



Clinical Studies

Necrotizing otitis externa: diagnosis, treatment, and outcome in a case series ☆☆☆

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ABSTRACT

We reviewed 25 cases of patients diagnosed with necrotizing otitis externa in our tertiary university-affiliated medical center between 2009 and 2015. Mean overall hospitalization duration was 14.52 days, 95% of the patients showed specific seasonal incidence. Mean duration of symptoms prior to hospitalization was 6 weeks and the duration correlated with outcome. Only 8% of the patients presented with cranial neuropathies; however, this presentation correlated with adverse outcome. *Pseudomonas aeruginosa* was the main causative organism (50%), with a 30% multidrug-resistance rate. A high rate (35%) of fungal pathogens was noted. Seventeen patients (68%) were eventually operated; however, only 5 patients needed extensive surgery under general anesthesia. Computed tomography (CT) evidence of adjacent structures' involvement correlated with adverse outcome. Eighty percent of our patients improved clinically. The overall death rate was 12% and the disease-related mortality rate was 8%. Our findings state the importance of limited surgical intervention and microbiologic cultures in disease treatment. This is particularly important in patients with cranial neuropathies and CT finding of adjacent structural involvement that correlate with adverse prognosis. A rising pseudomonal antibiotic resistance and fungal infections may challenge antibiotic treatment in the future.

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1. Background

Necrotizing otitis externa (NOE) is a severe infection that typically affects the elderly, diabetic, and immunocompromised patients (Chandler, 1968).

Another term is skull-base osteomyelitis, which describes the pathophysiology and local spread of the disease process (Nadol, 1980).

P. aeruginosa is the main causative organism. Fungal pathogens may cause NOE, particularly in immunocompromised patients who are not diabetic (Carfrae and Kesser, 2008).

Infection usually begins in the external auditory canal (EAC), spreading through bony channels, like the fissures of Santorini, to surrounding structures (Rubin Grandis et al., 2004). Advances in antipseudomonal antibiotics have reduced mortality, which was approximately 50% when NOE was first described (Carfrae and Kesser, 2008; Chandler, 1968).

The typical clinical presentation is severe, unremitting otalgia, aural fullness, otorrhea, and hearing loss.

Originally managed surgically, NOE can now be effectively treated with antibiotics, with surgery reserved for biopsy and local debridement (Carfrae and Kesser, 2008; Rubin Grandis et al., 2004).

The clinical course of NOE is variable and outcome prediction is difficult. Previous studies have attempted to identify diagnostic criteria, prognostic factors, and treatment guidelines, but a lack of consensus exists (Soudry et al., 2011).

This study aims to review our experience of diagnosis and management of NOE in a series of patients.

2. Methods

The study was approved by the Sheba Medical Center ethics committee. The database of the Department of Otolaryngology–Head and Neck Surgery in our tertiary university-affiliated medical center was searched for cases of NOE treated between 2009 and 2015.

The patients were diagnosed with NOE upon admission, or during their hospitalization. The diagnosis was based on the following criteria:

- 1) Severe, unremitting otalgia or sensation of aural fullness with duration of over 2 weeks.
- 2) Physical findings consistent with external otitis.
- 3) Signs and symptoms unresponsive to outpatient treatment of over 1 week.

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Due to the variability of the disease presentation, we decided to include in our study only patients with a definitive necrotizing disease.

Thus, only patients with one or more of the following were included in our study:

- 1) Evidence of external ear canal bone exposition or destruction on physical examination.
- 2) Radiologic evidence of bone erosion.

All of the patients were diagnosed, admitted, and treated at our department.

For the present study, patient background and clinical characteristics; clinical presentation; laboratory results; culture findings; imaging studies, if any; need for surgery; treatment, and short- and long-term outcome were reviewed.

3. Results

3.1. Background and clinical characteristics

A total of 25 cases, 7 women (28%) and 18 men (72%) met our diagnostic criteria with a mean age of 73.8 (range, 27–93).

Diabetes mellitus (DM) was present in 84% of the patients (21/25), 14 (66%) of them were insulin dependent. Mean hemoglobin A1c (HbA1C) level was 7.8 (range, 5.2–9.8). The patients' main clinical characteristics are shown in Table 1.

Two patients were defined as immunodeficient: 1 patient was under immunosuppressing therapy postrenal transplant and the other received chemotherapy for acute myeloid leukemia.

Interestingly, approximately 95% of the patients presented to our hospital between the months of April and October, when the weather is usually warm and humid in our geographic location.

3.2. Clinical presentation

All of the patients presented with over 2 weeks of otalgia, with a mean duration of 6 weeks, 56% on the right side. None had bilateral disease upon admission.

Table 1 shows the prevalence of relevant signs and symptoms in the patient group.

While auricular discharge (60%) and granulation tissue (96%) were the common symptoms/findings, erythema (16%), vertigo (12%), and pruritus (4%) were less common. None of the patients presented with fever. Four patients (16%) showed acute sensorineural hearing loss of different degrees.

Two patients presented with complete ipsilateral facial palsy along with other cranial neuropathies. According to previous studies, this

presentation defines a severe disease with worse prognosis (Chen et al., 2010; Soudry et al., 2011).

3.3. Laboratory tests

Fifteen (60%) of the patients were anemic. The mean albumin level was 3.8 g/dL.

Regarding inflammatory markers, 28% had leukocytosis with neutrophilia and 88% had elevated C-reactive protein (CRP) with a mean CRP level of 49. Eleven patients (44%) had elevated erythrocyte sedimentation rate (ESR) with a mean level of 63 mm/h. In the other 14 patients, this test was not performed.

3.4. Microbiology

Microbiologic cultures were taken from all infected ears. Organisms were identified in 80% (20/25) of them. The results of the positive cultures are presented in Table 2.

P. aeruginosa was the main causative organism and was present in 10 cultures (50%). When antimicrobial sensitivity was tested, 30% of the *P. aeruginosa*-positive cultures were multidrug-resistant. The second most common pathogen was fungi – 35% (7/20).

3.5. Histology

Tissue specimens were sent for histologic evaluation in 68% (17/25) of the patients. These specimens were obtained by external canal biopsy alone or during surgical debridement.

The most common findings were: pathologic changes compatible with acute and/or chronic inflammation, granulation, and ulceration.

Two patients showed histologic evidence of fungal infection, one presenting with findings compatible with an invasive infection.

3.6. Imaging

Twenty-one patients underwent computed tomography (CT) which is the imaging modality of choice in our department. In the remaining patients, CT was not performed due to the impression of a limited disease with rapid clinical improvement. In 19 (90%) of 21 scans, bone erosion was seen, mostly of the external ear canal and mastoid. Seven (33%) of 21 scans showed temporomandibular joint (TMJ) and/or infratemporal fossa involvement. Five (24%) of 21 scans showed base of skull involvement. The latter 2 CT findings were classified as major CT findings by Soudry et al. (Soudry et al., 2011), correlating with persistent/aggressive disease.

Magnetic resonance imaging (MRI) was performed in 7 patients, usually with CT scan showing extensive disease involvement. The main purpose was to determine soft tissue or intracranial involvement. Relevant findings were: involvement of the Eustachian tube, prevertebral fascia, nasopharynx, and muscles of mastication. These findings were used for preoperative assessment.

3.7. Treatment

The treatment protocol in our department includes primary treatment with oral fluoroquinolones +/- intravenous (IV) amoxicillin and clavulanic acid. Second line treatment included IV carbapenems,

Table 1
Patients' clinical characteristics and presentation.

	No. (%)
Characteristics	
Male	18 (72%)
Female	7 (28%)
DM	21 (84%)
Insulin dependent	14 (56%)
Immunodeficiency	2 (8%)
Signs/symptoms	
Right ear otalgia	14 (56%)
Left ear otalgia	11 (44%)
Auricular discharge	15 (60%)
Vertigo	3 (12%)
Pruritus	1 (4%)
Granulation tissue	24 (96%)
Periauricular erythema	4 (16%)
Sensorineural hearing loss	4 (16%)
Finding of tympanic membrane pathology	10 (40%)
Fever	0 (0%)
Cranial neuropathies	2 (8%)

Table 2
Positive microbiologic culture results from infected ears.

Pathogen	No. of positive culture
<i>P. aeruginosa</i>	10
<i>Enterococcus faecalis</i>	1
Candida species	3
<i>A. flavus</i>	3
<i>A. fumigatus</i>	1
Mixed pathogens	4

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