Microbiology of chronic suppurative otitis media with cholesteatoma

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ABSTRACT

Objective: To report the result of causative organisms in chronic suppurative otitis media with cholesteatoma.

Methods: Eighty eight patients clinically diagnosed with chronic suppurative otitis media with cholesteatoma, and confirmed intra-operatively and by histological examination were pre-operatively studied for the causative bacteria and fungi.

Results: A single isolate was obtained in 42 (48%) cases, no growth was isolated in 11 (12.5%) cases. Most common bacteria isolated were, *Pseudomonas Aeruginosa* in 51%, *Staphylococcus Aureus* in 31%, and *Proteus species* in 17%. Among the 15 fungal isolates, 9 (10%) were *Aspergillus species* and the remaining 6 (7%) were *Candida Albicans*.

Conclusion: Conventional ear swabs taken under direct vision using an operating microscope are reliable in establishing the microbiological profile of chronic suppurative otitis media.

Keywords: Micro-organism, otitis media, cholesteatoma, bacteria, fungi.

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Chronic suppurative otitis media (CSOM) with cholesteatoma is a serious disorder of the middle ear cavity which, is comprised of the presence of Keratinizing Stratified Squamous Epithelium with the subsequent accumulation of keratin within the middle ear space.[1] Treatment of otorrhoea due to CSOM of non-cholesteatomatous type, is a vexing clinical problem. Ideally, medical management should be based on the microorganisms isolated from middle ear aspirates.[2] Once the diagnosis of cholesteatoma is confirmed, the usual standard treatment is surgical intervention.[3] Otitis media in its all forms, is a common health problem among patients attending primary health care clinics.[4] It was reported that up to 3% of school boys in the Eastern province of Saudi Arabia have chronic otitis media.[5] In the pre-antibiotic era, complications resulting from chronic otitis media with cholesteatoma were common,[6] often serious and at times fatal. Today operations for chronic otitis media seem to have decreased markedly over the past few decades in Western societies. This could be due to improved health care and medical protection.[7] In uncomplicated cases the main symptoms are decreased hearing and ear discharge. This study was designed to determine the microbiology of cholesteatomatous CSOM in a group of patients operated upon by using appropriate aerobic and anaerobic bacteriological methods.

Methods. One hundred and eight patients with CSOM with cholesteatoma were selected for this study. The study group included 79 males and 29 females. All the patients presented with discharging ears when they were first seen in the out-patient clinic. Patients ages ranged from 10 to 60 (mean age 31 years), and all had history of chronic otitis media with disease duration ranging from 2-30 years. None had received local or systemic antimicrobial therapy for at least 2 weeks prior to sample collection.

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Investigations. (i) Computerized Tomography (CT) scans of mastoids were requested in the majority of the patients. (ii) Laboratory diagnosis. The specimens were collected by introducing a moistened cotton ear swab into the external auditory canal under direct visualization using a microscope. The ear swabs were transported in Amies transport medium provided with the swab container and were delivered to the laboratory immediately and were cultured within 1-2 hours. The swabs were inoculated on 1) 2 plates of blood agar for aerobic and anaerobic cultures; 2) a chocolate agar plate; 3) MacConkey's agar plate and; 4) Sabourad's agar plate for 24 hours. If negative the anaerobic and Sabourads cultures were incubated for a further 24 hours. All isolated organisms were identified by biochemical tests using API 20, API 20 NE and API strept (Biomeuix, France). The streptococci groups were confirmed by streptex method (Murex, France). The antibiotic susceptibility testing was performed by the Stoke's comparative disc diffusion method using Iso Sensi Test agar. Antibiotic discs with the following potencies were used: Ampicillin (10ug), Bacitracin (8ug), Neomycin (30ug), Cloxacillin (Methicillin 25ug), Erythromycin (5ug), Gentamicin (10ug), Penicillin (1unit), Cefoxitin (30ug), Piperacillin (100ug), Chloramphenicol (10ug), Cephalothin (30ug), Polymyxin (250ug), Cotrimoxazole (25ug), Framycetin (50ug), Tobramycin (10ug), Ciprofloxacillin (5ug), Carbencillin (100ug), Ticarcillin (75ug). If the organism was sensitive to 2 or more antibiotics, no more tests were carried out, otherwise more tests were performed. All the patients were treated with antimicrobial therapy prior to surgery. They were operated upon at King Abdulaziz University Hospital between August 1989 and June 1999. Through a postauricular approach, canal-down mastoidectomy was carried out in the majority of the cases, however, canal-up technique was performed in a few patients. Cholesteatoma was confirmed intra-operatively and in the majority of cases by histological examination.

Results. During the observation period, the medical records of 108 patients with age range between 10-60 years, operated on for chronic middle ear disease with cholesteatoma were evaluated. Twenty patients were excluded from the study because the results of culture and sensitivity of ear discharge were not available at the time of evaluation. Out of 88 ear swabs cultured, 11 (12.5%) were found to be sterile. Single isolates were seen among 42 (48%). Among the 15 (17%) fungal isolates, 12 (14%) isolates grew along with bacterial isolates and the remaining 3 (3%) isolates were of pure nature. Among the 15 fungal isolates, *aspergillus species* were observed in 9 (10%) cases and *Candida* in 6 (7%) cases. *Pseudomonas aeruginosa* formed the predominant pathogen (51%) in the present study, followed by *Staphylococcus Aureus* (31%), *Proteus species* (17%) and *Bacteriodes species* (12.5%). Among the mixed multiple isolates other organisms such as *Hemophilus Influenzae* (3%), *Prevotella species* (2%), and *Kleibsilla species* (1%) were isolated. Table 1 shows the various organisms isolated in chronic suppurative otitis media with cholesteatoma and their percentage.

Discussion. The main presenting symptoms for which the patients visited our clinic were ear discharge and decreased hearing loss. In a large

Table 1 - Shows the various organism isolated and their percentage (N=88).

Organism isolated	Single isolate	Mixed multiple isolate	Total isolate
Pseudomonas aeruginosa	24 (27%)	21 (24%)	45 (51%)
Staphylococcus aureus	9 (10%)	18 (20%)	27 (31%)
Proteus (vulgaris, mirabilis, morganii)	3 (3%)	12 (14%)	15 (17%)
Bacteroides	2 (2%)	9 (10%)	11 (12.5%)
Streptococcus species	1 (1%)	2 (2%)	3 (3%)
Hemophilus influenzae	-	3 (3%)	3 (3%)
Aspergillus niger	2 (2%)	7 (8%)	9 (10%)
Candida	1 (1%)	5 (6%)	6 (7%)
Prevotella species	-	2 (2%)	2 (2%)
Klebsiella species	-	1 (1%)	1 (1%)
No organism isolated	-	-	11 (12.5)

number of the cases operated on, the exact time of discharge was impossible to determine, because it was reported to be several years, or since childhood. Several reports concerning the type of organisms isolated from cases of chronic otitis media, have been published.[2,5,8,9] The proportion of different organisms isolated vary from study to study, but *Pseudomonas aeruginosa* is the pathogen most commonly isolated.[8-10] All the cultures in the present study were obtained from the external canal, using a microscope to exclude any possibility of contamination of the specimen by skin flora. This method had been criticized by some investigators to be inadequate and misleading,[11] despite the fact, others still advocate it.[12] Other investigators used different methods to obtain the specimens such as through postauricular approach to the mastoids, from patients undergoing ear surgery which included removal of cholesteatoma,[13] or by middle ear aspirates.[14]

Among the organisms isolated, in our study *Pseudomonas aeruginosa* formed the predominant isolate (51%). This is consistent with other hospital-based studies in Dammam, the Eastern province of Saudi Arabia.[15] *Pseudomonas aeruginosa* do not normally inhabit the upper respiratory tract, and these organisms were considered as secondary invaders from the external canal, entering the middle ear in the perforated tympanic membrane following an acute episode of otitis media.[16] However, other researchers believe that *Pseudomonas aeruginosa* cause disease, predominantly in human beings with altered host defenses, the defect leading to *Pseudomonas* infection of the middle ear is not known. However, observation from others suggest that eustachian tube dysfunction impairs middle ear defense, and the perforation is as a result rather than a cause of *Pseudomonas* otitis media.[17] *Staphylococcus aureus* is the second predominant organism in the present study (31%) followed by *Proteus species* (17%). A fecal-aural route of infection has been proposed by Fairbank.[18] However, Senior and Sweeney[19] reported that most of the *Proteus species* which they isolated from cases of chronic suppurative otitis media were of non-fecal origin. Our results documented that anaerobic bacteria were an important component of the isolated microorganisms in chronic suppurative otitis media. This was in agreement with the published reports.[11,12] *Bacteriodes species* were the next commonly isolated organisms occurring in 12.5% of the cases in the present study. According to Sugita[21] et al they are most frequently detected in the ear with extensive cholesteatoma or granulation tissue formation.

Although Riyadh is a dry city and swimming is not a popular habit among its inhabitants, the proportion of fungal infections in the present study and other local studies,[15] is higher than the figures reported in the West.[22] This may be due to irrational over use of local ear medications. In the present study no association was found between the patient's age, sex or the duration of otorrhoea and the type of isolated microorganism. No growth was observed in 12.5% of ear swabs in the present study, which is almost similar to the published data.[23] In active chronic suppurative otitis media, the bacteriological evaluation should include culture for both aerobes and anaerobes as well as gram stain. Material for culture should always be obtained prior to the start of the treatment. If medical treatment is to be planned, this will guide the choice of antimicrobial therapy. If surgery is to be planned, then appropriate peri-operative antimicrobials can be employed.[11,20,24]

Although many investigators had reported on the microbiology of chronic suppurative otitis media, most of these studies were carried out on the cholesteatoma type,[14] or in patients having chronic suppurative otitis media with no clear separation into groups with and without cholesteatoma.[11,21,25] In a recent study in 1999, a comparison was made between micro-organisms recovered from middle ear aspirates and those detected in the conventional ear swabs from external ear canal. Only 51% of the bacteria recovered from middle ear aspirates were also present in the conventional ear swabs. Furthermore, in many cases, the conventional ear swabs yield bacteria which were not present in the middle ear aspirates.[26]

In conclusion, our findings clearly demonstrate the polymicrobial (mixed aerobic-anaerobic) pattern in patients having chronic suppurative otitis media with cholesteatoma. Proper collection of middle ear swabs from the external auditory canal using a microscope is a reliable method in establishing the microbiology of chronic suppurative otitis media and in selecting the proper anti-microbial therapy.

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