Malignant otitis externa: experience at a tertiary center

Original Article

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Abstract

Objective: This study seeks to report the experience of a tertiary medical institution in managing MOE.
Materials and Methods: A retrospective analysis of MOE cases admitted to our tertiary hospital from January 2018 to December 2023 was conducted.
Results: Six patients, with a median age of 81.7 years, were included. Pseudomonas aeruginosa was the most isolated organism. CT scans, conducted for all patients, revealed mastoid and/or middle ear opacification in every case, with 83.3% displaying bone erosion. All patients were managed with intravenous antibiotics. The total average duration of hospitalization was 39.0 days, with 2 recorded deaths.
Conclusion: Despite healthcare advancements, MOE remains associated with high mortality and morbidity. While scintigraphy is historically used for diagnosis, CT and MRI are valuable alternatives for detecting bone and soft tissue involvement. First-line treatment consists of intravenous systemic antibiotic therapy, which can be complemented with surgery and/or hyperbaric oxygen therapy in refractory cases.

Keywords: Malignant otitis externa, necrotizing otitis externa, skull base osteomyelitis

Introduction

Malignant external otitis (MEO) is a severe and potentially fatal infection of the external auditory canal (EAC) and temporal bone. As an invasive and progressive condition, it can lead to osteomyelitis extending to the skull base, resulting in complications such as cranial nerve dysfunction, venous thrombosis, meningitis, and intracranial abscess.[1,2]

The term "malignant" was proposed by James R. Chandler in 1968[3] to highlight the high mortality rate associated with the condition. Over time, this term was gradually replaced by "necrotizing external otitis." [4,5] Despite a significant decrease in the mortality rates due to the advent of effective antibiotics against

Pseudomonas, MEO continues to have high morbidity. The most common causative agent of MEO is *Pseudomonas aeruginosa*, followed by *Staphylococcus aureus*, *Klebsiella* spp., *Proteus* spp., and less frequently, fungi such as *Aspergillus* spp.[6,7] MEO predominantly affects individuals from the sixth decade of life, particularly those with diabetes and immunocompromised conditions .[7-9]

Clinically, MEO is characterized by nocturnal otalgia, otorrhea that is refractory to topical antibiotic therapy, and presence of granulation tissue or bone erosion within the EAC.[10] Cranial neuropathy occurs in 35–45% of cases, with the facial nerve being most commonly affected.[11]

Targeted intravenous antibiotics are the first-line treatment, and may be combined with adjuvant treatments such as hyperbaric oxygen therapy or surgical debridement in refractory cases.[12,13]

This study aimed to retrospectively analyze patients with MEO who were admitted to the department of otorhinolaryngology at a tertiary hospital over five years, and to compare the findings with the data available in the literature.

Materials and methods

This retrospective longitudinal study analyzed patients with MEO who were admitted to the department of otorhinolaryngology between January 1, 2018 and December 31, 2023. Data were collected from the computerized clinical records. The following parameters were evaluated: (1) demographic data (sex, age), (2) comorbidities, (3) clinical presentation, (4) diagnostic methods (including physical examination, imaging studies, and laboratory results), (5) therapeutic interventions, and (6) clinical progression.

Results

During the study period (2018–2023), six cases of MEO were diagnosed, comprising five men (83.3%) and one woman (16.7%). The average age at admission was 81.7 ± 6.4 years (range: 73–88 years). The most frequently reported comorbidities (Table 1) were arterial hypertension (n = 6, 100%) and diabetes mellitus (n = 5, 83.3%). The most commonly reported symptom was otorrhea (n = 6, 100%), followed by otalgia (n = 3, 50%) and peripheral facial palsy (n = 3, 50%). On otoscopic examination, the most common EAC findings were edema (n = 4, 66.7%), granulation tissue (n = 3, 50.0%), and polyps (n = 3, 50.0%).

Laboratory tests conducted upon admission showed a mean leukocyte count of 7.82 ± 1.89 x 10^9/L and mean C-reactive protein level of 4.82 ± 4.33 mg/dL.

Ear exudate was collected from all patients for microbiological analysis, and the results are summarized in Table 2. The most commonly isolated pathogen was *P. aeruginosa*, including one multidrug-resistant strain. All patients underwent computed tomography (CT), with three patients additionally undergoing magnetic resonance imaging (MRI) and one patient undergoing technetium-99m scintigraphy. The main CT findings (Table 2) included opacification of the mastoid cells or middle ear (n = 6, 100%) and erosion of the cortical bone of the EAC or mastoid cells (n = 5, 83.3%). MRI was reserved for patients presenting with peripheral facial palsy or an altered state of consciousness on admission to rule out intracranial complications. The most frequent findings were skull base osteomyelitis (n = 2), mandibular condyle osteomyelitis (n = 1), infiltration of the suprahyoid cervical spaces (n = 1), infiltration of the nasopharynx (n = 2), peripheral facial nerve involvement (n = 1), mastoid cell filling (n = 2), retroclival empyema (n = 1), and sigmoid sinus occlusion (n = 1).

In two patients, biopsy of the EAC was performed due to inadequate response to therapy. Histopathological examination revealed fibroepithelial polyps with chronic stromal inflammation and bone sequestration.

All patients were treated with intravenous antibiotics for an average period of 39.0 days. The regimens included monotherapy with ciprofloxacin (n = 4), combination therapy with metronidazole and ciprofloxacin (n = 1), and combination therapy with vancomycin and ceftazidime (n = 1). In all cases, adjustments

Table 1
Clinical and demographic characteristics of the study participants

Clinical and demographic characteristics		n
Sex	Male	5
	Female	1
Comorbidities	Arterial hypertension	6
	Diabetes mellitus	5
	Chronic kidney disease	4
	Ischemic heart disease	4
	Peripheral arterial disease	1
Symptoms on admission	Otalgia	3
	Otorrhea	6
	Headache	1
	Hearing loss	2
	Peripheral facial palsy (House-Brackmann grades III, IV, and V)	3
	Altered state of consciousness	2
Otoscopy changes on admission	Edema in the EAC	4
	Polyp in the EAC	3
	Granulation tissue in the EAC	3
	Bone exposure in the EAC	2
	Otorrhea	6
	Concomitant chronic suppurative otitis media	2

n = number of cases; EAC, external auditory canal.

Table 2
Laboratory and radiological data of the study participants

Laboratory test	Average value
Leukocytes	7.82 ± 1.89 × 109/L
C-reactive protein	4.82 ± 4.33 mg/dL
Microbiology of the auricular exudate	**n**
Pseudomonas aeruginosa	3
Serratia marcescens	1
Negative	2
CT changes	**n**
Opacification of the mastoid cells or middle ear	6
Bone erosion	5
Thickening of the soft tissues of the EAC	4
Subdural empyema	1
Cerebral venous thrombosis	1
Skull base osteomyelitis	1

n = number of cases; EAC, external auditory canal; CT, computed tomography

of the antibiotic regimen were needed due to the lack of a therapeutic response or antibiotic susceptibility profile of the isolated microorganisms. In one case, antibiotic therapy was complemented with hyperbaric oxygen therapy, which was initiated after 17 days of hospitalization. In another case, wall-up canal mastoidectomy with debridement of bone sequestrations was performed on the second day of hospitalization.

The average length of hospital stay was 39.0 days. During the study period, two patients died; one due to osteomyelitis and another due to aspiration pneumonia complicated by septic shock.

Discussion

Over the 5-year study period, six cases of MEO were treated at our tertiary hospital. The average age of the patients (81.7 ± 6.4 years) was higher than that reported in most retrospective studies, typically ranging between 60–70 years.[10,14] A predominance of male patients was observed, consistent with the data in the literature.[15] Regarding comorbidities (Table 1), there was a high prevalence of diabetes mellitus, aligning with the rates of most previous studies (51–93%).[10,16,18]

In 1987, Cohen and Friedman proposed the first diagnostic criteria for MEO (Table 3). According to their proposal, a diagnosis of MEO could be established when all of the following major criteria were met: (1) otalgia disproportionate to the physical examination findings, (2) edema in the EAC, (3) otorrhea, (4) granulation tissue in the EAC, (5) intraoperative confirmation of micro-abscesses, (6) positive technetium-99m scintigraphy, and (7) lack of improvement after more than seven days of topical therapy.[19,20]

However, the use of these criteria may lead to false negatives, as they are not pathognomonic. Consequently, the diagnosis should be based on a combination of clinical findings, laboratory results, and radiological data. A 2023 systematic review that included 284 patients with MEO reported that the most frequent signs and symptoms were EAC edema (97.3%), granulation tissue in the EAC (78.0%), otalgia (99.3%), and otorrhea (87.5%).[10] In our study, otorrhea was the most common symptom on admission (100%), followed by otalgia (50.0%) and peripheral facial palsy (50.0%). The lower incidence of otalgia observed in our study may be attributed to the high prevalence of diabetes mellitus, which is often associated with reduced pain sensitivity. In our study, three patients presented with peripheral facial palsy on admission. Although none of them achieved complete recovery from the paralysis, they all met the criteria for MEO cure. While peripheral facial palsy has been frequently associated with a poor prognosis, recent studies have suggested that its presence does not necessarily worsen the outcomes. Furthermore, the degree of recovery from facial palsy should not be used as a measure of therapeutic success.[20,21]

Table 3
Diagnostic criteria for MEO proposed by Cohen and Friedman (1987)

Diagnostic criteria for MEO by Cohen and Friedman	
Major criteria (required)	**Minor criteria**
Otalgia disproportionate to the physical examination findings	Positive culture for *Pseudomonas*
Edema in the EAC	Diabetes mellitus
Otorrhea	Age > 55 years
Granulation tissue in the EAC	Cranial nerve dysfunction
Positive technetium-99m scintigraphy	Changes suggestive of MEO on CT
Lack of improvement after more than seven days of topical therapy	Immunosuppression

MEO, malignant external otitis; EAC, external auditory canal; CT, computed tomography

Despite divergent findings in the literature, the average leukocyte count was within the normal range in our study, consistent with the findings of Bhat et al. and Arsovic et al.[18,22] Conversely, CRP levels were high in most cases, correlating with the average length of hospital stay and imaging changes.[10,23]

In our study, CT and MRI were adequate for diagnosis and follow-up in most cases, with only one patient requiring complementary scintigraphy. Historically, scintigraphy was considered the gold standard for MEO diagnosis, being one of the major criteria proposed by Cohen and Friedman (Table 3).[19] However, its use has decreased in recent years due to the lower costs and greater accessibility of CT and MRI. A 2019 meta-analysis revealed lower-than-expected sensitivity rates of only 85.1% for technetium-99m scintigraphy and 71.2% for gallium-67 scintigraphy, with the presence of tumors or post-traumatic lesions often leading to false positives, which limits specificity.[24,25] CT and MRI are useful complementary diagnostic tools for MEO. CT has a high sensitivity for detecting bone erosion and is often the first-line imaging modality for the initial evaluation of patients with suspected MEO due to its widespread availability. Meanwhile, MRI is valuable for assessing the severity of intracranial infection and enables the early detection of bone marrow edema, which can precede the development of bone erosion.[24,25] However, MRI is more expensive and may have limited availability in some healthcare centers. *P. aeruginosa* was the most frequently isolated microorganism in our study, consistent with its reported prevalence of 50–90% in the literature.[7] The antibiotic susceptibility profile of all isolates was determined, enabling targeted antimicrobial therapy.

Biopsy of the EAC was performed in only two patients, as a high clinical suspicion of MEO guided the initial management in the remaining cases. Nevertheless, biopsy should be considered on admission, given that carcinoma may be diagnosed in up to 25% of the cases.[25]

Due to the rarity of MEO, there is no consensus on the most appropriate empirical antibiotic regimen. The introduction of fluoroquinolones was a turning-point in the treatment of MEO, significantly reducing its mortality rate from 67% to less than 10% in recent studies. However, the increasing emergence of ciprofloxacin-resistant strains has limited the use of fluoroquinolones as monotherapy. Studies have demonstrated the superiority of high-dose combination therapy (e.g., ciprofloxacin with third generation cephalosporin or aminoglycoside) over monotherapy, with a minimum treatment duration of 6–8 weeks.[26] In our study, although most patients (n = 4) were initially treated empirically with monotherapy covering *Pseudomonas*, all of them required treatment adjustments due to therapeutic failure or antibiotic susceptibility profiles. Hyperbaric oxygen therapy was used as an adjuvant therapy in only one patient in our study. Despite the lack of randomized clinical trials, previous studies have supported its effectiveness in refractory or advanced cases of MEO.[12,27] Surgery for MEO has decreased significantly in recent years, and there is still no consensus on the indications and the most appropriate surgical approach. In our study, only one patient underwent surgery for bone sequestration debridement.

The mortality rate in our study was slightly higher (33.3%) than that reported in more recent studies, which may be due to the older age of the participants.

Our study has some limitations, primarily the small sample size and limited use of surgery and hyperbaric oxygen therapy, which were only used in two patients. Therefore, we were unable to draw definitive conclusions and can only report their observed effectiveness.

Conclusion

MEO is a rare but potentially fatal infection of the EAC and temporal bone. Despite advances in medical care, MEO continues to have high morbidity and mortality rates, emphasizing the importance of early recognition of this entity. While scintigraphy was historically

considered the gold standard for diagnosis, CT and MRI have been proven to be useful diagnostic tools in recent years. First-line treatment consists of systemic antibiotic therapy against *P. aeruginosa*. In advanced or refractory cases, this may be complemented with surgical intervention or hyperbaric oxygen therapy.

Conflict of Interests

The authors declare that they have no conflict of interest regarding this article.

Data Confidentiality

The authors declare that they followed the protocols of their work in publishing patient data.

Human and animal protection

The authors declare that the procedures followed are in accordance with the regulations established by the directors of the Commission for Clinical Research and Ethics and in accordance with the Declaration of Helsinki of the World Medical Association.

Privacy policy, informed consent and Ethics committee authorization

The authors declare that they have obtained signed consent from the participants and that they have local ethical approval to carry out this work.

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Scientific data availability

There are no publicly available datasets related to this work.

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