Otogenic Brain Abscess: Literature Review

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Abstract

Background: Otogenic brain abscess is a rare but potentially life-threatening intracranial complication of otitis media and mastoid disease. Despite advances in neuroimaging, antimicrobial therapy, and surgical management, delayed diagnosis continues to contribute significantly to morbidity and mortality [1,2].

Objective: To review contemporary literature regarding the epidemiology, pathogenesis, microbiology, clinical presentation, diagnosis, and management of otogenic brain abscess.

Methods: A literature review in the English-language was conducted, focusing on systematic reviews, international clinical guidelines, and key observational studies related to otogenic brain abscess.

Results: Otogenic brain abscess most commonly arises from chronic suppurative otitis media, cholesteatoma, or acute mastoiditis and typically involves the temporal lobe or cerebellum. Magnetic resonance imaging with diffusion-weighted sequences is central to diagnosis. Management relies on prolonged intravenous antimicrobial therapy, neurosurgical drainage when indicated, and definitive otologic source control [1–4].

Conclusion: Otogenic brain abscess remains a serious complication of ear disease. Early recognition, prompt neuroimaging, microbiological diagnosis when feasible, and coordinated multidisciplinary management are essential to optimize outcomes.

Keywords: Otogenic brain abscess; otitis media; mastoiditis; cholesteatoma; intracranial complications

1. Introduction

Brain abscess is a focal intracranial infection characterized by localized suppuration within the brain parenchyma. Although uncommon, it represents a neurological emergency associated with substantial morbidity and mortality [2, 5]. Otogenic brain abscess refers specifically to abscess formation secondary to infection of the middle ear or mastoid air cells and remains an important cause of contiguous intracranial infection worldwide [1].

Historically, otogenic intracranial complications were common and frequently fatal. The introduction of antibiotics, advances in otologic and neurosurgical techniques, and early neuroimaging have markedly reduced incidence and improved survival [2]. Nevertheless, otogenic brain abscess continues to occur, particularly in association with chronic suppurative otitis media (CSOM), cholesteatoma, and acute mastoiditis [1, 4]. Otologic symptoms may be mild or partially treated, resulting in delayed diagnosis until neurological manifestations predominate [1].

This review summarizes current evidence on otogenic brain abscess, emphasizing epidemiology, pathogenesis, diagnosis, and management strategies relevant to modern clinical practice.

2. Epidemiology

The incidence of brain abscess varies globally, with higher rates reported in regions with limited access to healthcare and higher prevalence of chronic ear disease [2, 5]. In high-income countries, incidence is estimated at fewer than 1 case per 100,000 population annually [2].

Otogenic infections account for approximately 10–30% of brain abscess cases, with higher proportions observed in pediatric populations and in settings where CSOM is common [1, 4]. In children, otogenic brain abscess is most frequently associated with acute mastoiditis, whereas in adults it more commonly arises from chronic ear disease

and cholesteatoma [1, 4]. Although mortality has declined to below 10% in many contemporary series, morbidity remains significant, particularly when diagnosis is delayed or complications develop [2, 5].

3. Pathogenesis and Routes of Spread

Otogenic brain abscess develops primarily through contiguous spread of infection from the middle ear or mastoid to adjacent intracranial structures. Several mechanisms have been described:

3.1. Direct Extension

Chronic infection, especially in the presence of cholesteatoma, leads to progressive bone erosion of the temporal bone, allowing direct spread into the intracranial compartment. This mechanism most commonly results in temporal lobe or cerebellar abscess formation [1, 6].

3.2. Venous Spread

Septic thrombophlebitis of emissary veins and dural venous sinuses provides another pathway for intracranial dissemination and may coexist with venous sinus thrombosis [4, 7].

3.3. Masked Infection

Prior or partial antibiotic treatment may suppress otologic symptoms without eradicating infection, allowing progression to intracranial disease and delayed diagnosis [1].

Due to anatomical proximity, temporal lobe abscesses are most common, followed by cerebellar abscesses. Posterior fossa involvement is particularly dangerous because of limited space and risk of rapid neurological deterioration [1, 2].

4. Microbiology

The microbiology of otogenic brain abscess reflects the underlying ear pathology and prior antimicrobial exposure. Chronic otitis media and cholesteatoma-associated abscesses are frequently polymicrobial.

Commonly isolated organisms include aerobic and microaerophilic streptococci, *Staphylococcus aureus*, Gram-negative bacilli such as *Proteus mirabilis* and *Pseudomonas aeruginosa*, and anaerobic bacteria [1, 4, 8]. Anaerobes are likely under-detected due to culture limitations.

Culture-negative abscesses are common, particularly in patients who have received antibiotics prior to sampling [3]. For this reason, abscess aspiration and sampling from the otologic source are recommended whenever feasible to guide targeted therapy [3].

5.Clinical Presentation

The clinical presentation of otogenic brain abscess is variable and often nonspecific. The classic triad of headache, fever, and focal neurological deficit is present in a minority of cases [2, 5].

5.1. Otologic Features

Patients may report otorrhea, hearing loss, or a history of recurrent or chronic ear infection. However, otologic symptoms may be minimal or absent, particularly in partially treated disease [1].

5.2. Neurological and Systemic Features

Common symptoms include persistent headache, fever, nausea, vomiting, seizures, focal neurological deficits, and altered mental status [2]. Signs of raised intracranial pressure, such as papilledema or reduced consciousness, may be present in advanced disease [5].

In children, presentation may be subtle, including irritability, lethargy, or gait disturbance, necessitating a high index of suspicion [4].

6. Diagnostic Evaluation

6.1. Neuroimaging

Prompt neuroimaging is essential when otogenic brain abscess is suspected. Contrast-enhanced magnetic resonance imaging is the modality of choice, offering superior sensitivity for early cerebritis, abscess formation, and associated complications [2, 3]. Diffusion-weighted imaging is particularly useful, as restricted diffusion within a ring-enhancing lesion strongly suggests abscess [6].

Computed tomography with contrast remains valuable in unstable patients and where MRI is unavail-

able, particularly for identifying mass effect and guiding emergency intervention [2].

6.2. Otologic Assessment

Comprehensive otologic examination and temporal bone imaging are important to identify the primary source of infection and plan definitive surgical management [1, 4].

6.3. Microbiological Diagnosis

Whenever feasible, stereotactic or open abscess aspiration should be performed for microbiological diagnosis, including aerobic and anaerobic cultures [3]. Molecular diagnostic techniques may improve pathogen detection in culture-negative cases.

7.Management

Management of otogenic brain abscess requires close collaboration between otolaryngology, neurosurgery, infectious diseases, and radiology teams.

7.1.Antimicrobial Therapy

Empiric intravenous antimicrobial therapy should be initiated promptly and should cover streptococci, staphylococci, anaerobes, and Gram-negative organisms when chronic ear disease is suspected [3]. Therapy is subsequently tailored based on culture results. Treatment duration typically ranges from 6 to 8 weeks, depending on clinical and radiological response [3].

7.2.Surgical Intervention

Surgical intervention plays a central role in the management of otogenic brain abscess and is often required in conjunction with prolonged antimicrobial therapy. The primary goals of surgery are to reduce intracranial mass effect, obtain material for microbiological diagnosis, prevent further neurological deterioration, and eradicate the primary otogenic source of infection.[1, 2]

Neurosurgical drainage is indicated in most patients with otogenic brain abscess, particularly when the abscess is larger than 2–2.5 cm in diameter, is associated with significant mass effect or raised intracranial pressure, or when there is neurological deterioration despite appropriate medical therapy. Stereotactic needle aspiration, performed either via burr-hole or image-guided techniques, is the most commonly employed approach. This method allows decompression of the abscess cavity while minimizing damage to surrounding brain tissue and can be repeated if necessary.

Craniotomy with excision of the abscess capsule is reserved for selected cases, such as multiloculated abscesses, lesions that fail repeated aspiration, abscesses associated with foreign material, or when there is diagnostic uncertainty. Posterior fossa abscesses, particularly cerebellar lesions, may require urgent surgical drainage due to the risk of rapid brainstem compression and obstructive hydrocephalus.[2, 5]

Equally important is surgical management of the otologic source. [1] Definitive otologic surgery is considered mandatory in true otogenic brain abscess to prevent persistent infection or recurrence. Procedures may include myringotomy with or without tympanostomy tube insertion for middle ear drainage, cortical or modified radical mastoidectomy, and complete cholesteatoma removal when present. The timing of otologic surgery relative to neurosurgical intervention is individualized; in unstable patients, intracranial drainage is prioritized, whereas in stable patients, combined or staged neurosurgical and otologic procedures may be performed.

Failure to achieve adequate surgical source control has been consistently associated with poorer outcomes and higher recurrence rates. Therefore, close collaboration between neurosurgeons and otolaryngologists is essential in the surgical planning and execution of care for patients with otogenic brain abscess.[5]

7.3.Otologic Source Control

Definitive management of the otologic source is essential and may include myringotomy, mastoidectomy, and cholesteatoma removal. Failure to achieve adequate source control increases the risk of persistent or recurrent intracranial infection [1, 4, 8].

8.Outcomes and Prognosis

Advances in diagnosis and management have significantly improved outcomes. Mortality rates have declined to below 10% in many modern series [2, 5]. Prognosis depends on timing of diagnosis,

neurological status at presentation, abscess size and location, and adequacy of surgical and medical management.

Delayed presentation, posterior fossa abscesses, and complications such as ventriculitis or venous sinus thrombosis are associated with worse outcomes [4, 7]. Long-term neurological sequelae, including seizures and focal deficits, may occur and warrant ongoing follow-up.

9. Conclusion

Otogenic brain abscess is an uncommon but severe intracranial complication of otitis media and mastoiditis. Despite declining incidence, it remains associated with significant morbidity. Early recognition, prompt neuroimaging, appropriate antimicrobial therapy, neurosurgical drainage when indicated, and definitive otologic source control are critical to optimizing patient outcomes.

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