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Original Research Article

Microbiological profile and their antibiotic sensitivity pattern in patients of chronic suppurative otitis media at eastern tertiary care center of Nepal

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ABSTRACT

Background and Objectives: Chronic suppurative otitis media (CSOM) is one of the most common and an important global public health problem leading to hearing impairment and is particularly prevalent in developing countries. Even in this era of powerful antibiotics, due to increased irrational use of wide spectrum antibiotics, the resistance in the bacterial isolates is common. The objective of the study was to determine the aerobic bacterial etiology of patients with CSOM and the antimicrobial susceptibility of the bacteria isolated.
Materials and Methods: A descriptive cross sectional study was carried out in 112 patients suffering from chronic discharging ear. Pus samples were cultured aerobically. Antibiotic sensitivity testing was performed with standard antibiotic discs using modified Kirby-Bauer disk diffusion method.
Results: Out of 112 patients, 70 (62.5%) were females. Among 112 swab cultures, 98 (87.5%) were positive for the growth of organism and 14 (12.5%) were sterile cultures. Among them Staphylococcus aureus (42.24%), Pseudomonas aeruginosa (28.44%), Klebsiella pneumoniae (10.34%), Acinetobacter anitratus (6.9%), Proteus mirabilis (5.17%) and E. coli (4.31%) were the common microbial isolates. Among the antibiotics commonly available as topical eardrops, Ofloxacin (91.83%)) had the highest susceptibility rate, followed by Ciprofloxacin (81.63%), Tobramycin (73.46%) and Gentamicin (63.26%).
Conclusions: Staphylococcus aureus was the most common organism isolated followed by Pseudomonas aeruginosa. Ofloxacin had the highest susceptibility rate against the isolated organisms.

1. Introduction

Chronic suppurative otitis media (CSOM) is a chronic inflammatory process in the middle ear space that results in permanent changes in the tympanic membrane including atelectasis, dimeric membrane formation, perforation, tympanosclerosis, retraction pocket or cholesteatoma.[1] Clinically, CSOM presents with recurrent ear discharge and hearing impairment that may have serious long-term effect on language, auditory, cognitive development and educational progress.[2] CSOM is one of the most common diseases of all age groups, especially of childhood. It is prevalent in developing countries especially among low socioeconomic society because of malnutrition, overcrowding, poor hygiene, inadequate health care and recurrent upper respiratory tract infection.[3,4] Most of the microbiological studies on CSOM have shown that the common bacteria found in CSOM are Pseudomonas aeruginosa, Staphylococcus aureus, Escherichia coli, Proteus spp. and Klebsiella species. However, the type of bacteria associated with CSOM varies depending on the geographical area and other factors as well.[5–8] Topical antibiotics are more effective at clearing aural discharge than systemic antibiotics probably due to the achievements of higher concentrations locally.[9] Empirical therapy should

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be chosen according to the antibiotic sensitivity pattern of the most common organisms like Staphylococcus aureus and Pseudomonas aeruginosa associated with CSOM. The incidence of CSOM related complications has decreased due to the introduction of antibiotics. However, as the irrational use of broad-spectrum antibiotics has increased, the resistance in the bacterial isolates has become very common.[10] Antibiotics can still be obtained across the pharmacy counters and are prescribed often by clinicians in the polyclinics without any attempt at antibiotic sensitivity testing. The widespread use of the antibiotics has precipitated the emergence of multiple resistant strains of bacteria which can produce both primary and post-operative infections as well as lead to considerable financial burden to the patient.[10,11]

Early bacteriological diagnosis of all cases of CSOM helps in definitive therapy. The pattern of organisms isolated varies according to the time and place of study. However, due to lack of adequate resources in a developing country likes Nepal, it is not possible to subject all of the patients to ideal mode of investigation and treatment. Knowledge of the microbial flora prevailing and their susceptibility to the antimicrobial agents locally may allow the treating clinician to prescribe an empirical regimen so that the patients can get a better and specific treatments on time. Hence this study was planned to find the local pattern of microorganisms involved and their antibiotic susceptibility pattern in CSOM to provide a guideline for empirical antibiotic therapy.

2. Materials and Methods

A prospective cross-sectional study was conducted in Department of Otorhinolaryngology and Head and Neck surgery and Department of Microbiology, B.P.Koirala Institute of Health Sciences (BPKIHS),Dharan from 14^{th}August 2017 to 13^{th}July 2018.

2.1. Patient's selection

A total of 112 patients with history of ear discharge of more than three-month duration and diagnosed as a case of CSOM with any gender and demographic distribution were enrolled in study. The patients taking antibiotics currently or taken antibiotics in preceding five days (topical or systemic), having acute suppurative otitis media or otitis externa, recent ear surgery, traumatic perforation or grommet in situ, patients with systemic disease and unwilling/uncooperative patients were excluded from the study. Ethical approval was obtained from the Institutional ethical review board of BPKIHS. Written informed consent was taken from participants prior to the study.

2.2. Data collection procedure

Comprehensive history was taken including other associated symptoms. Systemic and general examination of ear, nose, throat, head and Neck were conducted thoroughly. Swabs were taken on the first day before any local medication was instilled with the patient lying comfortably. The external auditory canal of the discharging ear was cleaned with suction and then by mopping of the cartilaginous and lateral half of the external bony canal with sterile cotton pledged in a probe, after donning sterile gloves. The material for culture were obtained from the affected ears using thin sterile cotton wool swabs with full aseptic precautions without touching the pinna or any other parts of the ear with swabs during insertion into ear or during removal.

Two swabs were taken in each patient. One swab was used for making smears on clean glass slides for the microscopy using grams' staining. The smear and swabs were processed immediately in the department of microbiology. The other swab was used for culture for the isolation of aerobic bacteria and was inoculated onto Blood agar, Chocolate agar and MacConkey's agar. Blood agar and Chocolate agar were incubated at 37^0C with 3-5% CO_2 (in candle extinction jar) and MacConkey's agar was incubated at 37^0C.The agar plates were examined after 24 and 48 h. The plates showing no growth at 48 h were discarded and labeled as negative. The plates showing bacterial growth were identified by standard techniques based on morphological, cultural and biochemical characteristics.[12]

Culture for anaerobic organisms was not performed. The isolated bacteria were tested for susceptibility to Penicillin, Chloramphenicol, Ampicillin, Ceftriaxone, Gentamicin, Ciprofloxacin, Ofloxacin, Tobramycin, Ceftazidime, Amikacin, by using Kirby–Bauer disc diffusion method.[13] Interpretation of the sensitivity pattern was done according to CLSI (Clinical Laboratory Standards Institute) guidelines.[14]

Data were entered in Microsoft Excel 2007 (Microsoft, Redmond, WA, USA) and descriptive statistics like mean, frequency and percentage were calculated by using SPSS (Software Package for Social Sciences) 16 for windows software.

3. Results

Out of 112 patients, majority (62.5%) were females. Unilateral infection(71.42%) was more common than bilateral (28.57%).Among 112 swab cultures, 98 (87.5%) cultures were positive for the growth of organism and 14 (12.5%) were sterile cultures. Out of 96 swabs positive for gram stain, bacteria was cultured in only 92 swabs (95.83%) and out of 98 growths, bacteria were seen in only 92 swabs (93.87%). In 6(5.36%) swabs, stain was not positive, though growth was isolated. In 10 (8.93%) swabs, there were neither positive gram's stains nor growth isolated [Tables 1 and 2].

Out of 98 swabs with growth, 82 (83.82%) yielded monomicrobial organism, 16 (16.33%) yielded polymicrobial isolation, 14 (14.2%) swabs isolated 2

organisms while 2 (2.04%) swabs yielded 3 organisms.

The antimicrobial sensitivity pattern of the organism isolated were [Table 3]

3.1. *Staphylococcus aureus*

Highest rate of sensitivity was seen with Ofloxacin (91.83%) followed by Ciprofloxacin (81.63%), Tobramycin (73.46%), Gentamicin (63.26%), and Chloramphenicol (53.06%). Maximum resistance was seen with Penicillin (79.60%).

3.2. *Pseudomonas aeruginosa*

Highest rate of sensitivity was seen with Ofloxacin (90.90%) followed by Tobramycin (84.84%), Ciprofloxacin (75.75%), Gentamicin (66.66%), and ceftriaxone (57%). Maximum resistance was seen with Chloramphenicol (53.06%)

3.3. *Klebsiella pneumonia*

All isolate of the Klebsiella pneumoniae are sensitive to ofloxacin (100%). A high rate of sensitivity was seen with Amikacin (91.67%) followed by Ciprofloxacin (66.67%) and Gentamicin (58.33%).A lower rate of sensitivity was with Tobramycin (50%) and Chloramphenicol (33.33%). All isolate was resistant with Ampicillin.

3.4. *Acinetobacter anitratus*

All isolate of the Acinetobacter anitratusare sensitive to ofloxacin (100%), Amikacin (100%) and Gentamicin (100%). A high rate of sensitivity was seen with Ciprofloxacin (87.5%) and Tobramycin (75%). A lower rate of sensitivity was with Chloramphenicol (50%). All isolate was resistant with Ampicillin.

3.5. *Proteus mirabilis*

All isolate of the Proteus mirabalisare sensitive to ofloxacin (100%). A high rate of sensitivity was seen with Amikacin (91.67%) followed by Ciprofloxacin (66.67%) and Gentamicin (58.33%). A lower rate of sensitivity was with Tobramycin (50%) and Chloramphenicol (33.33%). All isolate was resistant with Ampicillin.

4. Discussions

CSOM is one of the most common and an important global public health problem leading to hearing impairment with approximately a five percent global incidence and is particularly prevalent in developing countries.[15,16] CSOM results from the presence of bacteria that induce chronic inflammation in the middle ear and mastoid cavity and it can cause many serious complications, including Mastoiditis, facial nerve palsy, meningitis and brain abscess etc. if not treated properly on time.[17] Otherwise it creates a difficult situation both for the surgeon as well as for the patient. Therefore, identification of the causative organisms is essential for proper management of CSOM. The correct choice of antibiotics is essential for treatment, but the recent misuse and overuse of antibiotics has induced changes in predominant bacterial species and their susceptibility to antibiotics, making it more difficult to manage CSOM.[18] It is nowadays common for an otologist to see discharging ears, whose bacterial flora have already been modified by prior antibiotic therapy leading often to sterile culture and hence treatment becomes a problem. This may be because of microbial resistance to these antibiotics thereby suggesting their failure leading to continuation of purulent discharge in the discharging ear. It is hence important to know what type of bacteria taking part in event of suppuration so that appropriate antibiotics may be instituted early and effectively to prevent complications.[19] Thus, repeated empirical prescription of antibiotics over a long period of time can induce multidrug-resistant strains. Frequent local treatment during repetitive active inflammation also causes the spread of resistant strains from hospital to patients and vice versa.

In our study, majority of the patients (62.5 %) were females who suffered from CSOM and similar findings had been reported by Lou et al[7] and Prakash et al.[17] In contrast, CSOM was more common in male patients in a study by Ahmed et al.[20]

In our study, majority (87.5 %) of the sample showed positive growth and 12.5% of the sample were sterile. This is accordance with Vijaya et al[21] who found 5.28% sterile samples in their study whereas Fatma et al[22] (16.9%) and Chakraborty et al[23] (12.6%) found higher percentage of culture negative samples in their studies. Monomicrobial growth was seen in majority (83.67%) of cases and polymicrobial growth seen in only16.33% of cases which is similar to the previous study by Agarwal et al[6]. The predominant organism isolated in our study was Staphylococcus aureus (42.24%) followed by Pseudomonas aeruginosa(28.44%), Klebsiella pneumoniae (10.34%), Acinetobacter anitratus (6.9%), Proteus mirabilis (5.17%). This is in accordance with the previous studies.[24,25] Taneja et al[26] had isolated Staphylococcus aureus as the most common organism in their study, but the percentage of isolation (33.3%) was lesser when compared to our study. Kuchal et al[27] also showed that in his study, S. aureus was the most common isolate followed by Pseudomonas sp. Shyamala et al[28] also has found out that these two were the predominant organisms isolated from the otitis media cases. Many of the previous studies showed Pseudomonas sp. to be the most common bacteria isolated from CSOM cases.[29–32] But Pseudomonas sp. was the second most common organism in our study, isolated from 28.44% cases. This is similar to a study by Sharma et al[33] who reported

Table 1: Correlation of gramstain and culture (n=112)

Gram Stain	Culture growth	No. of Swabs	Percentage
Bacteria seen	Positive	92	82.14
Bacteria seen	Sterile	4	3.57
Bacteria not seen	Positive	6	5.36
Bacteria not seen	Sterile	10	8.93

Table 2: Culture of Swabs

Culture of Swabs	Number of growth	Percentage (%)
Sterile	14	12.5
Positive for growth of Organism	98	87.5
Total	112	100

Table 3: Type of organismIsolated (n=116)

Name of organism	Number	Percentage
Staphylococcus aureus	49	42.24
Pseudomonas aeruginosa	33	28.44
Klebsiella pneumoniae	12	10.34
Acinetobacter anitratus	8	6.9
Proteus mirabilis	6	5.17
Escherichia coli	5	4.31
Enterobacter species	2	1.72
Streptococcus pyogenes	1	0.86

Pseudomonas in 36% cases. In our study, Staphylococcus aureus and Pseudomonas sp. together account for about 70.86% of cases and this is in consistent with the study by Aslam et al.[34] Among the gram negative pathogens, next to Pseudomonas, Klebsiella pneumoniae (10.34%) was the other common pathogen followed by Acinetobacter (6.9%) and Proteus sp. (5. 17%). This is similar to the study by Loy et al.[7]

Antibiotic susceptibility pattern was tested for all the isolated organisms. Most of the isolates were found to be susceptible to Ofloxacin. However, most of the organisms showed resistance to amoxicillin which is similar with Chakraborty et al[20] (95.4%) and Malkappa et al.[29] (90%).

Staphylococcus aureus was found to be highly susceptible to ofloxacin (91.83%) followed by Ciprofloxacin (81.5%), Tobramycin (73.46%) and Gentamicin (63.26%). Pseudomonas Sp. was found to be highly sensitive to ofloxacin (90.9%) followed by Tobramycin (84.84%), Ciprofloxacin (75%) and Gentamicin (66.6%). The gram-negative isolates were fairly susceptible to ciprofloxacin, third generation cephalosporin and gentamicin. Agarwal et al[6] study shows that Staphylococcus species was high (80-85%) with moxifloxacin, levofloxacin, and doxycycline among the commonly used antibiotics. Pseudomonas aeruginosa was 100% sensitive with colistin, polymyxin B, and carbapenems. Its sensitivity was about 60-70% with the commonly used antibiotics, viz. cephalosporins and fluoroquinolones. The probable reasons for this variation could be attributed to antimicrobial resistance profile of bacteria varies among population because of difference in geography, local antimicrobial prescribing practices and prevalence of resistant bacterial strains. One important fact to be kept in mind is that the antibiotic susceptibility pattern of the CSOM causing organisms keeps changing according to time and geographical region. Hence, routine antibiotic susceptibility testing should be done at certain interval to guide empirical treatment.

5. Conclusion

Staphylococcus aureus was the most common organism isolated followed by Pseudomonas aeruginosa. Ofloxacin has the highest susceptibility rate. This study would provide a rational basis for selecting empirical drugs in CSOM in eastern Nepal in set ups where microbiological logistics seems to be limited and it would also encourage many such attempts from different parts of Nepal and elsewhere so as to formulate local guidelines in years to come.

6. Source of Funding

None.

7. Conflict of Interest

None.

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