Malignant External Otitis: A Retrospective Study of 22 Cases

Introduction:

Malignant external otitis (MEO) is an osteitis of the skull base, beginning in the external auditory canal with infection of the temporal bone, and can spread towards the skull base, causing bone erosion, cranial nerve deficits, abscesses, and even death

[1]. This extremely serious condition occurs mainly in elderly immunocompromised and diabetic patients, constituting a diagnostic and therapeutic emergency

[2]. First described in 1959 by Meltzer and Kelemen, J.R. Chandler named it "malignant external otitis" in 1968 to emphasize its lethality

[3]. Pseudomonas aeruginosa is the main causative agent (90%), with occasional cases due to Candida and Aspergillus

[4]. Imaging helps guide the diagnosis and assesses the extent and effectiveness of treatment. A multidisciplinary approach is required, involving ENT surgeons, infectious disease specialists, microbiologists, endocrinologists, and neuroradiologists

[5]. Treatment is based on prolonged dual antibiotic therapy. New anti-Pseudomonas agents and hyperbaric oxygen therapy have improved prognosis

[6]. The objectives are to describe the epidemiology, explain the etiopathogenesis, analyze the clinical presentation, determine the usefulness of imaging, update treatment strategies, and define the criteria for recovery.

Materials and Methods:

This study is a retrospective descriptive research conducted within the otorhinolaryngology (ENT) department of the Avicenne Military Hospital in Marrakech, involving 22 patients hospitalized for malignant external otitis between January 2015 and February 2021. Patients included were those diagnosed with malignant external otitis according to the following criteria: persistent otitis externa resistant to local treatment, severe otalgia, predisposing factors (advanced age, diabetes, immunosuppression), presence of granulation tissue or bone sequestra in the external auditory canal (EAC), pyocyanic germ, positive computed tomography (CT) scan, petrous bone fixation on bone scintigraphy, and endocranial extension. Excluded were cases of secondary external otitis, specifically simple external otitis, tuberculous otitis, squamous cell carcinoma of the EAC, Wegener's granulomatosis, and histiocytosis X. Data were collected from departmental and ENT service records, in compliance with ethical principles. The variables collected included: epidemiological data (age, sex), clinical data (risk factors, triggers, diagnostic delay, functional signs, clinical examination), paraclinical data (biological, bacteriological, anatomopathological, radiological assessments), classification according to LEVENSON, therapeutic strategy (antibiotic therapy, local treatment, diabetes control, surgery, hyperbaric oxygen therapy), duration of hospitalization, developmental and prognostic aspects (clinical, biological, bacteriological, radiological monitoring, evolution profiles). Data were analyzed using Microsoft Office Excel 2007, with quantitative variables described by means and frequencies, and qualitative variables by percentages, maintaining patient confidentiality.

Results:

Patient ages ranged from 30 to 91 years, with an average of 67 years. Age group analysis showed a predominance in the 60 to 69 age group (31.8% of cases), followed by the 70 to 79 age group (27.2% of cases). A male predominance was observed with a male-to-female ratio of 2.14. Diabetes was present in 19 patients (86.36%). The average duration of diabetes progression was 13 years, ranging from 4 to 36 years, and 47.36% (n=9) of patients had a disease duration between 10 and 20 years. Among the 19 diabetic patients, 8 showed degenerative complications, notably diabetic nephropathy (n=4), followed by diabetic retinopathy (n=2). Diabetic foot and coronary artery disease were each present in one case. Comorbidities included hypertension

in 8 patients, a history of smoking in 7 patients, hypercholesterolemia in 3 patients, and long-term corticosteroid therapy in one female patient with rheumatoid arthritis. Regarding triggering factors, the use of cotton swabs was reported by 9 patients, trauma to the external auditory canal during cerumen plug removal in 3 cases, scratching lesions in one case, and frequent swimming in one patient. The interval between symptom onset and diagnosis ranged from 3 to 12 weeks, with an average of 8 weeks, indicating an advanced stage at diagnosis. All patients had received treatment for otitis externa with local antibiotics, with or without corticosteroids, sometimes accompanied by systemic antibiotics, without improvement. The diagnosis of MEO was established due to refractory symptoms, the patients' age, and their health status, particularly diabetes or immunosuppression. The clinical presentation was polymorphic, with the main symptoms prompting consultation. Otalgia affected 21 patients (95.4%), characterized by intense pain (VAS 8), throbbing, sleep-disrupting, resistant to analgesics, radiating to the temples and occipital region. Otorrhea was observed in 20 patients (90.9%). Hearing loss, variable and moderate, represented an aggravation of pre-existing hearing loss in the elderly, affecting 12 patients (54.5%). Progressive ipsilateral facial paralysis was observed in 5 patients (22.7%), present at admission in 3 patients (13.6%) and during hospitalization in 2 patients (9%). No patient experienced involvement of other cranial nerve pairs. Trismus was noted in 4 patients (18.18%), with temporomandibular pain in 3 cases (13.36%). Occipitotemporal headaches were noted in 3 patients. Recurrent vertigo with tinnitus was reported by two patients (9%). One patient presented with a painful, red facial swelling involving the parotid gland, due to infectious spread. Moderate fever was observed in 4 patients (18.2%). General health deterioration was noted in 2 patients (9%).

On examination of the auricle and external auditory canal, perichondritis of the auricle was observed in three patients, purulent discharge in 18 patients, and clear discharge in two patients. Palpation revealed pain upon movement of the auricle and compression of the tragus in 100% of cases. Otoscopic examination with microscopy was performed for all patients and repeated daily for local care and monitoring. This examination was difficult due to pain and stenosis of the external auditory canal. The exam showed a narrowed external auditory canal with skin inflammation in 100% of cases, otorrhea in 90.90% of cases (n=20), with aspiration of thick, foul-smelling, greenish pus in 81.8% of cases (n=18), and polypoid granulation tissue at the bone-cartilage junction in 86.36% of cases (n=19). No bony sequestrum was observed on the floor of the EAC. The contralateral ear was healthy in all patients. Peri-auricular inflammatory extension was noted in 40.9% of cases, a red, painful mastoid swelling in four cases (18.18%), and temporomandibular involvement in four cases (18.18%), with trismus and TMJ pain in three cases (13.63%) and isolated trismus in one case (4.5%). A fluctuating, red, painful parotid swelling was observed in one case (4.5%). Cranial nerve examination revealed ipsilateral peripheral facial paralysis in five patients, without involvement of other cranial nerve pairs. No signs of central infectious extension were found, notably meningeal or neurological.

Laboratory tests were performed for all patients during hospitalization. Blood cell counts were normal in the majority of patients, with 27% presenting with neutrophilic leukocytosis (average: 11,250 cells/mm^3). Erythrocyte sedimentation rate was accelerated, with an average of 85 mm at the first hour. CRP was positive in 19 cases (average: 22 mg/l). Blood glucose analysis revealed an average fasting glucose of 2.04 g/l, and a mean HbA1c of 9.06%. Monitoring of renal function revealed renal insufficiency in 4 cases, 2 of which required hemodialysis. Bacteriological samples were taken from all patients. Cultures were positive in 20 cases (90.9%), isolating Pseudomonas aeruginosa (77.28%), Staphylococcus aureus (4.54%), Aspergillus flavus and Candida albicans (4.54%).

CT scans of the temporal bone revealed a tissue process obstructing the external auditory canal in all patients. Bony erosion of the tympanic and mastoid cortex was observed in 17 cases, and of the zygomatic arch in one case. Mastoid cell opacification was present in 8 cases. Extension toward the temporomandibular joint was identified in 4 cases, and toward the middle ear in 8 cases. Thickening of the peri-auricular soft tissues was noted in 9 cases, and extension into the parapharyngeal spaces in 2 cases. Osteolysis of the skull base was

identified in 2 cases. Brain MRI performed in three cases showed variable involvement, including one case with a pseudoaneurysm of the right internal carotid artery, requiring urgent endovascular treatment. Bone scintigraphy in one patient revealed increased uptake in the temporomandibular area on the affected side. Based on clinical examination and paraclinical assessment, the LEVENSON classification was used to evaluate severity. The patients were distributed as follows: 13 cases (59.10%) in Stage I/II, and 9 cases in Stage III. Hospital management was systematic, with an average duration of three weeks. Diabetes stabilization was achieved by adjusting insulin doses according to capillary blood glucose levels. Analgesic treatment was provided in 18 cases with level 1 analgesics, and in 4 cases with level 2 analgesics. Initial empiric intravenous antibiotic therapy targeting P. aeruginosa was adapted according to the antibiogram. Treatment combined ciprofloxacin with ceftriaxone (10 cases), ceftazidime (6 cases), gentamicin (4 cases), or metronidazole (2 cases). Oral follow-up used ciprofloxacin alone for eight weeks. Ear instillation with ofloxacin and topical corticosteroids, along with daily local care, was systematic. Hyperbaric oxygen therapy was not used. Recovery was evaluated based on clinical and biological criteria. Clinical criteria included the disappearance of otalgia, regression of local inflammation, and reduction of stenosis. The outcome was favorable in 86.36% of cases, with 2 recurrences and 1 case of neurological sequelae. Pain subsided in all patients within 48 hours. Biological markers decreased significantly. In the long term, we observed inflammation resolution with re-epithelialization of the external auditory canal (81.8% of cases). Mean post-treatment blood glucose was 1.4 g/l with a glycated hemoglobin of 7.8%. For 2 patients, recurrence occurred after stopping antibiotics, requiring successful rehospitalization. Neurological sequelae persisted in one patient.

Discussion:

Malignant external otitis was first described under the name of osteomyelitis of the temporal bone by Toulmouche in 1883. Later, in 1959, the first report of this condition was made by Meltzer and Klemen, who described pyocyanic osteomyelitis of the temporal bone in a patient with uncontrolled diabetes. In 1968, Chandler detailed his experience with MEO based on a study of 13 elderly diabetic patients with external otitis caused by P. aeruginosa and multiple cranial nerve palsies, introducing the term “malignant” due to the infection’s extension to the subarachnoid spaces, resulting in death in a context of meningitis. Systemic antibiotic therapy was, however, only a complement to surgery. Colistin and Polymyxin were the available treatments for Pseudomonas infections. During the 1970s and 1980s, the combination of Carbenicillin—a semi-synthetic penicillin offering broad Gram-negative coverage—with intravenous aminoglycosides became the standard of care. This combination led to a decline in mortality rates, dropping from 46% in 1968 to 32% in 1972. However, it required prolonged parenteral treatment, often resulting in renal complications, hearing loss, ataxia, and depression.[5–7]In 1973, Evans and Richard, followed by Cohn in 1974, introduced the term "progressive necrotizing otitis," avoiding confusion with a neoplastic condition. In 1987, the introduction of oral ciprofloxacin transformed the treatment of MEO due to its activity against Pseudomonas Aeruginosa, good bone penetration, high tolerability, low toxicity, and allowing for outpatient treatment. In the early 1990s, ciprofloxacin became the standard treatment for MEO. Recently, case series report the use of combination therapy with ciprofloxacin and ceftazidime[3,8]. Regarding pathogenesis, malignant external otitis primarily affects elderly diabetic individuals in more than 90% of cases. This predisposition can be explained by diabetic microangiopathy. Additionally, the alkalinization of the pH in the external auditory canal, particularly in male subjects, promotes microbial proliferation. Malignant external otitis can also occur in non-diabetic patients, mainly due to immune dysfunction[9–11]. Pseudomonas aeruginosa is the pathogen most frequently associated with malignant external otitis. This organism is not a normal component of the auditory canal flora, and its isolation is pathological. Its virulence is attributed to its tissue toxicity—due to exotoxins and several proteolytic, lipolytic, elastolytic, and collagenolytic enzymes—and its antibiotic resistance thanks to a protective mucopolysaccharide. Other organisms have been reported, including Staphylococcus aureus, Staphylococcus epidermidis, Proteus mirabilis, Klebsiella oxytoca, Pseudomonas cepacia, Aspergillus fumigatus, and Candida parapsilosis, with fungal infection being more frequent in immunocompromised, non-diabetic patients[9,12,13]. Infection spreads through the fissure of Santorini, a usual site for granulation tissue formation. The infection causes necrosis of soft tissues, progressing from the outside inwards, leading to subcutaneous cellulitis, perichondritis, and osteitis of the tympanic and temporal bones. Infection spreads

anteriorly to the TMJ, masticatory spaces, and parotid region; posteriorly to the mastoid region and the facial nerve at its third segment, then to the lateral sinus and jugular bulb, possibly leading to cavernous sinus thrombosis. Medially, it may invade the temporal bone, petrous apex, and para-pharyngeal and prevertebral spaces. Superiorly, the infection progresses intracranially, potentially causing subdural empyema, meningitis, and intraparenchymal abscess. This accounts for the diversity of symptoms and unfavorable progression. Without treatment, inflammation related to osteitis affects the cranial nerve sheaths, and neurotoxic substances from pyocyanic organisms cause toxic neuritis, resulting in irreversible nerve blockage[14–16]. Epidemiologically, malignant external otitis is a rare condition, and its exact incidence remains unknown in Morocco. However, this disease appears to be increasing in frequency, likely due to current diagnostic tools. A study conducted in the United Kingdom revealed a significant rise in incidence over an eight-year period[17]. It mainly affects elderly diabetic patients but also occurs in immunocompromised younger patients. Patient ages range from 30 to 38 years, although rare cases are observed in children. A male predominance is reported, likely due to poorer compliance with antidiabetic treatment and less acidic cerumen pH in men. Diabetes remains the main risk factor, with the duration of the disease deemed important, even though the severity of MEO is not linked to poor glycemic control[1,9,10,18,19].

Malignant external otitis (MEO) is a serious infectious disease characterized by an insidious progression and often late diagnosis, which complicates its management and worsens its prognosis.A detailed analysis of the clinical, biological, and radiological data from the literature and our study highlights the diagnostic challenges, the varied clinical presentations, as well as current therapeutic strategies, while emphasizing the importance of rigorous follow-up.

The delayed diagnosis of MEO is mainly due to its initially nonspecific clinical presentation, often mistaken for simple external otitis. Severe, throbbing otalgia that is resistant to antalgics and radiates towards the skull, as well as chronic, purulent, foul-smelling otorrhea, are key signs that should alert the clinician. The presence of granulation tissue in the external ear canal—almost pathognomonic—is an essential diagnostic marker and justifies a systematic biopsy to rule out neoplastic lesions. The importance of a thorough neurological examination is also emphasized, as cranial nerve involvement, especially of the facial nerve, indicates an advanced stage of the disease and determines the severity of the prognosis[9].

Microbiologically, Pseudomonas aeruginosa remains the predominant pathogen, isolated in over 75% of cases in this series, confirming its central role in MEO pathogenesis. Other organisms such as Staphylococcus aureus and fungi like Aspergillus are more frequent in immunocompromised patients. The pathogen's virulence stems from its tissue-destructive enzymes and resistance mechanisms, complicating treatment[20].

Biologically, MEO is particular in that it frequently does not cause leukocytosis, which can give a misleading impression of a non-severe disease. However, a high erythrocyte sedimentation rate remains a nonspecific yet useful marker for diagnosis and follow-up. Strict glycemic control is essential, given the strong association between MEO and diabetes, and the possibility that MEO may reveal previously undiagnosed diabetes. Systematic screening for glycemic imbalance and adjusting antidiabetic treatment are fundamental components of management[9,18].

Imaging plays a central role in the diagnosis, classification, and follow-up of MEO. Computed tomography (CT) detects bone destruction, notably tympanic osteolysis, mastoid cortical involvement, and extension to adjacent structures such as the temporomandibular joint (TMJ) and the skull base. Nevertheless, CT has its limitations—especially insufficient sensitivity at early stages and limited specificity, making it unsuitable for ruling out differential diagnoses such as squamous cell carcinoma. MRI, although less sensitive for bone erosion, usefully complements the evaluation by assessing soft tissue, meningeal, and central nervous system involvement[12].

Isotopic techniques, particularly technetium-99m bone scintigraphy and gallium-67 scintigraphy, offer high sensitivity for early diagnosis and monitoring of osteomyelitis. Bone scintigraphy detects osteoblastic activity early, before lesions are visible on X-ray, but its low specificity often requires coupling with gallium scintigraphy, which is more specific for active inflammatory processes. New imaging modalities, such as

positron emission tomography (PET) with inflammatory tracers (18F-FDG, Gallium 68), appear promising due to their sensitivity and predictive value, but their cost and limited availability still restrict routine use[21,22].

The clinical and radiological classification of MEO, notably those of Corey, Levenson, and Thakar, allows for stratification of disease severity, guiding management, and anticipating disease progression. These classifications incorporate the extent of the infection, the presence of nerve involvement, and severe complications such as meningitis or brain abscesses. Their systematic application facilitates communication among specialists and standardizes therapeutic protocols[7,12].

Therapeutically,a multidisciplinary approach is vital. The treatment of MEO is based primarily on prolonged systemic antibiotic therapy targeting Pseudomonas (primarily ciprofloxacin with ceftazidime), combined with strict diabetes control and daily local treatment. The emergence of resistance to quinolones—previously the reference treatment—now requires dual therapies combining fluoroquinolones and third-generation cephalosporins, with oral therapy introduced upon clinical improvement. Local antibiotic therapy, though controversial, remains an important adjunct for debridement and control of local bacterial flora. Surgery retains a limited adjuvant role, mainly for draining purulent collections and removing bone sequestra, as aggressive surgery has shown limited effectiveness and high morbidity.Hyperbaric oxygen therapy, as an adjuvant treatment, improves local vascularization, reduces edema, and enhances the effectiveness of antibiotics, especially in advanced forms with skull base involvement. Despite its demonstrated benefits, restricted access and related risks limit its widespread use. The study confirms favorable outcomes in most patients (86.36% cure rate), though recurrences and neurological sequelae remain concerns[7,12].

Clinical, biological, bacteriological, and radiological follow-up is crucial to prevent recurrence. The disappearance of otalgia, regression of local signs, normalization of inflammatory markers, and negative bacteriological cultures are indicators of response. Gallium scintigraphy remains the primary radiological criterion for cure, although its availability can sometimes be limited.

Finally, differential diagnosis remains a major challenge, with conditions such as severe external otitis, tuberculous otitis, cholesteatoma, granulomatosis, and squamous cell carcinoma of the external auditory canal. Biopsy of granulation tissue and microbiological examinations are essential to exclude these diagnoses and guide management.

Conclusion:

Malignant external otitis remains a complex disease requiring multidisciplinary management, early diagnosis, and prolonged monitoring. Advances in imaging techniques and therapeutic protocols have improved prognosis, but the clinical variability and special forms require constant adaptation of strategies. Close collaboration among ENT specialists, infectious disease specialists, radiologists, and endocrinologists is essential to optimize outcomes and reduce the morbidity associated with this disease. Limitations of the study include its retrospective design, small sample size, and lack of advanced imaging and long-term follow-up data on quality of life and economic impact. These factors constrain the generalizability of findings and the ability to fully evaluate treatment efficacy and prognosis.