Figure 4**). Neurosurgical evaluation confirmed that the empyema was encapsulated, stable, and did not require urgent drainage. Long-term antibiotherapy was initiated with instructions for re-evaluation after otologic surgical management. Cultures of left otorrhea and occipital wound drainage yielded Pseudomonas aeruginosa (susceptible to ciprofloxacin and ceftazidime) and coagulase-negative Staphylococcus (susceptible to vancomycin). Accordingly, the patient received a six-week course of intravenous ceftazidime (2 g every 8 hours) combined with oral ciprofloxacin (750 mg twice daily), followed by an additional four weeks of oral ciprofloxacin monotherapy, guided by clinical response and inflammatory markers.

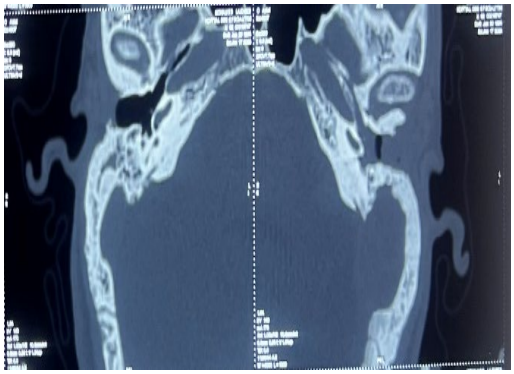

Figure 1. Axial CT image showing an abscess adjacent to the left sigmoid sinus.

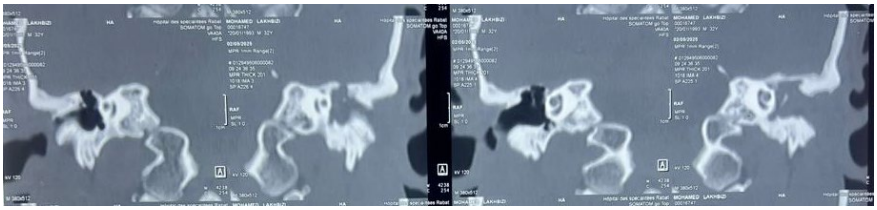

Figure 2. Coronal CT images showing complete opacification of the middle ear and mastoid air cells, with ossicular chain and tegmen tympani erosion.

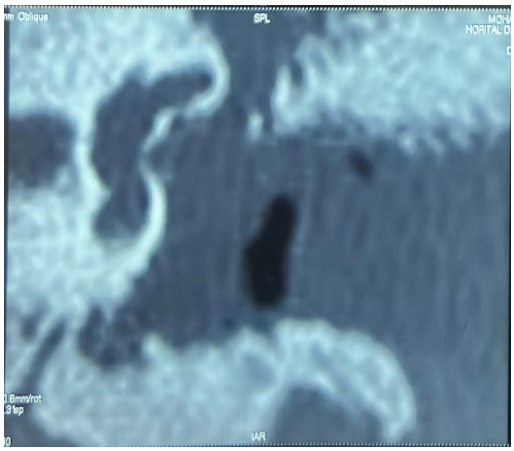

Figure 3. The lesion reaches the second segment of the left facial canal, with no involvement of the semicircular canals.

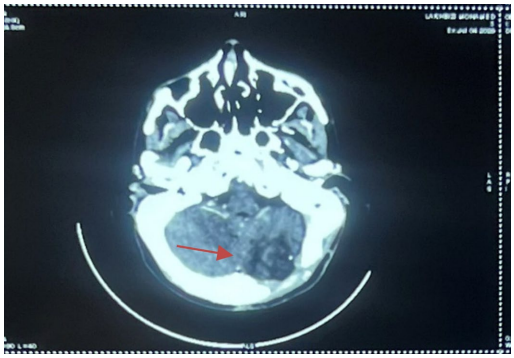

Figure 4. Axial brain CT scan showing a left occipital subdural empyema (arrow) measuring 11 mm in thickness.

The patient underwent left canal-wall-down mastoidectomy under general anesthesia. Intraoperatively, a large middle-ear polyp was removed, revealing extensive cholesteatoma that had eroded the mastoid cortex, extended posteriorly toward the sigmoid sinus (**Figure 1**), and inferiorly to the digastric ridge. The posterior canal wall was lowered, and a wide meatoplasty was performed to ensure adequate drainage. The posterior fossa dura was exposed due to complete cortical destruction and was sealed with Orsly bone wax. The cavity was irrigated, packed with Spongel and biogaze, and the wound closed in layers.

3. Discussion

This case illustrates the severe complications resulting from long-existing cholesteatoma, emphasizing practical management principles relevant to otologic surgeons. Osteoclast-mediated resorption is the fundamental pathological event underlying cholesteatoma-induced bone erosion, driven by chronic inflammation and the inflammatory mediators it generates (Hamed et al., 2016). The RANK-RANKL-osteoprotegerin axis is central to this process: RANKL, an osteoclast activator, is markedly over-represented in cholesteatoma tissue compared with control skin, and the RANKL/OPG ratio has been proposed as an index of bone erosion (Jeong et al., 2006), with experimental work confirming that osteoclasts modulate erosion through RANKL signalling (Imai et al., 2019). Bacterial colonisation of entrapped keratin amplifies this inflammatory cascade and accelerates destruction (Kuo et al., 2015). In this patient, the disease had progressed silently for years, leading to the erosion of the posterior fossa plate.

The management of the intracranial collection warrants explicit justification, because surgical evacuation is the default in subdural empyema and remains the position of most published series. In the largest CT-era comparative analysis, 89 of 90 patients underwent operation and only one was managed without surgery (Bok & Peter, 1993). A minority of reports, however, document successful treatment with antibiotics alone in carefully selected patients: Leys and colleagues treated seven patients non-surgically, of whom six recovered without sequelae and one required delayed surgery (Leys et al., 1986). The criteria usually invoked for such an approach are the absence of focal neurological deficit, preserved mental status, a limited and localised collection, and an adequate response to antibiotics, with the important caveat that posterior fossa location has been proposed as a reason to exclude conservative management (Hendaus, 2013).

Our decision must therefore be read in its specific context. The collection was not an acute, previously untreated empyema but a chronic, encapsulated residuum of a posterior fossa empyema drained six years earlier, radiologically stable, 11 mm in thickness, without mass effect or midline shift, in a patient with a Glasgow Coma Scale of 15 and no focal deficit. Re-drainage of a stable chronic collection would not have addressed the persisting otologic source, which was the actual driver of infection. The decision was taken jointly with the neurosurgical team, with pre-defined thresholds for escalation: neurological deterioration, any in-

crease in empyema dimensions, new fever or rising inflammatory markers, or suspicion of dural sinus thrombosis. We emphasise that this approach is not generalisable to acute posterior fossa empyema, for which urgent evacuation remains the standard.

CT remains the diagnostic modality of choice for the initial assessment of bone erosion and its complications, allowing evaluation of ossicular status, the extent of disease, the facial canal, and the tegmen and sinus plates, together with dural, sigmoid sinus and jugular bulb positions (Baráth et al., 2011). MRI was deferred at the initial stage because CT adequately characterized the bone erosion, sinus plate involvement, and empyema morphology required to guide urgent surgery, and the patient's preserved neurological status did not necessitate immediate soft-tissue mapping. MRI would be mandated by any of the following: neurological deterioration, increase in empyema dimensions on CT, new fever or rising inflammatory markers, or suspicion of dural sinus thrombosis. An interval contrast-enhanced MRI of the brain is planned at six weeks postoperatively to confirm empyema resolution and exclude residual intracranial disease.

The decision to perform canal-wall-down mastoidectomy was justified by multiple criteria: complete erosion of the posterior canal wall, dural exposure, sinus plate involvement, and a history of intracranial complications. Recurrence remains the central problem of cholesteatoma surgery, and pooled analyses continue to examine the determinants of recidivism across canal-wall-up and canal-wall-down strategies and mastoid obliteration (Massoud et al., 2025); in advanced disease with an unreconstructable posterior canal wall, exteriorisation of the cavity permits complete clearance under direct vision, and adjunctive obliteration techniques have been described to mitigate the resulting cavity problems (Sioshansi et al., 2021). Long-term follow-up nevertheless remains essential, given the potential risks of recurrent disease, cavity infection, or persistent otorrhea.

In the present case, the exposed dura was sealed sequentially with a layer of Orsly bone wax applied directly to the bony margins, followed by a fat graft harvested from the postauricular region to obliterate the dead space, a sheet of oxidized cellulose (Surgicel) placed over the fat for haemostasis, and final closure with periosteal and muscular flaps; the mastoid cavity was then packed with Spongel and biogaze before layered skin closure. Given the patient's prior intracranial infections, achieving a watertight, multilayer barrier was considered critical to preventing recurrent meningeal seeding.

Effective management of such cases requires close coordination between otologists and neurosurgeons. The chronic occipital wound in this patient suggested persistent communication with the intracranial compartment, which perpetuates infection if the primary otologic source is not eliminated; this principle underlies the recommendation that otologic surgery be undertaken alongside management of the intracranial complication (Gkrinia et al., 2024; Duarte et al., 2018). Active intracranial infection was distinguished from a residual postoperative sinus tract by the combination of the following findings: 1) absence of fever or systemic in-

flammatory signs at presentation; 2) stable empyema size without peripheral enhancement on CT; 3) non-purulent, serous character of occipital discharge on direct examination; and 4) negative Gram stain of occipital aspirate. These features were collectively interpreted as indicating a chronic fibrous tract rather than an actively expanding infectious collection. Long-term antibiotherapy and scheduled imaging follow-up form essential components of care.

Overall, this case underlines the importance of early diagnosis, timely surgical intervention, and multidisciplinary collaboration in preventing neurological sequelae from advanced cholesteatoma.

4. Conclusion

Neglected cholesteatomatous chronic otitis media represents a major cause of severe intracranial complications. Canal-wall-down mastoidectomy remains the most effective approach for advanced disease involving the sinus plate or posterior fossa. Multidisciplinary coordination and long-term follow-up are crucial to ensure complete disease eradication and prevent recurrence.

5. Patient Consent and Ethics Statement

Written informed consent was obtained from the patient for publication of this case report and for use of all associated clinical images. No institutional ethics committee approval was required for the publication of a de-identified single case report at our institution; however, patient confidentiality and anonymity were fully maintained throughout manuscript preparation in accordance with the Declaration of Helsinki.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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