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Microbiology of Chronic Suppurative Otitis Media in Singapore

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ABSTRACT

The objective of the study was to study the microflora and the antibiograms of patients with chronic suppurative otitis media (CSOM) in Singapore. Ninety patients with CSOM were prospectively studied. They had chronic ear discharge and had not received antibiotics for the previous five days. Swabs were taken, and cultured for bacteria. Antibiotic testing was done using modified Kirby Bauer disk diffusion method. In addition to the usual antibiotics, the three most common topically available antibiotics (chloramphenicol, gentamicin and neomycin) were tested.

There were 135 positive cultures for organisms from the 90 patients. The most common causal organisms isolated were *Pseudomonas aeruginosa* (33.3%) and *Staphylococcus aureus* (33.3%) followed by coagulase negative *Staphylococcus* (21.1%). Fungi accounted for 8.8% of isolates while 6.6% were anaerobes. Of the three antibiotics commonly available as topical eardrops, gentamicin has the highest susceptibility rate (82.6%), followed by neomycin (67.8%) and chloramphenicol (62.8%).

Keywords: microbiology, chronic otitis media, antibiotics, topical drops

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INTRODUCTION

Chronic suppurative otitis media (CSOM) is a commonly encountered infection of the middle ear. Knowledge of the local pattern of infection is essential to enable efficacious treatment of this disorder. The objective of this study was to determine the microbial profile (aerobic and anaerobic) and the antibiograms of active CSOM patients in Singapore.

METHODS

Ninety patients who presented to the Ear, Nose and Throat (ENT) department from February 1996 to January 1997 were prospectively studied. All patients had perforated tympanic membranes with active purulent discharge. Only patients who had not received antibiotic therapy (topical or systemic) for the previous five days were included in the study. Patients with ear disease due to cholesteatoma were excluded from the study.

Single use Mini-tip Culturette swabs were used to harvest the middle ear microflora through the tympanic membrane perforation. One swab was processed for aerobic bacteria, and another swab for anaerobic bacteria, using standard microbiological procedures with enrichment. Any fungi that were isolated were subcultured onto Sabouraud Dextrose agar.

All organisms isolated were identified according to standard microbiological methods, using tubed media, and where necessary, the API system (bioMerieux, France). Antimicrobial susceptibility test for aerobic bacteria was performed using modified Kirby Bauer disk diffusion method[1], and using National Committee for Clinical Laboratory Standards (NCCLS) breakpoints for interpretation of results[2]. Apart from the standard antibiotics, testing was also done specifically for gentamicin, neomycin and chloramphenicol, which are available locally as topical antibiotic eardrops.

Table I. Age range of patients.

Age range in years	Number of patients (%)
<10	1 (1.1)
11-20	1 (1.1)
21-30	16 (17.8)
31-40	21 (23.3)
41-50	18 (20.0)
51-60	11 (12.2)
61-70	15 (16.7)
71-80	7 (7.8)

RESULTS

The mean age of patients was 45 years, with the peak age group being between 31-41 years (23.3%) (Table I). There was equal distribution between sexes (male 46.7% and females 53.3%).

Fig. 1a Antibiotic profile of *Pseudomonas aeruginosa*.

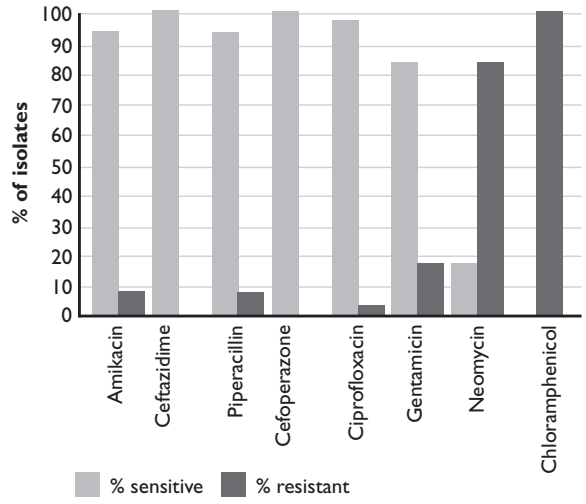


Fig. 1b Antibiotic profile of *Staphylococcus aureus*.

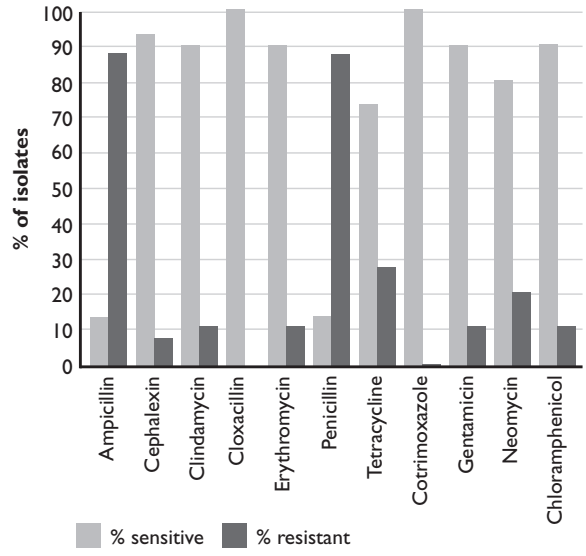


Fig. 1c Antibiotic profile of coagulase negative *Staphylococcus*.

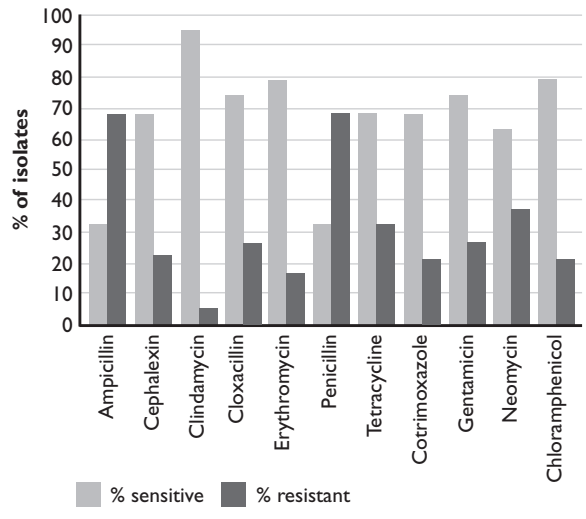


Table II. Number of isolates.

Number of isolates	Number of patients (%)
0	2 (2.2)
1	57 (63.3)
2	21 (23.3)
3	8 (8.9)
6	2 (2.2)

Table III. Microbiological profile of chronic suppurative otitis media.

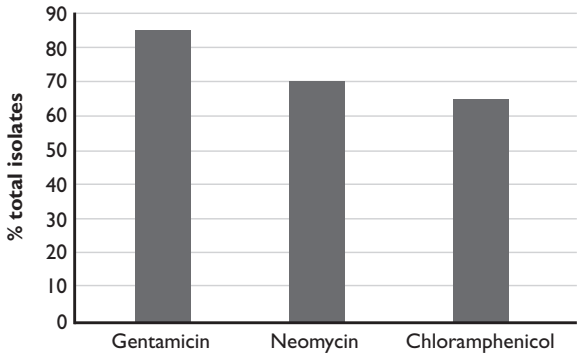
Types of organisms	Number of isolates	% of patients infected
Aerobic organisms		
1. Gram positive bacteria		
Staphyloccus aureus	30	33.3
Coagulase negative Staphylococcus	19	21.1
Corynebacterium sp	10	11.1
Aerococcus sp	1	1.1
Streptococcus sp	3	3.3
MRSA	1	1.1
2. Gram negative bacteria		
Pseudomonas aeruginosa	30	33.3
Klebsiella sp	7	7.8
Alcaligenes xylosoxidans	3	3.3
Acinetobacter baumanii	2	2.2
Enterobacter sp	2	2.2
Escherichia coli	3	3.3
Morganella morganii	2	2.2
Proteus mirabilis	2	2.2
Citrobacter sp	2	2.2
Pseudomonas sp	1	1.1
Non-fermentative bacilli	1	1.1
Serratia marcescens	1	1.1
Stenotrophomonas maltophilia	1	1.1
Anaerobic organisms		
Bacteroides sp	4	4.4
Porphyromonas asaccharolyticus	1	1.1
Prevotella melaninogenica	1	1.1
Fungal Organisms		
Aspergillus niger	3	3.3
Aspergillus sp	3	3.3
Candida sp	2	2.2

From the 90 patients enrolled in the study, there were 135 isolates. Fifty-seven patients (63.3%) had a single organism isolated from the middle ear culture, while the remaining 31 patients had two or more organisms isolated. There were only two patients (2.2%) who had a sterile culture with no organisms isolated (Table II).

The most common causal organisms isolated were *Pseudomonas aeruginosa* (33.3%) and *Staphylococcus aureus* (33.3%) followed by coagulase negative *Staphylococcus* (21.1%). Fungi accounted for 8.8% of the isolates while 6.6% of cultured organisms were anaerobic bacteria (Table III).

The antimicrobial sensitivities of the bacteria were tested and the results for the three most common

Fig. 2 Percent of total isolates sensitive to topical antibiotics.



organisms are shown (Figs. la-1c). Of the three antibiotics that are available commonly as topical eardrops, gentamicin has the highest susceptibility rate (82.6%) for all the isolates tested, followed by neomycin (67.8%) and chloramphenicol (62.8%) (Fig. 2).

DISCUSSION

Chronic suppurative otitis media (CSOM) is a condition of the middle ear that is characterised by persistent or recurrent discharge through a chronic perforation of the tympanic membrane. Due to the perforated tympanic membrane, bacteria can gain entry into the middle ear via the external ear canal. Infection of the middle ear mucosa subsequently results in ear discharge.

Untreated cases of CSOM can result in a broad range of complications. These may be related to the spread of bacteria to structures adjacent to the ear or to local damage in the middle ear itself. Such complications range from persistent otorrhoea, mastoiditis, labyrinthitis, facial nerve paralysis to more serious intracranial abscesses or thromboses. While the incidence of such complications is low, they need to be borne in mind when faced by a patient with active CSOM. Treatment hence needs to be instituted early and effectively to avoid such complications.

The mainstay of treatment for uncomplicated CSOM is twofold: meticulous aural toilet (with suction/mopping up of ear debris and discharge) and instillation of a topical antimicrobial agent. The therapeutic use of antibiotics is usually started empirically prior to results of microbiological culture. Selection of any antibiotic is influenced by its efficacy, resistance of bacteria, safety, risk of toxicity and cost. Knowledge of the local microorganism pattern and their antibiotic sensitivity is then essential to allow for effective and cost-saving treatment.

Our results show that active CSOM infection in Singapore is mainly due to *Pseudomonas aeruginosa* and *Staphylococcus aureus*. This finding is in tandem with the pattern of CSOM infection within the tropical region[3-6]. *Pseudomonas aeruginosa* was shown to be sensitive to ceftazadime, ciprofloxacin, piperacillin and amikacin, while *Staphylococcus aureus* was sensitive to cephalexin, cloxacillin, clindamycin and bactrim. The third most commonly isolated organism, coagulase negative *Staphylococcus* may represent skin flora contamination, and not be a true pathogen. However, they were mostly sensitive to clindamycin, erythromycin and cloxacillin. Anaerobic bacteria were not a significant pathogen according to our results. Similarly, while fungi were not specifically cultured for in this study, they also did not appear to be a significant cause of active CSOM infection compared to bacteria.

For the antibiotics commonly available locally as topical eardrops, gentamicin was shown to be the most effective, with high sensitivities for the most commonly isolated organisms. With specific regard to the two most common pathogens in CSOM, *Pseudomonas aeruginosa* was found to be resistant to chloramphenicol and mostly resistant to neomycin, while *Staphylococcus aureus* showed sensitivity to all three topical antibiotics tested. Gentamicin eardrops thus appear to be an effective first-line topical antibiotic in the treatment of active CSOM.

There remains, however, a controversy over the question of ototoxicity with the topical usage of aminoglycosides, such as gentamicin. While the systemic usage of aminoglycosides has been known to have a deleterious effect on the inner ear, the effect of topical aminoglycosides is less clear. Animal studies which have been well documented to show inner ear toxicity due to ototopical agents cannot be replicated in humans[7], and there are only a few reports of hearing loss following the administration of such drops in human patients[8,9]. The fact that the disease process in CSOM itself causes a sensorineural hearing loss[10] have led many to conclude the benefits derived from the usage of topical aminoglycosides in the treatment of CSOM and the prevention of attendant complications far outweigh the ototoxic side-effects which may potentially occur.

Newer topical antibiotic eardrops such as ofloxacin and ciprofloxacin have also been recommended for the treatment of active CSOM, with the added advantage of not being ototoxic. While we did not assess their effectiveness against all the organisms isolated, several reports have indicated their efficacy particularly against *Pseudomonas aeruginosa* and *Staphylococcus aureus*[11,12]. They would hence provide a viable alternative for the treatment of patients with active CSOM, although their higher cost may prove prohibitively expensive for some patients.

Furthermore, there is concern that widespread use of quinolones such as ofloxacin and ciprofloxacin could lead to the emergence of resistance especially in *Pseudomonas aeruginosa*, *Staphylococcus aureus*, and some *Enterobacteriaceae*[13,14]. There should therefore be judicious usage of this class of antibiotics in the treatment of active CSOM infection.

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