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Review

# Is Facial Nerve Decompression Justified in Malignant External Otitis? Literature Review and Own Experience

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**OBJECTIVE:** The aim of the study was to present the indications for facial nerve decompression in malignant external otitis, to analyze the results of such treatment, and to describe own experience in that field.

**METHODS:** A search in the PubMed and Google Scholar databases for English language articles published between 1968 and May 2022 was performed. We focused on papers describing patients with malignant external otitis and facial nerve palsy treated by decompression. Moreover, retrospective analysis of 24 consecutive patients with malignant external otitis hospitalized in our department in the past 10 years was performed.

**RESULTS:** In the literature, 48 cases with malignant external otitis and facial nerve paresis treated by decompression were identified. In total, 41 patients recovered (85.42%), 4 died (1 due to exacerbation of the disease, 2 for pneumonia, and 1 for heart failure), and in 3 cases the final outcome was not presented. In most cases (24; 50%), facial nerve function did not improve after decompression, in 8 patients (16.67%) partial recovery was observed, in 11 cases (22.92%) full improvement was observed, and data were not given for 5 patients. In only one case, the spread of infection and deterioration of local and general patient states were noted. In our material, we identified 13 patients with malignant external otitis and facial nerve palsy. Two of them were treated surgically, of which only one had facial nerve decompression. Partial improvement of facial nerve function was observed after 6 months of rehabilitation.

**CONCLUSION:** The management of malignant external otitis is still difficult and not well defined. Facial nerve decompression seems justified in selected cases of malignant external otitis not responding to conservative treatment.

**KEYWORDS:** Facial nerve, decompression, *Pseudomonas aeruginosa*, otitis

## INTRODUCTION

Malignant external otitis (MEO) is a life-threatening, progressive infection of the temporal bone. It predominantly affects elderly, diabetic, or immunocompromised patients.[1] It was termed "malignant" by Chandler in 1968 due to the high mortality rate.[2] Some clinicians have adopted the name "necrotizing" to more properly describe the pathological process that can spread across the skull base resulting in bony erosion and cranial nerve deficits.[2,3] Malignant external otitis is relatively rare; however, the reported incidence is growing compared to previous years.[4] It is related to the aging, diabetic populations but also patients' awareness and development of diagnostic tools.[4] Clinical manifestations usually include severe otalgia, otorrhea, hearing loss, and involvement of cranial nerves, especially the VIIth.[2,5] A reported incidence of facial nerve (FN) palsy in the course of MEO ranges from 10% to 70%.[1-8] The FN paresis may be detected at presentation and may develop despite the treatment. The question arises of how to treat these patients. Most clinicians recommend at least 6-week culture-directed combined intravenous antibiotic therapy.[9] Some authors expand it to an antifungal treatment[7,10] or hyperbaric oxygen[11] if no improvement is observed. Few authors still advocate various surgical approaches to improve clinical outcomes.[7,10,12-14] Although extensive otosurgery is contraindicated in most recommendations due to the risk of the skull base infection spread,[15,16] there is no paper in the literature confirming that sequel. The question arises if FN decompression should be forbidden or rather advocated in selected cases of MEO with the VIIth nerve palsy. The issue prompted us to review the literature and to analyze own material in that field.

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The aims of the study were (1) to present the indications for FN decompression in MEO in different clinical centers, (2) to analyze the results of such an approach, (3) to describe own experience in that field, and (4) to answer the question if FN decompression is justified in MEO.

## CLINICAL AND RESEARCH CONSEQUENCES

### Methods

#### Literature Review

A search in the PubMed and Google Scholar databases for English language articles published between 1968 and June 2022 was performed. Terms included were MEO, necrotizing otitis externa, skull base osteomyelitis, and FN decompression. All types of publications were analyzed and reviewed. The authors focused on papers describing patients with MEO and FN palsy treated surgically by means of decompression. Twenty-three articles with 48 cases were found (Table 1).[2,10-14,17-33]

## OWN MATERIAL

Retrospective analysis of 24 consecutive patients with MEO hospitalized in the department in the past 10 years was performed. Patients treated surgically were evaluated in detail. The study was approved by the Bioethics Committee at Poznań University of Medical Sciences (KB 175/20). Written informed consent was obtained from the patients who agreed to take part in the study.

## RESULTS

### Literature Review

A total of 48 cases with MEO and FN paresis treated by means of surgical decompression were identified. There were 4 women and 31 men, and in 13 cases, data were not given. Mean age of patients was 65 (range: 34-91). Of the 40 patients with data available, 33 had diabetes or were immunocompromised (82.5%). In 3 patients, infection was bilateral. In most patients (26; 54.17%), canal wall down (CWD) mastoidectomy with FN decompression was performed, in 4 patients canal wall up (CWP) technique was used, in other 4 petrosectomy was used, while in 14 cases, the type of surgical approach was not presented. Intraoperative findings included granulation tissue, pus, fluid, polyps, and necrotic mass, and some surgeons described atrophy of the FN or erosion of its bony canal. Among causative pathogens, *Pseudomonas aeruginosa* dominated (30 cases), followed by *Aspergillus* (3 cases), in single swabs *Zygomycetes* spp, *Malassezia* and co-infection with *Staphylococcus epidermidis* and *Corynebacterium* or unspecified fungi were found, in 11 patients data were not given. Different antibiotic schemes were used. In pre-ciprofloxacin era, gentamycin + carbenicillin were mostly used, and from 1996, ciprofloxacin + aminoglycosides or ciprofloxacin with third generation of cephalosporines or piperacillin-tazobactam were used. In fungal infection, amphotericin B or itraconazole was introduced. In most patients, aural toilet and local debridement were additionally performed. In the whole group, 41 patients recovered (85.42%), while 4 died (1 due to exacerbation of the disease, 2 for pneumonia, 1 for heart failure), in 3 cases, the final outcome was not presented. In most cases (24; 50%), FN function did not improve after decompression, in 8 patients (16.67%) partial recovery, in 11 cases (22.92%) full improvement was noted, and in 5 patients data were not given. In only one case, the spread of infection and deterioration of local and general patient state were noted. It was a 68-year-old diabetic woman with bilateral disease who died in the picture of meningitis, cerebritis, and multiple thrombosis in 1958. She was probably not treated with antibiotics but only surgically.

#### Own Material

In the past 10 years in our department, there were 24 hospitalized patients with MEO altogether. Thirteen manifested FN palsy (Table 2). Two of them were treated surgically, of which only one had FN decompression. It was a 70-year-old man with diabetes and heart insufficiency transferred to our department from another hospital due to the iatrogenic postoperative FN palsy. Canal wall up procedure was primarily performed due to the suspicion of acute mastoiditis. He was reoperated, granulation and necrotic tissue found out in the mastoid cavity were partially removed, and VIIth nerve was exposed and decompressed in the tympanic and mastoid parts. Further diagnostics (high resolution computed tomography [HRCT] and scintigraphy) confirmed MEO. Six-week therapy with ciprofloxacin and ceftriaxone was sufficient to reach normal levels of inflammatory markers, and partial improvement of FN function was observed after 6 months of rehabilitation.

The rest of the patients were treated conservatively. Six-week antibiotic therapy with ciprofloxacin together with ceftriaxone was mostly used. In 2 patients, hyperbaric oxygen was additionally applied. All patients recovered. FN function improved in 53.84% of cases.

## DISCUSSION

The VIIth nerve is often involved in MEO due to its integration with the temporal bone and proximity of the stylomastoid foramen to the ear canal.[24] Typically, the infection spreads via vascular and facial planes within temporal bone, finally affecting petrous apex.[25] The inflammation could lead to cellulitis, chondritis, osteitis, and eventually osteomyelitis.[34] Facial palsy is probably caused by the secretion of neurotoxins or the compressive effect of the bone destructive process. Nerve conduction becomes disturbed by inflammatory process, and in advanced cases, nerve integrity may be impaired and replaced by granulation tissue.[35] Involvement of FN is determined by the fallopian canal erosion which could be visualized on computed tomography (CT) scans.[10] Mani et al[24] suggest that in diabetic patients blood supply to the nerve may be compromised by preexisting microvascular disease leading to neuropathy.

Improvement of FN function in MEO is so far unpredictable. Patients require hospitalization for management of decompensated diabetes (if needed), parenteral antibiotic therapy, and daily aural toilet. *P. aeruginosa* is the most common causative pathogen,[5] although infections caused by *Staphylococci*, *Streptococci*, and gram-negative bacilli (e.g., *Klebsiella*, *Escherichia*) have also been described.[6-8] Recent reports have stressed the occurrence of fungal pathogens that account for 5%-20% with *Aspergillus* species being the most common.[7,36] Six weeks or longer of culture-directed antibiotic therapy is the current standard of treatment.[37] Such a fixed time is based on the finding that bone needs 3-4 weeks to revascularize.[1] Kamalden and Misron[38] recommend a treatment duration according to phase of the disease according to CT scan findings (phase I: up to 3 months, phases II, III, and IV: up to 6 months, phase V: 12 months). Nondiabetic, non-immunocompromised patients have better response to antibiotic

**Table 1.** Literature Review—Patients with MEO and Facial Nerve Palsy Treated Surgically by Means of Decompression

| | Year of Publication | Author | Sex | Age | Immunosuppression | Bilateral Infection | Facial Nerve Function Before Surgery (HB scale) | Surgical Treatment—Method | Intraoperative Findings | Pathogen(s) | Systemic Antibiotics | Local Treatment | Facial Nerve Function After Treatment (HB Scale) | Follow-Up Results |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1972 | Chandler[2] | Male | 91 | DM | No | ND | An extended radical mastoidectomy and total intratympanic and soft tissue decompression of the facial nerve | ND | *Pseudomonas aeruginosa* | Gentamicin, carbenicillin (6 weeks) | Nonadherent gauze impregnated with polymyxin B, neomycin, and bacitracin ointment | No improvement | Recovery |
| 2 | 1972 | Chandler[2] | Male | 83 | DM | No | 80% paralysis | An extended radical mastoidectomy and total decompression of the facial nerve | Granulation tissue, dehiscence of the intratympanic portion of the facial nerve, enlarged distal portion of the descending Fallopian canal and filled with granulation tissue which surrounded the otherwise intact nerve | *Pseudomonas aeruginosa* | Carbenicillin, gentamicin | ND | Partial recovery | Recovery |
| 3 | 1973 | Evans and Richards[17] | Female | 68 | DM | Yes | Almost complete—bilateral | Right cortical mastoidectomy (the facial nerve was not exposed) and left modified radical mastoidectomy with decompression of the facial nerve | Right mastoid—fluid left mastoid—partially filled with fluid and thick mucosa | *Pseudomonas pyocyaneus S. aureus*, Streptococcus | ND | ND | No improvement | Deterioration of general state/death (meningitis, cerebritis, multiple thrombi) |
| 4 | 1980 | Raines and Schindler[18] | Female | 71 | DM | No | ND | Subtotal temporal bone resection (including facial nerve decompression) and parotidectomy | Granulation, necrotic bone | *Psedomonas aeruginosa* | Gentamycin, carbenicillin (6 weeks) | Irrigation of the wound with betadine solution | Partial recovery | Recovery |
| 5 | 1980 | Raines and Schindler[18] | Female | 63 | DM | Yes | ND | Right subtotal temporal bone resection (including facial nerve decompression) with removal of mastoid tip and inferior tympanic ring left subtotal temporal bone resection | Pus, necrotic bone | Pseudomonas | Gentamycin | Local dressings | ND | Recovery/ death from pneumonia |
| 6 | 1980 | Raines and Schindler[18] | ND | 70 | DM | No | ND | Subtotal temporal bone resection (including facial nerve decompression) | Pus, necrotic bone | Pseudomonas | Gentamycin, carbenicillin (6 weeks) | Irrigation of the wound with betadine solution | Recovery | Recovery |
| 7 | 1988 | Cunningham et al[19] | Male | 85 | no | No | ND | Radical mastoidectomy with facial nerve decompression | Granulation, facial nerve atrophic | *Aspergillus* species, *Staphylococcus epidermidis*, *Corynebacterium* | Penicillin, gentamycin, Amphotericin B, rifampin | ND | No improvement | Refused further therapy, died of heart failure |
| 8 | 1988 | Vernham et al[20] | Male | 78 | DM | No | ND | Mastoid exploration and facialnerve decompression | ND | *Pseudomonas aeruginosa* | Tobramycin and carbenicillin, piperacillin and tobramycin | Gentisone wicks | Recovery | Recovery |
| 9 | 1996 | Thakar et al[21] | Male | 60 | DM | No | | Modified radical mastoidectomy with facial nerve decompression | Pus, necrotic bone, edema of the lower part of the VIIth nerve | *Pseudomonas aeruginosa* | Third-generation cephalosporin + aminoglycoside/ quinolone | Aural toilet | Improvement | Recovery |

(*Continued*)

**Table 1.** Literature Review—Patients with MEO and Facial Nerve Palsy Treated Surgically by Means of Decompression (Continued)

| | Year of Publication | Author | Sex | Age | Immunosuppression | Bilateral Infection | Facial Nerve Function Before Surgery (HB scale) | Surgical Treatment—Method | Intraoperative Findings | Pathogen(s) | Systemic Antibiotics | Local Treatment | Facial Nerve Function After Treatment (HB Scale) | Follow-Up Results |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | 1996 | Thakar et al[21] | Male | 65 | DM | No | | Modified radical mastoidectomy with facial nerve decompression | Pus, necrotic bone, edema of the lower part of the VIIth nerve | *Pseudomonas aeruginosa* | Third-generation cephalosporin + aminoglycoside/ quinolone | Aural toilet | No improvement | Recovery |
| 11 | 1996 | Thakar et al[21] | Male | 70 | DM | No | | Radical mastoidectomy with facial nerve decompression | Granulation, pus, necrotic bone, edema of the lower part of the VIIth nerve | *Pseudomonas aeruginosa* | Third-generation cephalosporin + aminoglycoside/ quinolone | Aural toilet | No improvement | Recovery |
| 12 | 1996 | Thakar et al[21] | Male | 63 | DM | No | | Modified radical mastoidectomy with facial nerve decompression | Pus, necrotic bone, edema of the lower part of the VIIth nerve | *Pseudomonas aeruginosa* | Third-generation cephalosporin + aminoglycoside/ quinolone | Aural toilet | No improvement | Recovery |
| 13 | 1996 | Thakar et al[21] | Male | 72 | DM | No | | Radical mastoidectomy with facial nerve decompression | Granulation, pus, necrotic bone, edema of the lower part of the VIIth nerve | *Pseudomonas aeruginosa* | Third-generation cephalosporin + aminoglycoside/ quinolone | Aural toilet | No improvement | Died of pneumonia |
| 14 | 1996 | Thakar et al[21] | Male | 70 | DM | No | | Radical mastoidectomy with facial nerve decompression | Granulation, pus, necrotic bone, edema of the lower part of the VIIth nerve | *Pseudomonas aeruginosa* | Third-generation cephalosporin + aminoglycoside/ quinolone | Aural toilet | no improvement | Recovery |
| 15 | 2000 | Chai et al[22] | Male | 53 | DM | No | ND | Transmastoid facial nerve decompression | Extensive granulation tissue in the middle ear cleft and mastoid system | *Malassezia sympodialis* | Ticarcillin/ clavulanic acid, ciprofloxacin, amphotericin B, fluconazole | Ear toilet | No improvement | Recovery |
| 16 | 2002 | Sardesai et al[12] | Male | 72 | DM | No | HB6 | Canal wall down modified radical mastoidectomy with facial nerve decompression | Granulation, necrotic bone | *Pseudomonas aeruginosa* | Ciprofloxacin + aminoglycosides | ND | No improvement | Recovery |
| 17 | 2002 | Sardesai et al[12] | Male | 64 | DM | No | HB6 | Canal wall down modified radical mastoidectomy with facial nerve decompression | Granulation, necrotic bone | *Pseudomona aeruginosa* | Ciprofloxacin + aminoglycosides | ND | no improvement | Recovery |
| 18 | 2002 | Sardesai et al[12] | Male | 70 | DM | No | HB6 | Canal wall down modified radical mastoidectomy with facial nerve decompression | Granulation, necrotic bone | *Pseudomonas aeruginosa* | Ciprofloxacin + aminoglycosides | ND | No improvement | Recovery |
| 19 | 2002 | Sardesai et al[12] | Male | 35 | DM | no | HB6 | Canal wall down modified radical mastoidectomy with facial nerve decompression | Granulation, necrotic bone | *Pseudomonas aeruginosa* | Ciprofloxacin + aminoglycosides | ND | No improvement | Recovery |
| 20 | 2002 | Sardesai et al[12] | Male | 40 | CRF (D) | No | HB6 | Canal wall down modified radical mastoidectomy with facial nerve decompression | Granulation, necrotic bone | *Pseudomonas aeruginosa* | Ciprofloxacin + metronidazole | ND | No improvement | Recovery |
| 21 | 2002 | Sardesai et al[12] | Male | 65 | No | No | HB6 | Canal wall down modified radical mastoidectomy with facial nerve decompression | Granulation, necrotic bone | *Pseudomonas aeruginosa* | Ciprofloxacin | ND | No improvement | Recovery |
| 22 | 2006 | Makeham et al[23] | Male | 48 | Alcohol- depended | No | HB5 | Lateral temporal bone resection and decompression of facial nerve | ND | ND | ND | ND | Partial recovery to HB4 | Partial recovery |
| 23 | 2007 | Mani et al[24] | ND | ND | ND | No | HB5 | Cortical mastoidectomy and facial nerve decompression | ND | ND | Cephalosporin + ciprofloxacin | ND | ND | Recovery |
| 24 | 2008 | Lee et al[25] | ND | ND | ND | ND | ND | Facial nerve decompression | ND | ND | ND | ND | ND | ND |
| 25 | 2008 | Lee et al[25] | ND | ND | ND | ND | ND | Facial nerve decompression | ND | ND | ND | ND | ND | ND |

(*Continued*)

**Table 1.** Literature Review—Patients with MEO and Facial Nerve Palsy Treated Surgically by Means of Decompression (Continued)

| | Year of Publication | Author | Sex | Age | Immunosuppression | Bilateral Infection | Facial Nerve Function Before Surgery (HB scale) | Surgical Treatment—Method | Intraoperative Findings | Pathogen(s) | Systemic Antibiotics | Local Treatment | Facial Nerve Function After Treatment (HB Scale) | Follow-Up Results |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 | 2012 | Karaman et al[11] | Male | 82 | DM + CRF (D) | No | HB4 | CWD + facial nerve decompression | Granulation | *Pseudomonas aeruginosa* | Tazobactam + fluoroquinolone | ND, | Partial recovery to HB2 | Recovery |
| 27 | 2012 | Karaman et al[11] | Male | 76 | DM + CRF (D) | No | HB5 | CWD + facial nerve decompression | Polyp + granulation | *Pseudomonas aeruginosa* | Imipenem + fluoroquinolone | ND | No improvement | Recovery |
| 28 | 2012 | Karaman et al[11] | Male | 64 | DM | No | HB2 | CWD + facial nerve decompression | Granulation | *Pseudomonas aeruginosa* | Ceftazidime + fluoroquinolone | ND | Recovery | Recovery |
| 29 | 2012 | Karaman et al[11] | Male | 83 | DM + CRF (D) | No | HB2 | CWD + facial nerve decompression | Granulation | *Pseudomonas aeruginosa* | Piperacillin + fluoroquinolone | ND | Recovery | Recovery |
| 30 | 2012 | Bradoo et al[26] | Male | 65 | DM | Yes | HB5 | Exploration with facial nerve decompression | Mass arising from posterior canal wall, eroding adjacent bone, abutting vertical part of the facial nerve in its entire extent | *Aspergillus flavus.* | Itraconazole | ND | Partial recovery to HB3 | Recovery |
| 31 | 2013 | Nawas et al[27] | Male | 74 | DM | No | HB6 | Tympanomastoidectomy, drainage of mastoid tip abscess, and decompression of facial nerve | Granulation, pus, atrophied facial nerve | *Pseudomonas aeruginosa* | Ciprofloxacin | ND | No improvement | Partial recovery |
| 32 | 2013 | Saha et al[28] | Male | 62 | DM | No | HB6 | Facial nerve decompression | ND | *Pseudomonas aeruginosa* | Piperacillin-ta zobactam + ciprofloxacin | ND | Partial recovery to HB2 | Partial recovery |
| 33 | 2013 | Lambor et al[13] | ND | ND | DM | No | ND | Canal wall down mastoidectomy with facial nerve decompression (from the first genu to the stylomastoid foramen), with mastoid tip amputation | Granulation | ND | Depending on antibiotic sensivity | Daily insertion of ointment wicks (polymyxin B and neomycin sulphates) | Recovery, | Recovery |
| 34 | 2013 | Lambor et al[13] | ND | ND | DM | No | ND | Canal wall down mastoidectomy with facial nerve decompression (from the first genu to the stylomastoid foramen), with mastoid tip amputation | Granulation | ND | Depending on antibiotic sensitivity | Daily insertion of ointment wicks (polymyxin B and neomycin sulfates) | No improvement | Recovery |
| 35 | 2013 | Lambor et al[13] | ND | ND | DM | No | ND | Canal wall down mastoidectomy with facial nerve decompression (from the first genu to the stylomastoid foramen), with mastoid tip amputation | Granulation | ND | Depending on antibiotic sensitivity | Daily insertion of ointment wicks (polymyxin B and neomycin sulfates) | No improvement | Recovery |
| 36 | 2014 | Galletti et al[29] | Male | 68 | DM | No | ND | Facial nerve decompression | ND | *Pseudomonas aeruginosa* | Ciprofloxacin, gentamycin | Aural toilet | no improvement | Partial recovery |
| 37 | 2018 | Kaya et al[30] | ND | ND | ND | No | ND | Canal wall down mastoidectomy with facial nerve decompression | ND | ND | ND | ND | ND | ND |
| 38 | 2019 | Reddy et al[31] | Male | 34 | no | No | ND | Radical mastoidectomy, facial nerve decompression, and endoscopic-guided debridement of the bilateral ethmoid, sphenoid sinuses, and pterygopalatine fossa | Necrotic tissue in the involved sinuses and around the facial nerve | *Zygomycetes* species | Amphotericin B, posaconazole | ND | partial recovery to HB2 | recovery |
| 39 | 2020 | Peled et al[14] | ND | ND | ND | No | ND | Canal wall down mastoidectomy with facial nerve decompression | Granulation tissue in mastoid, gross facial canal erosion (mastoid part) | *Pseudomonas aeruginosa* | Anti-PA antibiotic | Daily aural toilette | partial recovery | Recovery |
| 40 | 2020 | Peled et al[14] | ND | ND | ND | No | ND | Canal wall down mastoidectomy with facial nerve decompression | Necrotic soft tissue, gross facial canal erosion (second genu) | *Pseudomonas aeruginosa* | Anti-PA antibiotic | Daily aural toilette | partial recovery | Recovery |

(*Continued*)

**Table 1.** Literature Review—Patients with MEO and Facial Nerve Palsy Treated Surgically by Means of Decompression (Continued)

| | Year of Publication | Author | Sex | Age | Immunosuppression | Bilateral Infection | Facial Nerve Function Before Surgery (HB scale) | Surgical Treatment—Method | Intraoperative Findings | Pathogen(s) | Systemic Antibiotics | Local Treatment | Facial Nerve Function After Treatment (HB Scale) | Follow-Up Results |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 41 | 2020 | Dabiri et al[10] | ND | ND | ND | No | HB5 | Facial nerve decompression | ND | ND | ND | ND | duration of facial nerve palsy - 3 months | Recovery |
| 42 | 2020 | Dabiri et al[10] | ND | ND | ND | No | HB6 | Facial nerve decompression | ND | ND | ND | ND | duration of facial nerve palsy - 5 months | Recovery |
| 43 | 2020 | Vinayakumar et al[32] | ND | ND | DM | No | HB6 | Facial nerve decompression | ND | ND | ND | Daily aural toilet | No improvement | Recovery |
| 44 | 2022 | Freeman et al[33] | Male | 57 | DM + organ damage | No | HB3 | Facial nerve decompression | ND | *Pseudomonas* | ND | ND | Recovery | Recovery |
| 45 | 2022 | Freeman et al[33] | Male | 73 | DM | No | HB6 | Facial nerve decompression | ND | *Pseudomonas* | ND | ND | Recovery | Recovery |
| 46 | 2022 | Freeman et al[33] | Male | 79 | DM | No | HB5 | Facial nerve decompression | ND | *Pseudomonas* | ND | ND | Recovery | Recovery |
| 47 | 2022 | Freeman et al[33] | Male | 66 | No | No | HB4 | Facial nerve decompression | ND | *Aspergillus* | ND | ND | Partial improvement | Recovery |
| 48 | 2022 | Freeman et al[33] | Female | 65 | No | No | HB4 | Facial nerve decompression | ND | Unspecified fungi | ND | ND | No improvement | Recovery |

CRF, chronic renal failure; CWD, canal wall down; D, dialysis; DM, diabetes mellitus; HB, House-Brackmann; ND, no data; PA, *Pseudomonas aeruginosa*.

**Table 2.** Patients with MEO and Facial Nerve Palsy—Own Material

| | |
|---|---|
| Number of patients | 13 |
| Mean age (range) [years] | 54 (38-72) |
| Sex—male:female | 9:4 |
| Comorbidities (% of patients) | Diabetes (84.62%), CRF (7.69%) |
| Pathogens | *Pseudomonas aeruginosa* (92.31%), *Pseudomonas aeruginosa* + *Enterobacter cloacae* (7.69%) |
| Facial nerve function before the treatment (HB scale) (% of patients) | 6 (84.62%), 5 (15.38%) |
| Systemic treatment (% of patients) | Ciprofloxacin + ceftriaxone (76.92%)<br>Ciprofloxacin (7.69%)<br>Ceftriaxone (7.69%)<br>Meronem (7.69%) |
| Mean time (range) of antibiotic therapy (weeks) | 6 (4-10) |
| Local treatment (% of patients) | Daily aural toilet (100%) |
| Surgical treatment (% of patients) | Biopsy of the granulation tissue (61.54%)<br>Antromastoidectomy (7.69%)<br>Facial nerve decompression (7.69%) |
| Other methods of treatment (% of patients) | Hyperbaric oxygen (15.38%) |
| Facial nerve function after the treatment (% of patients) | Facial nerve improvement (53.84%): full (7.69%), partial (46.15%)<br>HB 1 (7.69%), HB 2 (30.77%), HB 3 (7.69%), HB 4 (7.69%), HB 6 (46.15%) |
| Outcome (% of patients) | Recovery (100%) |

CRF, chronic renal failure; HB, House-Brackmann; MEO, malignant external otitis.

therapy and need shorter hospitalization.[39] The key factors that reduce morbidity and mortality are early diagnosis and adequate treatment.[40] Combined antibiotic therapy is associated with better outcomes when compared to monotherapy.[41] The majority of recent studies recommend ciprofloxacin (high doses) and ceftazidime. Unfortunately, in many cases, swab cultures reveal an increase in bacterial resistance. There are no well-established standards for further management. Treatment schemes depend on the individual experience. For patients with no improvement after 2 weeks of targeted antibiotic therapy, additional antifungal therapy,[7,10] hyperbaric oxygen therapy,[11] or surgery could be considered.[7,10, 12-14] Arsovic et al[42] notice that there is a growing trend toward surgical intervention as part of comprehensive MEO treatment.

In some centers, FN decompression is the treatment of choice for FN palsy in the course of MEO.[12] Some authors strongly discourage from such a management underlying that it may promote the spread of infection to the healthy bone.[29] What are then the indications for FN decompression? Unfortunately, due to the deficiencies in the literature, determining them is not so easy. Interestingly, the ones that exist have not changed much over the years. Chandler[2] advocated more aggressive surgery only in cases that failed to respond to conservative treatment. Raines and Schindler[18] recommended exploration and drainage of subtemporal tissues on the progression of the disease manifested by the development of other cranial neuropathies and local/general signs of the disease despite 2-week therapy. Karaman et al[11] performed FN decompression together with

hyperbaric oxygen therapy in cases of MEO with FN palsy which did not benefit from conservative treatment. Lambor et al[13] recommend surgical intervention in patients with persistent otalgia for more than 10 days (visual analogue scale [VAS] score of more than 50%), and those with persistent granulations. They conclude that most stage I patients respond well to medical therapy, whereas stage II and III patients are likely to require surgical intervention to improve their outcomes. Dabiri et al[10] point out that the decompression of the FN might be useful in patients with the erosion of the mastoid part of the FN canal on CT imaging. Furthermore, the study indicates that the stylomastoid area involvement should not predict the risk of paralysis of the seventh nerve. Peled et al[14] and Hasibi et al[7] suggest the surgery if improvement is not seen after 2 weeks of conservative therapy, other authors[18,43] consider the patient as nonresponsive after 3-4 weeks. Freeman et al[33] conclude that mastoidectomy and debridement with or without FN decompression may improve FN outcomes when compared to isolated medical management, especially when performed within 14 days of the onset of paralysis. The next question concerns the technique (CWU or CWD) which should be used during decompression. Peled et al[14] recommend surgical extent tailored to the sites of involvement: Canal wall up mastoidectomy is the minimal surgical procedure that should be converted to CWD mastoidectomy in cases of severe bone erosion of the posterior canal wall and when better exposure of the middle ear is required. Such a recommendation sounds reasonable. Other clinicians mostly use CWD technique[2,11-14,17-19,30-31] or petrosectomy,[18,23] which, in our opinion, should not be approaches of choice. In many articles, surgical technique is not specified.[10,22,25-29,32-33]

Our paper has strong points and some limitations. It is the first literature review focusing on FN decompression in MEO. It presents all cases published in the past 50 years with an emphasis on treatment outcomes. It shows that nowadays, in the era of appropriate antibiotic therapy, even extensive surgery does not exacerbate or deteriorate local and general patient status and does not bring the risk of infection spread along the skull base. Unfortunately, our experience with such an approach is limited. National standards do not recommend surgical treatment, including FN decompression, in MEO. Therefore, we do not perform it routinely, except for histopathological sampling of the granulation tissue to exclude malignancy. However, some authors reported improvement of FN function after its decompression. Thus, based on the literature, it seems justified in selected unresponsive cases.

## CONCLUSION

The management of MEO is still difficult and not well defined. Long-term combined culture-directed antibiotic therapy together with minimally invasive debridement and intensive treatment of hyperglycemia, if indicated, remains the mainstay of the treatment strategy. The FN decompression seems justified in selected cases of MEO. It can be considered as a therapeutic option in patients with VIIth nerve palsy not responding to conservative treatment.

**Ethics Committee Approval:** This study was approved by the Bioethics Committee at Poznań University of Medical Sciences (Approval Number: KB 175/20).

**Informed Consent:** Written informed consent was obtained from the patients who agreed to take part in the study.

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