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Full Length Research Paper

Microbiological assessment of ENT infections and diseases: Clinical case study at Orlu, Imo State, Nigeria

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Abstract

Microbiological assessment of Ear, Nose and Throat (ENT) specimens from patients attending Imo State University Teaching Hospital, Orlu, Imo State, Nigeria were studied. Six hundred and twenty three male and female patients comprising of 312 with ear infections, 204 and 107 with throat and nasal infections respectively, were randomly selected and screened from February 2006 to March 2007. The samples were examined microbiologically using culture technique and direct microscopy. The findings showed that eight genera of bacteria *Staphylococcus species, Streptococcus pneumoniae, Neisseria pneumoniae, Klebsiellapneumoniae, Pseudomonas* sp., *Proteus mirabilis, Escherichia coli, Haemophilus*sp. And two genera of fungi *Candida* sp., and *Aspergillus*sp, were responsible for various ENT infections amongst patients examined at Imo State University Teaching Hospital Orlu. The most prevalent organism was *Staphylococcus* species (15.89%) while the least prevalent organism was *Klebsiellapneumoniae* (1.93%). The highest number of micro-organisms (222) was observed in ear swabs followed by throat swabs (156) while nasal swabs had the least number (101). Antibiotic susceptibility test on the isolates showed that sparfloxacin exhibited the highest antibacterial activity (89.3%) while chloramphenicol exhibited the least (14.7%) against the isolates.

Keywords: Microbiological assessment, ear, nose and throat (ENT) infections, diseases, antibiotic susceptibility.

INTRODUCTION

The human ear, nose and throat (ENT) are closely related and inter - connected parts of the human body. Infections, diseases and health problems related to the ENT are therefore jointly studied and managed. Like most other parts of the human body, the ENT are colonized by a wide range of micro - organisms, some of which are more or less harmless under normal conditions. According to Volk and Wheeler, (1990), in the course of normal breathing, humans inhale a number of pathogenic and potentially pathogenic bacteria, fungi and viruses, most of which are filtered off by the hairs in the nose. Others bye – pass into the moist surface of the nasal mucous membranes. Some get up to the naso-pharynx and reside there.

Micro-organisms have been associated with many infections, diseases and problems of the ENT. Azeez (2000) reported that micro-organisms were the cause of 98% cases of *otitis media* at the State Hospital, Oyo. Previous workers (Shurin, et al., 1978, Keith, et al., 1978, Ogisi and Osamor, 1982, Coker et al., 1983) reported that bacteria species: *Staphylococcus aureus, Streptococcus* sp., *Proteus* sp., *Haemophilus*and Coliforms were responsible for most cases of ear infections. Elsewhere, some workers (Bailey and Scott, 1992; Ikeh, et al., 1993) implicated *Actinomycesisraeli, Mycoplasma pneumoniae, Mycobacterium tuberculosis* and *Corynaebacteriumdiphtheriae*as the cause of varying prevalence of ENT infections and diseases.

The health implications and grave consequences of ENT infections and diseases have been reported. Generally, they may be associated with mild to severe pains, fever and headache (Azeez, 2000), running or stuffy nose, fullness of the ear (Elaine et al., 1987). Other symptoms and complications include difficulty in

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swallowing food, meningitis, rhinorrhoea, laryngo stenosis, laryngo paralysis, hearing loss and *otitis*, etc. A number of factors have been mentioned by previous workers to cause ENT infections and diseases. These include poor habits, carelessness and hard blowing of the nose or excessive sniffing, which drives infected mucus into the middle ear leading to *otitis media* in adults (Schnert, 1996). Azeez (2000) was of the opinion that *otitis media* is common amongst children due to narrowness of the eustachin tube, which may fail to drain properly,

In Nigeria, adequate attention has not been given to ENT infections and diseases probably due to lack of specialists in the area of otorhinolaryngology. Little or no attention is given to micro – organisms as a major cause of ENT diseases. Thus there is paucity of literature in Nigeria on the role of micro – organisms in ENT diseases and related health problems. Although a countless number of antibiotics and antimicrobial agents are available in Nigerian markets, there is little information on the use of antibiotics in the management and treatment of ENT infections and diseases. The present study was undertaken to review the role of micro – organisms (bacteria and fungi) in ENT infections and diseases as well as the antibiogram of micro – organisms associated with the infections in Imo State Nigeria.

MATERIALS AND METHODS

Selection of Patients

Six hundred and twenty three male and female patients comprising 312 with ear infections / diseases, 204 and 107 with throat and nasal infections respectively, at the ENT and out – patient Departments of Imo State University Teaching Hospital Orlu from February 2006 to March 2007 were randomly selected for the study. The patients presented with various symptoms of ENT diseases and infections ranging from discharge to inflammation of the ear, nose and throat. They were registered at the General out patients department and their personal records: name, age, sex, occupation, contact address and other relevant information were taken.

Collection of Samples

Throat swabs were collected asceptically in sterile swab packs by the Medical doctor in the ENT department. The samples were sent to the Microbiology Laboratory immediately after collection for analysis.

Swabs from each site were collected aseptically using sterile Evepon swab sticks. All specimens collected were properly labeled with patient's number, date and the side of ear or nose.

Examination of Samples

Throat, ear and nasal swabs collected from selected patients were examined microbiologically using culture technique and direct microscopy as described by Cruickshank et al., (1985) and Chesbrough (1998).

Each sample was cultured in duplicate plates of Blood agar, MacConkey and Saboraud dextrose agar, using streaking technique. One set of the inoculated MacConkey and Blood agar plates were incubated anaerobically and the other set was incubated aerobically at 37^0C for 24 hours. They were examined for bacterial growth and those without bacterial growth were re – incubated for another 24 hours before discarding them. One set of inoculated Saboraud dextrose agar plates was incubated at 37^0C and the other set at room temperature for 24 hours to5 - 7days.

Discrete and pure colonies of bacterial and fungal isolates were stored in slants in the refrigerator until they were required for identification tests and antibiotic susceptibility test.

Duplicate smears of each throat, ear and nasal swab were made on clean grease – free slides. One set was examined directly under the microscope as wet mount while the second set was stained and examined microscopically with oil immersion objective.

Antibiotic Susceptibility Test

The antibiotic susceptibility of the bacterial isolates was tested using disc diffusion technique as in Cruickshank et al., (1985). Commercially prepared single antibiotic discs were used for the study. Standard organisms: *Staphylococcus aureus*NCTC 6571, *Escherichia coli* NCTC 10418 and *Pseudomonas* sp. NCTC 1066 were used as control organisms for the study.

Statistical Analysis

The laboratory findings were correlated with the personal data of each patient and the final data obtained were analyzed statistically using Chi square as in Philips, (1973), Onu and Igwenma, (1998).

RESULTS

The findings of this study showed that eight genera of bacteria *Staphylococcus* species*, Streptococcus pneumoniae, Neisseria pneumoniae, Klebsiellapneumoniae, Pseudomonas* sp., *Proteus mirabilis, Escherichia coli, Haemophilus*sp and two genera of fungi *Candida* sp., and *Aspergillus*sp, were involved in various ear, nose and throat infections amongst patients examined at Imo State University

Table 1. Prevalence of Microbial Infections amongst ENT Patients

Samples	Sex	Number Examined	Number Infected	
			Bacteria	Fungi
Ear Swab	M	173	112	14
	F	139	87	9
Nasal Swab	M	51	36	3
	F	56	42	5
Throat Swab	M	110	70	18
	F	94	57	11
TOTAL		623	404 (64.85)	60 (9.63)

Table 2. Micro – organisms Associated with ENT Infections

Isolates	Ear	Nose	Throat	Total
Staphylococcus sp	38	31	30	99
Streptococ. pneumoniae	-	32	33	65
Neisseria pneumoniae	-	23	25	48
Klebsiellapneumoniae	9	1	2	12
*Haemophilus*sp	4	26	27	57
Pseudomonas sp.	63	3	-	66
Proteus mirabilis	71	5	7	83
Escherichia coli	14	2	3	19
*Aspergillus*sp.	13	7	16	36
Candida sp.	10	1	13	24
Total	222	131	156	509

Teaching Hospital Orlu. *Candida* sp and *Aspergillus*sp. Were isolated from Ear, nose and throat swabs, while *Streptococcus pneumoniae*and *Neisseria pneumoniae*did not occur in ear swabs. Also, *Pseudomonas* species did not occur in throat swabs. Of the 509 organisms isolated, 222 (43.61%) occurred in ear swabs followed by throat swabs 156 (30.65%) while the least 131 (25.74%) occurred in nasal swabs.

Generally, the most prevalent organism was *Staphylococcus* species (19.4%) while the least prevalent organism was *Klebsiellapneumoniae* (2.4%). Of the 312 male and female patients examined for ear infections, 222 (71.2%) had microbial infections. Out of 204 throat swabs examined, 156 (76.5%) were infected with micro-organisms and 101 (94.4%) out of 107 nasal swabs examined, were infected with micro-organisms. The prevalence of bacteria and fungi in ear and throat swabs was higher in males (72.3% and 80% respective) than in females (69.1% and 72.3% respectively). On the other hand, the prevalence of bacterial and fungi in nasal swabs was higher among females (83.9%) than males (76.5%).

Antibiotic susceptibility test on the bacterial isolates showed that the most susceptible antibiotic was Sparfloxacin, which inhibited 89.3% of the bacterial isolates while the least sensitive antibiotic was chloramphenicol, which inhibited growth of 14.7% of the bacterial isolates. Drug sensitivity test was not carried out on the fungal isolates (*Candida* and *Aspergillus*species) (Table 1, table 2, table 3, table 4, and table 5).

DISCUSSION

This study showed that micro-organisms (bacteria and fungi) are major causes of infection and diseases in human ear, nose and throat. The findings corroborates that of previous workers (Coker et al., 1983; Azeez, 2000) who reported that bacterial species (*Staphylococcus* species, *Streptococcus* species, *Proteus* species *Haemophilus*species and Coliforms) were responsible for most cases of ear infections. Improved personal hygiene and health education of the masses on how to care for ear, nose and throat will greatly reduce the incidence of these microbial infections.

The age and gender – related prevalence of infection in this study showed that the highest prevalence of infection (85%) was amongst those aged 41 – 50 years while the least (75%) was amongst those aged 11 – 20 years. Also, prevalence of infection was higher amongst males than female patients. However, statistical analysis of the data showed there was no significant difference ($p >$

Table 3. Age – Related Prevalence of ENT Infections

Age (years)	No Exam	Number of Isolates										Total (%)
		Staph	*Strept*	*Neisse*	*Klebs*	*Haemophilus*	*Pseudomonas*	*Proteus*	*E. coli*	*Aspergillus*	*Candida*	
1-10	102	5	6	4	3	2	25	21	5	6	3	80 (78.43)
11-20	97	10	9	7	3	9	15	16	4	3	2	78 (75.25)
21-30	109	21	15	13	2	12	5	10	2	9	4	93 (85.32)
31-40	112	20	10	10	1	9	11	14	4	5	7	91 (81.25)
41-50	100	19	14	8	2	11	6	12	1	8	4	85 (85. 00)
51-60	103	24	11	6	1	14	4	10	3	5	4	82 (79.61)
Total	623	99	65	48	12	57	66	83	19	36	24	506 (81. 22)

Table 4. Antibiotic Susceptibility Pattern of Bacterial Isolates

Isolate	No. Exam	Number of Susceptible Isolates (%)							
		Ofloxacin	Ciprflo	Peflacin	Strept	Genta	Eryth	Chloramph	Sparflox
Staphylococcus sp.	99	81	70	64	42	66	10	-	92
Streptococcus pneumoniae	65	50	41	33	49	19	3	-	61
Neisseria pneumoniae	48	31	42	21	13	32	9	5	40
Klebsiellapnemoniae	12	4	7	4	7	5	2	-	7
*Haemophilus*sp.	57	41	50	43	39	40	9	10	52
Pseudomonas sp.	66	50	45	48	25	50	21	12	55
Proteus miririabis	83	74	71	66	31	47	30	32	79
Escherichia coli	19	15	16	13	14	15	10	7	15
Total	449	346 (77.06)	342 (76.17)	292 (65.03)	220 (49. 0)	274 (61.02)	94 (20.93)	66 (14.7)	401 (89.3)

0.05) in the prevalence4 of infection between the different age groups as well as between males and female. This shows that ear, nose and throat infections are not influenced by age or gender. Males and females of all ages are susceptible to microbial infections of the ear, nose and throat.

The antibiogram of the selected antibiotics on the test isolates were comparable to those obtained elsewhere in related studies by Ikeh et al., (1993) and Azeez (2002). This finding shows that despite the increasing wave of adulterated and substandard drugs in Nigerian markets, the use of chemotherapeautic agents (antibiotics) in treatment of ENT infections and diseases still offers good results. The mean zones of growth inhibition produced by the selected antibiotics on the test isolates were comparable to those on the standard organisms used as control. This finding shows that the chemotherapeutic effects of the antibiotics on the infective organisms are reproducible elsewhere.

The third and fourth generation antibiotics, fluoroquinolones (Ofloxacin, Ciprofloxacin and sparfloxacin) were observed to yield higher antibacterial activity than older antibiotics (erythromycin, chloramphenicol and streptomycin) against the infective agents and control organisms. This may be attributed to development of resistant strains resulting from continued use of these older drugs over the years and possibly drug abuse. Clinicians should consider the use of the newer antibiotics, which offer less resistance. Statistical analysis however did not show significant difference ($p < 0.05$) between the antibacterial activity of older injectible antibiotics like gentamycin and 3rd generation antibiotics like

Table 5. Growth inhibitory effects of selected antibiotics on the bacterial isolates

Isolate	No. Exam	Mean Zone of Bacterial growth inhibition (mm)							
		Ofloxac	Ciprofl	Peflacin	Strept	Genta	Eryth	Chlora	Sparflo
Staphylococcus sp.	99	18. 00	15. 00	10. 00	12. 00	10. 00	6. 00	4. 00	20. 00
Streptococcus pneumoniae	65	16. 00	10. 00	8. 00	10. 00	9. 00	5. 00	5. 00	19. 00
Neisseria pneumoniae	48	15. 00	10. 00	10. 00	9. 00	10. 00	8. 00	5. 00	20. 00
Klebsiellapnemoniae	12	13. 00	15. 00	9. 00	8. 00	10. 00	9. 00	4. 00	18. 00
*Haemophilus*sp.	57	16. 00	12. 00	10. 00	10. 00	12. 00	6. 00	5. 00	16. 00
Pseudomonas sp.	66	18. 00	10. 00	8. 00	10. 00	11. 00	6. 00	6. 00	15. 00
Proteus miririabilis	83	14. 00	18. 00	10. 00	8. 00	10. 00	8. 00	4. 00	16. 00
Escherichia coli	19	13. 00	15. 00	12. 00	10. 00	9. 00	6. 00	5. 00	18. 00
Control *Staphylococcus* sp.NCTC 6571	1	20. 00	16. 00	10. 00	8. 00	11. 00	7. 00	6. 00	17. 00
Control *Escherichia coli* NCTC 10418	1	16. 00	18. 00	10. 00	10. 00	10. 00	8. 00	8. 00	18. 00
Control *Pseudomonas* sp.NCTC 1066	1	15. 00	16. 00	8. 00	10. 00	9. 00	8. 00	6. 00	20. 00
Total	452	346	342	292	220	274	94 (20.93)	66 (14.7)	401 (89.3)
Number of isolates inhibited		(77.06)	(76.17)	(65.03)	(49. 0)	(61.02)			

pefloxacin and Ciprof; loxacin, showing that hope is not totally lost with the older antibiotics.

Ear, nose and throat infections / diseases are increasing in Nigeria. In rural communities, most cases are neither reported nor hospitalized. Lack of specialist ENT practitioners in Nigeria resulted to lack of adequate attention to ENT infections and diseases. The present study showed that ENT infections and diseases are highly prevalent in Imo State. Majority of cases are caused by micro-organisms, most of which are considered to be normal flora of the ear, nose and throat. These findings corroborate the findings of previous workers (Volks and Wheeler, 1990, Azeez 2000). Public health workers in Nigeria especially in the rural communities should educate the masses on the need for routine clinical check up for ENT infection and the dangers of not reporting cases until they are full blown.

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