AETIOLOGICAL AGENTS OF EAR DISCHARGE: A TWO YEAR REVIEW IN A TEACHING HOSPITAL IN GHANA

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DOI: http://dx.doi.org/10.4314/gmj.v48i2.6

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Conflict of Interest: *None declared*

SUMMARY

Background: The discharging ear is a common presentation in medical practice affecting all age groups but primarily children. This study shows the current aetiological causes of ear discharge and their antibiograms, data which would guide empirical treatment of ear infections, and also form a basis for further research.

Methodology: This was a retrospective review of laboratory records of all ear swabs submitted for culture over a two year period in the Korle Bu Teaching Hospital Accra, Ghana. Data was obtained on demographic characteristics of patients, clinical diagnosis, isolated organisms and antibiotic susceptibility patterns of the isolated organisms. Data was analyzed by simple descriptive statistics.

Results: A total of 351 ear swabs were received by the laboratory for processing over the two year period. Of these 277(78.9%) had microorganisms isolated. A significant number127 (47%) was obtained from children under five years. *Pseudomonas spp* was the commonly isolated organism 121(46%) followed by *Staphylococcus aureus* 33(12.5%) and Proteus spp 32(12.2%). Candida was the commonest isolated fungi 9 (69.2%). Susceptibility of *Pseudomonas spp* to commonly used ototopics (ciprofloxacin & gentamicin) was 93% and 74% respectively.

Conclusions: Most cases of the discharging ear were found in children under the age of five years. The most common bacteriologic cause of the discharging ear was *Pseudomonas spp* followed by *Staphylococcus aureus. Candida species* was the commonest fungal cause of ear discharge. Ciprofloxacin and gentamicin are effective ototopic antimicrobial agents for empirical treatment of the discharging ear.

Key words: Ear discharge, antimicrobial agents, susceptibility, ototopics, Korle-Bu teaching hospital

INTRODUCTIONS

Ear discharge is a common presentation in medical practice. It affects people of all age groups but primarily it is a condition of children.[1-3] inflammatory conditions of the external and middle ear account for most ear discharges. These include acute and chronic otitis externa, acute otitis media, chronic suppurative otitis media with or without cholesteatoma, and malignant otitis externa.[2,4-6] It may also occur as a result of tympanostomy and ventilation tube insertion.[2]

The incidence rate of acute otitis media worldwide is 10.85% with 51% occurring in under-fives. That of chronic suppurative otitis media is 4.76% with 22.6% occurring annually in under-fives. It is estimated that twenty thousand people die each year from otitis media; and the overall burden of these diseases is borne in the poorest countries.[1]

The bacteriologic spectrum of ear discharge is variable. Majority of practitioners treat discharging ears empirically with systemic and topical antibiotics, and do not routinely send specimens of the discharge for microbiological analysis unless the discharge is refractory to treatment,[6] however, several authors suggest otherwise.[4,7] Like any other disease of microbiologic origin, it is important to know the spectrum of organisms causing ear discharge and their antibiograms.

In Ghana the only existing data dates back to 27 years ago(1987)[8] The current study was carried out to determine the current aetiological agents of ear discharge and their antibiograms; data that would guide empirical treatment of ear infections and also form a basis for further research to improve quality of care extended to patients.

METHODS

This was a retrospective review of laboratory records of all ear swabs taken from patients with ear discharge from 1st May 2011 to 30th April 2013 in the Korle-Bu Teaching Hospital, Ghana

Study area:

The Korle-Bu Teaching Hospital (KBTH), the largest tertiary health care facility in Ghana, was the survey site. The bacteriology unit (The Central La Laboratory) was used as the survey centre. Samples from patients to the Central Laboratory were from the main Clinical Departments i.e. Internal Medicine, Surgery, Child Health and Obstetrics and Gynaecology (OBGYN) as well as all allied health units of the Teaching Hospital. The KBTH has a bed capacity of 2000 and over 3000 staff.

The Central Outpatients Departments of the Hospital run general and specialised medical and surgical clinics from Monday to Friday. Patients requiring admission or specialist services offered in other areas of the hospital are referred to the appropriate ward or clinic from the outpatients units. In 2010, a total of 357,086 patients were seen at the central outpatient department, averagely, 29,757 patients were seen per month; according to the Annual Report of KBTH, 2010.

Specimen collection and processing:

The entire specimen were taken using dry sterile cotton swabs and processed at the bacteriology unit of the Korle-Bu Teaching Hospital (Central Laboratory). All swabs were cultured on blood, chocolate and MacConkey agar and incubated aerobically at 37 °C for 24 hours. Isolated organisms were identified using standardized biochemical tests, including urease and indole production, citrate utilization, hydrogen sulphide gas production and fermentation of sugars. The biochemical media used included Simon's Citrate medium, Urea and Triple Sugar Iron agar (TSI).[9] Antimicrobial susceptibility testing was performed according to Clinical and Laboratory Standards Institute (CLSI) guidelines.[10] *Acinetobacter species* and *S. epidermidis* were deemed as skin flora and probable contaminants as such no susceptibility testing was performed on them.

Data collection

A retrospective review of laboratory records of all ear swabs taken from patients with ear discharge over a two-year period from all departments and units of the Hospital were reviewed. Data was retrieved from laboratory record books with a data abstraction form. Data abstracted from the record books included basic demographic characteristics of patients (age and sex), clinical diagnosis, isolated organisms and antibiotic susceptibility patterns of the isolated organisms. . In all a total of 351 ear swabs were received by the laboratory for processing over the two year period.

Data analysis

Data obtained on demographic characteristics of patients, clinical diagnosis, isolated organisms and antibiotic susceptibility patterns of the isolated organisms were analyzed by simple descriptive statistics (i.e. proportions, ratios and percentages). Age of the patients were categorized into ≤1, 2-4, 5-13, 14-19, 20-44, 45-64 and ≥65 years, to determine common organisms in the ear discharges of infants, children under 5 years, school age children and paediatric patients, young adults, older adults and the elderly.

The agents isolated were categorized into Enterobacteria, Gram positive organisms, *Pseudomonas species*, Fungi, and *Acinetobacter species*. The microbial agents were tested for antibiotic susceptibility using the following common antibiotics- Ampicillin, Augmentin, gentamicin, amikacin, ciprofloxacin, levofloxacin, cefuroxime, cefotaxime, chloramphenicol, co-trimoxazole, tetracycline and meropenem.

Data from abstraction form were entered into Microsoft Excel 2007 and imported into Statistical Package for Social Sciences IBM (SPSS VERSION 21) for analysis.

RESULTS

A total of 351 ear swabs were received by the laboratory for processing over the two year period. Of these 277(78.9%) had microorganisms being isolated from the discharge.

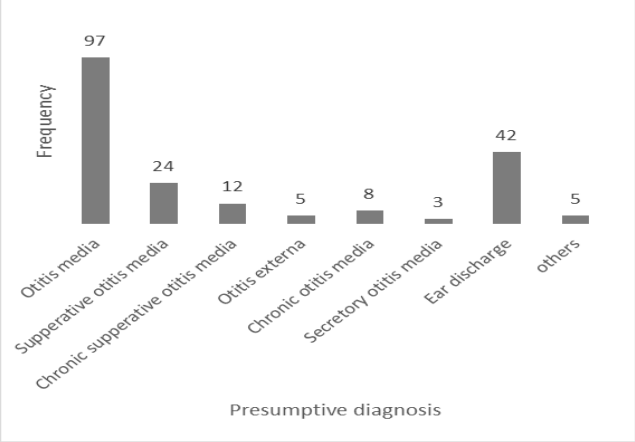

Figure 1 Frequency of presumptive clinical diagnosis on ear discharge from patients in the Korle-Bu Teaching Hospital

Table 1 Age and sex characteristics of patients

Sex	Age Groups							Total (%)
	≤1 (%)	2-4 (%)	5-13 (%)	14-19 (%)	20-44 (%)	45-64 (%)	≥65 (%)	
Male	39 (60.9)	41 (65.1)	39 (70.9)	7 (63.6)	25 (47.2)	14 (73.7)	6 (85.7)	171 (62.9)
Female	25 (39.1)	22 (34.9)	16 (29.1)	4 (36.4)	28 (52.8)	5 (26.3)	1(14.3)	101(37.1)
Total	64(100)	63(100)	55(100)	11(100)	53(100)	19(100)	7(100)	272(100)

A single organism was isolated from 232(83.8%) samples whilst 45(16.2%) samples had two organisms isolated; fifty-nine isolates were deemed contaminants.

Table 1 shows the age and sex distribution of the study patients, whilst Figure 1 shows the presumptive diagnosis written on request forms. Fifty (51.5%) of the patients with otitis media were under five years.

Table 2 Summary of isolated organisms from ear discharge of patients

Isolated organism	Frequency (Grand total=322)	Percentage
Gram Negative organisms	220	68.3
Gram positive organisms	89	27.6
Fungi	13	4.0
Total	322	100
Enterobacteria		
Proteus spp	32	35.6
Escherichia coli	13	14.4
Providencia spp	6	6.7
Klebsiella spp	5	5.6
Citrobacter spp	22	24.4
Serratia spp	2	2.2
Enterobacter spp	9	10
Morganella spp	1	1.1
Total	90	100
Gram positive organisms		
Streptococcus spp *Streptococcus pneumoniae*	2 3	2.2 3.4
Enterococcus spp	1	1.1
Staphylococcus epidermidis	50	56.2
Staphylococcus aureus	33	37.1
Total	89	100
Fungi		
Candida spp *Aspergillus spp*	9 4	69.2 30.8
Total	13	100
Non-Fermentative bacteria		
Acinetobacter spp	9	6.9
Pseudomonas spp	58	44.6
Pseudomonas aeruginosa	63	48.5
Total	130	100

**Acinetobacter spp* and *Staphylococcus epidermidis* were deemed contaminants

Table 2 shows the susceptibility patterns of bacterial isolates from ear discharge of patients and indicates that the most commonly isolated organism was *Pseudomonas spp.*

Table 3 demonstrates the distribution of isolated organisms per different age groups of patients. Most of the organisms were isolated from the age group 0-5 years (e.g. the distribution of enterobacteria among the age groups 0-5 was 39(43.4%) compared to 2(3.3%) among adults aged ≥65 years.

Table 3 Summary of age groups of patients and isolated organisms from ear discharge

Age category	Enterobacteria (%)	Gram positive organisms (%)	Pseudomonas spp (%)	Fungi (%)	Acinetobacter spp (%)	Total (%)
≤1	15(16.7)	22(24.7)	31(25.6)	2(15.4)	3(37.5)	73(22.7)
2-4	24(26.7)	21(23.6)	26(21.5)	2(15.4)	3(37.5)	76(23.6)
5-13	18(19.8)	15(16.9)	30(24.8)	3(23.1)	0(0)	66(20.5)
14-19	6(6.7)	4(4.5)	4(3.3)	0(0)	0(0)	14(4.3)
20-44	21(23.3)	19(21.3)	14(11.6)	4(30.8)	1(11.1)	59(18.3)
45-64	4(4.4)	7(7.9)	10(8.3)	1(7.7)	2(22.2)	24(7.5)
≥65	2(2.2)	1(1.1)	6(4.2)	1(7.7)	0(0)	10(3.1)
Total	90(100)	89(100)	121(100)	13(100)	9(100)	322(100)

Table 4 indicates the susceptibility patterns of the various isolates. Enterobacteria was most susceptible to amikacin (77/85; 90.6%) followed by cefotaxime (63/81; 77.8%). *Pseudomonas spp* was most susceptible to ceftazidime (99/103; 96.1%) and then ciprofloxacin(80/86; 93%). Regarding Gram positive organisms, Staphylococcus aureus was most susceptible to cloxacillin (30/31;96.8%).

Table 4 Antimicrobial susceptibility patterns of microbial isolates from ear discharge

Antimicrobial agent	Resistant (%)	Susceptible (%)	*Total (%)
Enterobacteria			
Ampicillin	55(94.8)	3(5.2)	58(100)
Augmentin	18(58.1)	13(41.9)	31(100)
Gentamicin	25(31.2)	55(68.8)	80(100)
Amikacin	8(9.4)	77(90.6)	85(100)
Ciprofloxacin	12(27.9)	31(72.9)	43(100)
Levofloxacin	4(20)	16(80)	20(100)
Cefuroxime	27(34.2)	52(65.8)	79(100)
Cefotaxime	18(22.2)	63(77.8)	81(100)
Chloramphenicol	48(81.4)	11(18.6)	59(100)
Co-trimoxazole	38(66.7)	19(33.3)	57(100)
Tetracycline		4(7)	57(100)
Gram-positive organisms.	53(93)		
Ampicillin	23(95.8)	1(4.2)	24(100)
Augmentin	6(33.3)	12(66.7)	18(100)
Gentamicin	10(33.3)	20(66.7)	30(100)
Penicillin	34(97.1)	1(2.9)	35(100)
Cefuroxime	10(30.3)	23(69.7)	33(100)
Cloxacillin	1(3.2)	30(96.8)	31(100)
Cotrimoxazole	17(81)	4(19)	21(100)
Tetracycline	13(62)	8(38)	21(100)
Erythromycin	11(46)	13(54)	24(100)
Pseudomonas species			
Gentamicin	28(26)	80(74)	108(100)
Amikacin	12(12.5)	84(87.5)	96(100)
Ciprofloxacin	6(7)	80(93)	86(100)
Levofloxacin	7(13.2)	46(86.8)	53(100)
Ceftazidime	4(3.9)	99(96.1)	103(100)

*The varying denominators for the antimicrobial agents are due to periodic shortages of reagents in the laboratory which affected the testing panel during the period of review.

DISCUSSION

Pseudomonas species was the most commonly isolated organism in our study. It is a common environmental organism usually found in warm and moist environment, and is known to colonize the external auditory canal. [2] It is commonly associated with otitis externa and chronic superlative otitis media. [2,6,11]

In an earlier study in Ghana[8] *Pseudomonas aeruginosa* ranked second to *Streptococcus pyogenes* as a cause of otitis media. In similar studies conducted in Nigeria, Greece and, Ethiopia *Pseudomonas aeruginosa* was the most commonly isolated organism; 34.6% in Nigeria[7] and 26% in Greece[11], whilst it ranked third, 13.4% in Ethiopia.[12] In chronic suppurative otitis media it has been found to be the commonest isolated organism. This has been corroborated in studies in Nigeria [13], Sri lanka[14], India[15] and Pakistan.[16]

Common causes of otitis media i.e. *Haemophilus influenzae, Streptococcus pneumoniae and Moraxella catarrhalis*[2, 3, 6, 7] were rarely isolated despite otitis media being the highest recorded presumptive diagnosis in our study. These findings are similar to that of an earlier study conducted in Ghana.[8] This may be indicative of a limited role played by these organisms in ear infections in our environment. It may also be as a result of inability of non-Otolaryngology doctors to appropriately diagnose the causes of ear discharge. However the high rate of *Pseudomonas species* isolation may point to a possible under diagnosis of chronic supperative otitis media and otitis external in the hospital.

Candida species was identified as the common non-bacterial cause of ear discharge, this is at variance with findings in India and Greece where *Aspergillus species* was the commonest isolated fungus.[11,15] A significant number of patients127 (47%) in our study were in the under-five age category. This is in agreement with available literature which shows that the majority of ear infections occur in children less than five years of age.[1, 3]

The most common mode of treatment for a discharging ear is aural toileting and use of ototopic agents.[2,4,6] Susceptibility of *Pseudomonas species* to ciprofloxacin and gentamicin; commonly used ototopic agents were high 93% and 73% respectively. Susceptibility of enterobacteria to these two antibiotics was also relatively high in our study. This means ciprofloxacin can be used as an empirical ototopic agent in the management of ear discharge in our setting. Several studies recommend ciprofloxacin as a safe and effective ototopic agent for the management of discharging ears in both adults and children.

This is because of its broad spectrum of activity, including coverage of *Pseudomonas spp, Staphylococcus and Streptococcus spp*[2,4,6,15] Gentamicin may also be used as empirical treatment for ear infections with a discharge in this environment based on the susceptibility patterns identified from this review. However, it has to be used with care and for limited periods because of its potential ototoxicity.[6, 17]

CONCLUSIONS

The discharging ear is a common presentation in this large hospital, typically found in children under the age of five years. The most common bacteriologic cause of the discharging ear is *Pseudomonas species* followed by *Staphylococcus aureus*. *Candida species* is the commonest fungal cause of ear discharge. Ciprofloxacin and gentamicin are effective ototopic antimicrobial agents for empirical treatment of the discharging ear.

Limitations

Demographic and clinical data was not completely analyzed on account of inadequate information on request cards. Vital information on the clinical units where the ear discharge was sent from could not be determined; due to inadequate data from the laboratory records. Anaerobes were not isolated because our laboratory doesn't perform anaerobic cultures routinely. Due to periodic shortages in reagents the testing panel was reduced for particular periods during the period under review, thus affecting the denominators for the various antibiotics. However, the analysis gives enough basis for the application of the recommendations for health delivery in the Teaching Hospital

RECOMMENDATIONS

There is the need to conduct studies into individual infective causes of ear infections, their microbial profile and anti-microbial susceptibility patterns to further guide therapy. Continuous medical education programmes and seminars should be held periodically to help practitioners improve their ability to diagnose ear infections. Clinicians must be encouraged to complete laboratory request forms appropriately to improve quality of laboratory results and also aid research.

ACKNOWLEDGEMENTS

We are grateful to all the patients from whom the records were obtained and to the staff of the Microbiology Department of the Korle-Bu Teaching Hospital for their support.

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