ORIGINAL ARTICLE

Bacteriology of Chronic Suppurative Otitis Media among Children at the Arthur Davidson Children's Hospital, Ndola, Zambia

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ABSTRACT

Objectives: The study aimed to determine the bacteria that cause CSOM and their sensitivity to drugs used in children attending at the Ear Nose and Throat (ENT) clinic at Arthur Davidson Children's Hospital(ADCH) in Ndola.

***Methodology*:** It was a retrospective descriptive hospital based cross sectional study whereby the medical files of 60 patients aged between 0-15 years who diagnosed with CSOM from January 2014 to January 2016 at Arthur Davison Children Hospital were reviewed and the socio-demographic data, type of bacteria isolated and their antibiotic sensitivity were analysed using quantitative methods Statistical Package for the Social Sciences(SPSS version 16.0).

***Results*:** Of the 60 patients included in the study, more than half (56.7%) of the participants were 7 years old or younger and majority (86.7%) of participants came from high density areas. CSOM seemed to be more common in females (55%) than males (45%). The common organisms isolated included; Staphylococcus species (36%), Proteus vulgaris species (35%), Pseudomonas species (15%), Streptococcus species (7%), E. coli species (3%), Enterobacter species (2%) and Serratia marcens species (2%). Antimicrobial sensitivity tests showed that Ciprofloxacin was more sensitive to most of the microbial isolates.

***Conclusion*:** It is important to know that Staphylococcus was the commonest isolated pathogen responsible for CSOM at ADCH. This will ensure success in the choice of suitable antibiotics according to susceptibility tests as they guide the treatment and thus reduce complications of CSOM and curbing resistance to antibiotics.

INTRODUCTION

Chronic suppurative otitis media (CSOM) is defined as a chronic inflammation of the middle ear and mastoid cavity, which presents with recurrent ear discharges or gonorrhoea for at least two weeks through a tympanic perforation.[1] CSOM can be managed by evaluating a specimen of the discharge for culture and sensitivity, preferably before beginning antimicrobial therapy. Prevalence surveys, which vary widely in disease definition, sampling methods, and methodologic quality, show that the global burden of illness from CSOM involves 65–330 million individuals with draining ears, 60% of whom (39–200 million) suffer from significant hearing impairment. CSOM accounts for 28 000 deaths and a disease burden of over 2 million DALYs. Over 90% of the burden is borne by countries in the South-east Asia and Western Pacific regions, Africa, and several ethnic minorities in the Pacific regions.. CSOM is uncommon in the Americas, Europe, the Middle East, and Australia.[2] There scarcity of data in Zambia however the WHO global survey report of CSOM[1], indicated the nearby

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Susceptibility test results were interpreted according to performance standards for antimicrobial disc susceptibility tests, M100.S22, CLSI volume 32 NO.3, January 2012

A desk review of the patients' case files allowed for data collection. The data that was collected included the age of the patient, sex, and place of origin, isolated bacteria and the antibiotic sensitivity pattern. Statistical Package for the Social Sciences version 16.0 was the statistical analysis used in this study.

RESULTS

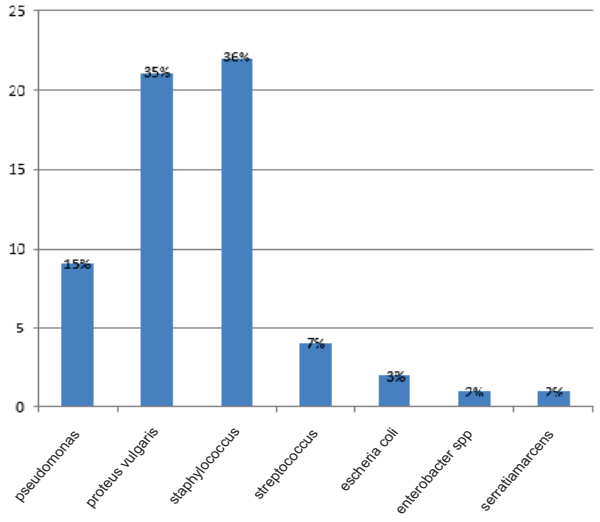
On analysis, using SPSS version 16.0, the prevalence of organisms was determined and expressed in percentage. A total number of 60 children aged between 0-15 years with a mean age of 6.82 (standard deviation of 0.333) were included in the study. Distribution by sex revealed more of females (55%) than males (45%) infected with CSOM. Majority of the participants came from high density areas and it was analysed that more than half (56.7%) of the participants were 7 years or younger (Table 1). Ciprofloxacin was the most sensitive drug to the bacterial isolates (Table 2 and 3).

Table 1: Description of the study sample (distribution of study participants by socio-demographics).

			Sex				Statistics (X^2 and P value)
	No.	%	Male		Female		X^2 = 0.025
Age group;			No.	%	No.	%	P value = 0.875
0-7yrs	34	56.7	15	55.6	19	57.6	
8-15yrs	26	43.3	12	44.4	14	42.4	
Residence;			Male		Female		Fisher's exact test;
	No.	%	No.	%	No.	%	0.276 = 2 sided
Low density	8	13.3	2	7.4	6	18.2	0.202 = 1 sided
High density	52	86.7	25	92.6	27	81.8	

Comment: More than half (56.7%) of the participants were 7 years old or younger. Majority (86.7%) of participants come from high density areas.

Graph 1: Bacteria isolated



Comment: Staphylococcus species were the most isolated bacteria species while Enterobacter and Serratia marcens were the least isolated bacteria species. The bacteria isolated were 42% anaerobes.

Table 2: Total number of isolated bacteria samples tested for drug sensitivity

Isolated Bacteria	Gen	Nor	Cip	Cefo	Amp	Pen	Cefta	Chlora	Eryth	Cotri	Van	clav	kana
Pseudo	6	4	7	2	5	2	3	3	1	2	0	0	0
P. vulgaris	16	11	16	8	7	2	5	8	1	1	0	1	0
Staph	5	9	19	6	3	12	4	7	4	2	5	0	1
Strep	0	0	2	2	1	1	0	1	3	0	1	0	0
E. coli	0	0	1	2	2	0	0	1	0	2	0	0	0
Entero	1	0	1	0	1	0	0	0	0	0	0	0	0
S.marcens	1	1	0	1	1	0	1	1	0	0	0	0	0
TOTAL	29	25	46	21	20	17	13	21	9	7	6	1	1

Comment: Ciprofloxacin was the commonest drug used to test for sensitivity against the isolated bacterial species while clavulanic acid and kanamycin were the least common drugs used as shown in the table.

Table 3: The three most commonly isolated bacteria and their specific sensitivity test results.

Isolated Bacteria	Drug: Ciprofloxacin		Drug: Norfloxacin		Drug: Gentamycin	
	Sensitive	Resistant	Sensitivity	Resistance	Sensitivity	Resistant
Proteus vulgaris	14	2	10	1	6	10
Staphylococcus	13	6	7	2	0	5
Total	27	8	17	3	6	15

countries like Tanzania, Mozambique and Angola to be in a category of High to Highest.[2]

In Nepal, children less than 10 years were reported to have the highest incidence of the CSOM and more females were affected by the condition than males.[3] In India, higher infection rate was observed in age group 11-20 years and it was noted that the most common organism isolated was *Pseudomonas aeruginosa* followed by *Staphylococcus aureus*. In patients with *Staphylococcus aureus* infection, 100% sensitivity was found to Linezolid and Vancomycin followed by Cefoperazone, Amikacin, Clindamycin, Piperacillin, Erythromycin and Ofloxacin.[4] Gram negative bacteria showed maximum sensitivity to Piperacillin, followed by Amikacin and Cefoperazone. Less sensitivity was observed with Clavulenic acid, Gentamycin and Ciprofloxacin. Least sensitivity was seen with Piperacillin and Cotrimoxazole.

In the Free State Province of South Africa, it was shown that children in the range of 1-12 years had a high number of the infection.[5] In this study, the most common bacteriae that causing CSOM were *Proteus mirabilis* followed by *Pseudomonas aeruginosa* and *Haemophilus influenza*; all of which are gram negative bacteria. In Garissa district of Kenya, among pupils less than 18 years, the isolated bacteria in the 261 swabs analysed included *Proteus* species (32.7%), Enterococcus (28.6%), *Staphylococcus aureus* (12.8%), and *Pseudomonas* (11.3%) respectively. *Proteus* was susceptible the majority of the antibiotics tested while Enterococcus was poorly susceptible

Bacterial predominance and their antibiotic sensitivity pattern vary with time and geographical area as well as continent to continent, probably due to indiscriminate use of the antibiotic.[6] As topical antibiotic treatment is often effective and seldom harmful, most experts would start with a wide spectrum antibiotic on an empiric basis and make a request for cultures if drug resistance is suspected.[2] Selection of any antibiotic is influenced by its toxicity, and cost. Knowledge of the local microorganism pattern causing CSOM and their antibiotic sensitivity is therefore essential to start an effective and cost saving treatment. In our study, the focus was to assess the bacteriological agents responsible for CSOM among children attending ENT clinic at ADCH.

MATERIALS AND METHODS

The study design was a retrospective descriptive hospital based cross sectional study looking at the commonly isolated bacteria responsible for the occurrence of CSOM among children between the ages of 0-15 years who attend at the ENT clinic at ADCH. Sixty (60) patients with CSOM who presented to the ENT department at ADCH from January 2014 to January 2016 were retrospectively studied. The study involved children aged between 0-15 years who were captured during the visits to the ENT clinic and diagnosed with CSOM and had ear pus swab collected.

The ear swab were collected from external auditory canal by a certified ENT Surgeon or ENT Clinical officer by rotating a sterile cotton tipped swab then put into a transport media to the laboratory the same day. The swab from the patients were inoculated on Blood, Chocolate and MacConkey agar and incubated for 24 hours at 37^0C (aerobically and anaerobically). On the following day, non-pure colonies were sub-cultured to make pure cultures by touching a single colony and inoculating on media. This was done in order to make pure cultures. The microorganisms from pure cultures were identified on the basis of their colony morphology, appearance on media and subsequent biochemical tests.

Antibiotic susceptibility testing;

Antibiotic susceptibility of bacterial isolates were assayed according to Kirby-Bauer disc diffusion method of 1966.[7] All the media plates were put in the incubator for ten minutes before inoculation and placement of antibiotic disc to allow excess moisture to dry from the media plates.

Comment: Of the 16 P. vulgaris species tested for sensitivity to ciprofloxacin, 14 tested positive and 2 were resistant and of the 19 Staphylococcus species tested for sensitivity to ciprofloxacin, 13 were sensitive and 6 were resistant. Norfloxacin and Gentamycin were also tested for sensitivity as the results show in the table.

DISCUSSION

The sequelae of CSOM may include tympanosclerosis and atelectasis.[8] Its complications can be broadly grouped into two namely categories; intratemporal (acute and subacute mastoiditis, petrositis, facial nerve paralysis and suppurative labyrinthitis) and intracranial (meningitis, intracranial abscess (brain abscess, extradural and subdural), lateral sinus thrombosis and otic hydrocephalus). These serious complications may be seen by an otologist, paediatrician or general practitioner in their daily practice. However, early microbiological diagnosis ensures prompt and effective treatment to avoid such complications. Prevalence of culture positive cases of CSOM was seen in our study. CSOM was more prevalent in the first decade of life where 56.7% of the participants were under 7 years of age and there was a female preponderance (M: F, 55%: 45%). These findings correlate with the observations made by researchers in Nepal.[3] According to WHO, the high prevalence of CSOM in children has been attributed to the multifactorial nature of otitis media, inadequate antibiotic treatment, frequent upper respiratory tract infections, nasal disease, and poor living conditions with poor access to medical care.[1] This can be linked to high density areas as illustrated in this and other published studies.[9,10]

In this study, the commonest isolated bacteria isolated were *Staphylococcus* species (36%), followed by *Proteus vulgaris* species (35%), *Pseudomonas* species (15%), *Streptococcus* species (7%), *Escherichia coli* species (3%), *Serratia marcens* species (2%) and *Enterobacter* species (2%). This prevalence pattern was in contrast to other studies where the most common bacteria isolated were *Pseudomonas* species followed by *Staphylococcus* species.[11] The differences observed in the isolates could be explained by geographical or ethnic variations or the nature of the study which was retrospective hospital based which is likely to miss some of the subjects. Antibiotic susceptibility patterns serve as a useful guideline for choosing the appropriate antibiotic for treatment. Ciprofloxacin was the most sensitive drug of choice in this study. Variation in sensitivity to antibiotics may have other mechanisms of resistance such as impermeability of outer membrane and or active efflux mechanism. The study had limitations posed by challenges in record-keeping, the consistency of taking swabs, variations in the drug sensitivity test disks and being a retrospective descriptive hospital based study, the results may not be necessarily generalized.

CONCLUSION

Knowledge of the socio-demographic factors and the most common isolated bacteria and there sensitivity to drugs at ADCH helps in the adequate management of CSOM. This reduces the chances of complicating to severe forms of the disease. Despite the many challenges faced, the study showed that children below the age of 7 were more prone to CSOM and majority came from high density areas. *Staphylococcus* was the most isolated bacteria species and Ciprofloxacin was the most sensitive drug used on the population studied.

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