Bacteriological agents of chronic discharging ears and their antibiotic sensitivity pattern in Ido – Ekiti, Nigeria

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Summary

Aims and Objectives: To identify bacterial agents of chronic discharging ear and determine their antibiotic sensitivities pattern in Ido – Ekiti, Nigeria.

Patients and Methods: Swab specimens of each chronically (>8 weeks) discharging ears of patients with chronic suppurative otitis media (CSOM) presenting to the Ear, Nose and Throat (ENT) clinic of the Federal Medical Centre, Ido Ekiti were bacteriologically cultured aerobically and the antibiotic sensitivity pattern of the recovered organisms determined by the modified Kirby-Bauer disc-diffusion method over a three year period starting from January 2005.

Results: Seventy eight patients with CSOM whose age ranged between 3 months and 85 years were seen during the study period with 73.1% of them having unilateral disease and majority were children <15 years (71.8%). Out of 99 ear swabs that were examined, 87.9% were culture positive with 90.8% yielding a single isolate. Coliforms (34.7%) were the most frequent isolated group of organisms. Other isolates included Staphylococcus aureus (26.3%), Proteus spp (24.2%), Pseudomonas spp (9.5%) and Klebsiella spp (5.3%). Sparfloxacin and ciprofloxacin showed highest activity on all the isolates unlike cefuroxime and ceftiaxone to which all isolates were resistant.

Conclusion: Chronic discharging ear is caused by bacteria agents most sensitive

Introduction

Chronic suppurative otitis media (CSOM) is a chronic inflammation of the middle ear cleft often associated with perforated tympanic membrane and muco-purulent ear discharge persisting or recurring for more than eight (8) weeks [1, 2, 3]. It is a commonly encountered infection of the middle ear and an important cause of preventable hearing loss particularly in the developing world [4, 5]. CSOM is a childhood disease because children tend to have a higher predisposition to ear infection though adults are also affected and it is one of the commonest ailments seen by Otorhinolaryngologist in Nigeria [6-9]. It occurs as a complication of acute otitis media, a common condition with an alarming propensity to become chronic in developing settings due to various factors, including inadequate treatment [10]. Occasionally, complications such as meningitis, brain abscess, facial nerve palsy, subperiosteal and mastoid abscess and even death follows when not properly treated[3, 5, 11]. Its association with hearing impairment, death and severe disability coupled with the high costs incurred in its management makes CSOM a significant health problem in developing countries[12]. In Nigeria, a study done at the University of Nigeria Teaching Hospital, Enugu revealed that chronic middle ear infection accounted for 71% of the cases of conductive deafness [13]. As acute otitis media develops into a chronic infection, the underlying microbiology also changes markedly. Studies in various centers in Nigeria and world over have identified *Pseudomonas aeruginosa, Staphylococcus aureus, Proteus* spp, *Klebsiella spp,* among others as causative agents of CSOM [3, 7- 9, 11, 14-19]. No such studies have been carried out at our centre despite the global problem of antibiotic resistance. Besides, empirical antibiotic treatment is the rule in our setting for which periodic review is a necessary guide through determination of prevalent strains and their sensitivity pattern. This study

therefore was designed to determine the current bacterial agents of CSOM and their antibiotic sensitivity patterns in Ido - Ekiti, Nigeria

Patients and Methods

This is a prospective study carried out at the ENT Clinic of the Federal Medical Centre (FMC), Ido Ekiti over a 3 year period starting from January 2005. Federal Medical Centre, Ido Ekiti is the only tertiary health centre located in Ekiti state, southwest, Nigeria. The hospital attends to the people in the Ido Ekiti metropolis, surrounding communities and receives referral from health facilities in Ekiti and neighbouring state.

All consecutive patients with discharging ears of two or more months presenting to the ENT Clinic of the FMC, Ido-Ekiti were recruited during the study period having obtained their consent. Patients who were on antibiotic treatment within the last 1 week, and patient who refused to participate in the study were excluded. Ethical clearance was obtained from the research and ethical committee of the hospital. The age, sex, occupation, clinical presentation and previous treatment types were noted at recruitment. General and otoscopic examinations were carried out on all patients. Ear swab specimens of each discharging ear was taken with a sterile cotton swab and sent for bacteriological examination at the Microbiology laboratory of the hospital inside Stuarts transport medium.

Swabs specimens were inoculated unto blood and MacConkey agar plates which were incubated aerobically and chocolate agar which was incubated inside candle extinction jar, all at 37^{o}C for 24 to 48 hours. Anaerobic culture was not done because the facility was not available at the time of the study. Growth on culture plates were identified by colony morphology, Gram staining and standard biochemical tests [20].

Antibiotics sensitivity test was performed using the modified Kirby-Bauer disc-diffusion method [21]. Pure colonies of the isolated organisms were suspended in sterile normal saline inside Bijou bottles and the turbidity of the suspension adjusted to 0.5 McFarland's standard. A sterile cotton swab was dipped into the suspension and squeezed against the side of the bottle. The swab was then used to inoculate Mueller Hinton agar before the application of single antibiotic discs and subsequent incubation at 37^{o}C aerobically for 24hours. Zone diameters of inhibition around each disc were measured using a calibrated ruler and interpreted according to National Committee for Clinical Laboratory Standard (NCCLS) [22] *Escherichia coli NCTC 10418, Staphylococcus aureus NCTC 6571* and P*seudomonas ATCC 27853* were used as control strains as appropriate.

The antibiotic discs used were cefuroxime (30µg), sparfloxacin (5ug), ceftazidime (30µg), ceftiaxone (30µg), gentamicin (10µg), chloramphenicol (10µg), erythromycin (5µg), and ciprofloxacin (5µg).

Data obtained were entered into SPSS Version 15.0 for analysis and results presented in tables.

Results

Seventy-eight patients with CSOM were recruited into the study comprising of 46 (59.0%) males and 32 (41.0%) females given a M: F ratio of 1.4:1. The age of patients range between 3 months and 85 years with 56 (71.8%) patients in the paediatric age group ($\leq$5 years). The peak prevalence was in patient's $\geq$10 years old accounting for 62.8% of the patient studied (Table I). Unilateral CSOM were recorded in 57 (73.1%) of the patients while 21(26.9%) had bilateral disease.

Of the 99 ear swabs examined, 87 (87.9%) were culture positive and 12 (12.1%) negative. Among the culture positive ones, 79 (90.8%) were single isolates (Table II).

In all, there were 95 isolates which after typing were divided into five groups of bacteria comprising of Coliforms (34.7%), *Staphylococcus* aureus (26.3%), *Proteus* spp (24.2%), *Pseudomonas* spp (9.5%) and *Klebsiella* (5.3%) (Table III). Table IV showed that right ears of the male patients were relatively more affected than the female patients, Staphylococcus aureus were more involved where there is a mixed growth.

The antibiotic sensitivity patterns of the isolates are shown in Table V. Most of the isolates were sensitive to the quinolones (ciprofloxacin and Sparfloxacin), but resistant to erythromycin, cefuroxime and ceftiaxone. There was however some degree of sensitivity to ceftazidime by *Staphylococcus aureus* (62.5%), *Proteus spp* (60.0%) and *Pseudomonas* (75.5%).

Table I: Age and sex distribution of patients with CSOM in Ido - Ekiti, Nigeria

Age range (years)	Male Frequency (n)	(%)	Female Frequency (n)	(%)	Total Frequency (n)	(%)
d”10	31	(39.7)	18	(23.1)	49	(62.8)
11-20	4	(5.1)	5	(6.4)	9	(11.5)
21-30	4	(5.1)	2	(2.6)	6	(7.7)
31-40	1	(1.3)	2	(2.6)	3	(3.8)
41-50	2	(2.6)	3	(3.8)	5	(6.4)
>50	4	(5.1)	2	(2.6)	6	(7.7)
Total	**46**	**(59.0)**	**32**	**(41.0)**	**78**	**(100.0)**

Table ii: Ear related frequency distribution of bacteria isolates of chronic ear discharge culture

ORGANISM	RIGHT EAR	LEFT EAR	TOTAL (N)	(%)
Pure growth				
Coliforms	23	6	29	(36.7)
Staphylococcus aureus	13	5	18	(22.8)
Proteus spp	10	10	20	(25.3)
Pseudomonas spp	3	5	8	(10.1)
Klebsiella spp	2	2	4	(5.1)
TOTAL	**51**	**28**	**79**	**(100.0)**
Mixed growth				
Staphylococcus aureus + *Coliforms*	3	1	4	(50.0)
Staphylococcus aureus + *Proteus* spp	2	1	3	(37.5)
Pseudomonas spp + *Klebsiella* spp	-	1	1	(12.5)
TOTAL	**5**	**3**	**8**	**(100.0)**
No Growth	**10**	**2**	**12**	**(100.0)**
GRAND TOTAL	**66**	**33**	**99**	**(100.0)**

Table iii: Frequency distribution of bacterial isolates among culture positive chronically discharging ears

Organism	Frequency N	(%)
Coliform spp	33	(34.7)
Staphylococcus spp	25	(26.3)
Proteus spp	23	(24.2)
Pseudomonas	9	(9.5)
Klebsiella	5	(5.3)
Total	**95**	**(100)**

Table iv: Distribution of bacteria isolates in pure and mixed culture by ear and sex of patients with csom

organism isolated	right ear		left ear		total(n)	(%)
	male	female	male	female		
Coliforms	14	8	4	3	29	(33.3)
Staph. Aureus	8	5	3	2	18	(20.7)
Proteus spp	6	4	6	4	20	(22.9)
Pseudomonas spp	0	3	2	3	8	(9.2)
Klebsiella spp	1	1	1	1	4	(4.6)
Staph aureus + coliforms	3	0	1	0	4	(4.6)
Staph aureus +proteus spp	2	0	1	0	3	(3.4)
Pseudomonas spp + klebsiella spp	-	-	0	1	1	(1.1)
Total	34	21	18	14	87	(100.0)

Table v: antimicrobial sensitivity patterns of isolates from patients with chronic suppurative otitis media

	ANTIBIOTIC	Sparfloxacin (5ug)	(5ug)	Erythromycin (10ug)		Chloramphenicol (10ug)		Gentamicin (30ug)		Ceftazidime (30ug)		cefuroxime (5ug)		Ciprofloxacin (30ug)		Ceftiaxone	
ORGANISM	SENSITIVITY	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)
Coliforms	Sensitive	18	(90.0)	0	(0.0)	0	(0.0)	14	(56.0)	1	(10.0)	0	(0.0)	17	(100)	1	(5.9)
	Resistant	2	(10.0)	29	(100)	18	(100)	11	(44.0)	9	(90.0)	10	(100)	0	(0.0)	16	
(94.1)																	
	Total tested	20	(100)	29	(100)	18	(100)	25	(100)	10	(100)	10	(100)	17	(100)	17	(100)
Staphylococcus	Sensitive	10	(71.4)	10	(55.6)	7	(58.3)	10	(58.8)	5	(62.5)	1	(20.0)	4	(66.7)	1	(11.1)
Aureus	Resistant	4	(28.6)	8	(44.4)	5	(41.7)	7	(41.7)	3	(37.5)	4	(80.0)	2	(33.3)	8	(88.9)
	Total tested	14	(100)	18	(100)	12	(100)	12	(100)	8	(100)	5	(100)	6	(100)	9	(100)
Proteus spp	Sensitive	9	(81.8)	1	(5.6)	9	(47.4)	15	(78.9)	3	(60.0)	0	(0.0)	12	(92.3)	2	(25.0)
	Resistant	2	(18.2)	17	(94.4)	10	(52.6)	4	(21.1)	2	(40.0)	1	4(100)	1	(9.7)	6	(75.0)
	Total tested	11	(100)	18	(100)	19	(100)	19	(100)	5	(100)	14	(100)	13	(100)	8	(100)
Pseudomonas spp	Sensitive	1	(100)	3	(50.0)	4	(50.0)	0	(0.0)	3	(75.5)	-		7	(87.5)	0	(0.0)
	Resistant	0	(0.0)	3	(50.0)	4	(50.0)	7	(100)	1	(25.5)	-		1	(12.5)	2	(100)
	Total tested	1	(100)	6	(100)	8	(100)	7	(100)	4	(100)	-		8	(100)	2	(100)
Klebsiella spp	Sensitive	4	(100)	-		1	(50.0)	0	(0.0)	0	(0.0)	0	(0.0)	4	(100)	0	(0.0)
	Resistant	0	(0.0)	-		1	(50.0)	2	(100)	2	(100)	4	(100)	0	(0.0)	4	(100)
	Total tested	4	(100)	-		2	(100)	2	(100)	2	(100)	4	(100)	4	(100)	4	(100)

Discussion:

In this study, majority (62.8%) of the patients with CSOM were aged ≤10 year. This is due to children predisposition to CSOM because of their relative susceptibility to infection, increased mass of lymphoid tissue and Eustachian dysfunction/anatomy[7]. Usually, children have greater tendency to develop upper respiratory tract infections which often lead to acute otitis media (AOM) and when untreated or poorly treated transform to CSOM aided by the ignorance of the parents[2]. Such parents only seek medical attention when the ears start discharging.

Nwabuisi et al[11] in Ilorin and Okafor[7] in Enugu had reported 45% and 33.2% CSOM prevalence among children respectively which were lower than was recorded in this study. Could the higher prevalence (62.8%) of CSOM in childhood recorded in this study be an indication of increasing propensity of this disease in our setting? However, male preponderance as obtained in this study is similar to reports by other workers [2,7,9,11].

Unilateral disease was more common in the present study. Bilateral disease was only recorded in 26.9% of our patients. This agrees with similar study by Oni etal [9, 11, 12]. However, this is contrasting to the finding of Okafor[7] in Enugu who reported bilateral involvement in 44.3% of his patients. The higher occurrence of unilateral disease in this study is adjudge good because of the expected better prognosis from reduced risk of bilateral hearing loss when the two ears are affected [23].

The most common group of isolate recovered in this study were coliforms (34.7%). All member of the coliform group could not be identified conclusively because of inadequate facility at our centre this is a major limitation of this study. . Other isolates included *Staphylococcus aureus* (26.3%) and *Proteus* spp (24.2), *Pseudomonas* spp (9.5%) and *Klebsiella* spp (5.3%). This finding slightly differs from those of other studies in our environment as *Pseudomonas* and *Proteus* were the predominant cause of CSOM as reported by Coker and co [3] in Lagos, Okafor[7] in Enugu and Nwabuisi *et al* [11] in Ilorin. Other organisms like *Staphylococcus aureus*, *Klebsiella* and coliforms were also seen in these studies. Our inability to characterise the coliforms due to sub-optimal laboratory facility, as it is the case with similar studies in our setting, was a major setback. This is because conclusive identification of all bacterial isolates would have added more value to this study with particular reference to antibiotic sensitivity test result interpretation.

Compared with reports from outside Nigeria, *Pseudomonas* spp and *Staphylococcus aureus* were the major isolates in Singapore [5] while *Proteus, Staphylococcus aureus, Escherichia coli* and *Klebsiella* spp predominated in Ethiopia [12]. Similarly, Ettehad et al[17] in Ardebil reported that CSOM infections were mainly due to *Staphylococcus aureus, Pseudomonas* spp and *Proteus* spp. In another study, Oguntibeju[14] in South Africa reported *Proteus* spp, *Klebsiella* spp, *Escherichia coli*, *Pseudomonas* spp, and *Staphylococcus aureus* as common cause of CSOM. These differences might be due to geographical variations, culture and sampling techniques such as tympanocentesis or aspiration of middle ear discharge for microscopy, culture and sensitivity. However, Loy et al[5] reported that 6.6% of CSOM discharge isolates were anaerobes, while Brook and Nikakhlaqh et al reported 12% [24] and 13%[25] of anaerobes respectively in their studies.

All isolates were sensitive to ciprofloxacin and sparfloxacin but resistant to erythromycin, cefuroxime and ceftriazone. However reasonable sensitivity to ceftazidime was demonstrated by *Staphylococcus aureus* (62.5%), *Pseudomonas* (75.5%) and *Proteus* spp (60.0%). The pattern of sensitivity displayed by bacterial isolates of this study to the quinolones makes them the drug of choice for the treatment of CSOM in our centre except when contraindicated as in children less than 7 years old in which it may be suitable for topical application. It is noteworthy that

similar result had been obtained in past studies[9, 11, 17, 26]

There are controversies as to the use in CSOM of the commonly available local topical antibiotics like the quinolones and aminoglycoside. Ciprofloxacin is broad spectrum and active against most agents of CSOM with an added advantage of not being ototoxic[27, 28]. It causes cartilage damage in young animals, which limit its use in children[17]. However there have been treatment trials of topical quinolones in otitis media [29-33]. Aminoglycosides like gentamicin have also been shown to be effective against most agents of CSOM [5]. This is against the finding in this study as *Pseudomonas* and *Klebsiella* were completely resistant to this antibiotic. Furthermore, there is problem of ototoxicity with its topical usage as evident by few reports of hearing loss following its administration to some patients[21].

In conclusion, CSOM is most common in children in our setting and are caused by bacteria agents mostly sensitive to the quinolones.

Treatment of patients with CSOM in Ido-Ekiti with the quinolones is recommended except where contraindicated.

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