Bacteria isolates and antibiotic susceptibility of Ear infections in Abeokuta, Nigeria

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Abstract: Ear infections are a common medical condition globally, often overlooked as a minor medical problem, evidence has shown that if left untreated or baldly managed it could lead to severe complications. We have therefore reviewed ear infections screened for microorganisms at the Microbiology unit of Federal Medical center Abeokuta. A total of 91 ear swab samples were processed comprising 45 male and 46 female patients. 78(85.7%) isolates were recovered consisting 57(73%) GNB, 20(25.6%) GPC and 1 isolate of *Candida albicans*. It showed that *Pseudomonas aeruginosa* 38(48.7%) was the most predominant bacteria species isolated from ear infection. This was followed by *Staphylococcus aureus* 20(25.6%), *Proteus spp.* 16(20.5%) and *Escherichia coli* 2(2.5%). *Klebsiella spp.* 1(1.3%) and *Candida albicans* 1(1.3%) was the least prevalent. A total of 78 isolates were recovered from samples, age group 1-14 years of age gave a frequency of 60(76.9%) while 15 years and above gave 18(23.1%). *Escherichia coli* 2(2.5%) was only isolated from age group 1-14 years of age. *Klebsiella spp.* 1(1.3%) and *Candida albicans* 1(1.3%) were only isolated from subjects in age group 15 years and above. Gentamycin was the most broadly active antibiotic followed closely by Ofloxacin and Ceftazidime, high level of resistance was seen against Amoxicillin, and Chloramphenicol, other antibiotics tested performed below average. The findings of this study indicates a predominance of opportunistic pathogens like *pseudomonas* and an emerging resistance profile to Chloramphenicol a widely used antibiotic for this condition. There is a need for increased surveillance of conditions such as otitis media in order to prevent emergence of multi-drug resistant opportunistic pathogens capable of complicating an otherwise simple infection.
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1. INTRODCTION

The ear is the organ responsible for hearing and also maintaining balance, its divided into the outer, middle and inner ear with the outer and middle regions being most susceptible to injury and infections (Richard and Robert, 1996). Ear infections are of different types with Otitis media being the most common, occurring mostly in children. The frequency of this infection in children has been attributed to the shorter length of the Eustachian tube and more a horizontally inclined orientation in children than in adults (Weiner and Collison, 2003). Sources of ear infections include bacteria, fungi and viruses with bacteria being the commonest cause (Bello et al 2011). The route of infection is varied but the principal target is the estachian tube which leads to the nasopharynx, as a result the infection may arise from the nose, throat such as tonsillitis or the outer ear (Aroll 2005; Oyeleke 2009).

Infections such as otitis media, can be symptomatic or asymptomatic, acute symptomatic infections are characterized by signs such as moderate to severe pain, irritation, rashes ear discharge(pus) and sometimes fever (Damoiseaux, 2005; Oyeleke, 2009). A complication of major ear infections such as otitis media varies depending on the duration of microbial colonization, severity of infection and associated microorganisms. Depending on the clinical presentation otitis media can be subdivided into 2 types chronis suppurative otitis media (CSOM) and Acute otitis media (AOM) (Oni et al., 2002). Bateria organisms often associated with otitis media include *Pseudomonas aeruginosa, Proteus mirabilis*, *Staphylococcus aureus, Streptococcus pneumoniae, Heamophilus influenza* and rarely *Moraxella catarrhalis* (Ako-Nai et al., 2002; Bello et al., 2011).

The emergence of broadly resistant strains of both gram positive and gram negative bacteria able to suppress the most effective antibiotics such as the extended spectrum beta lactamase (ESBL) producers and changing pattern of antibiotic effectiveness motivated the conception of this work. The objective of our study is to retrospectively review the frequency of isolation of different bacteria species from patients reporting with ear infections and to examine their antibiotic susceptibility pattern in Abeokuta.

2. MATERIALS AND METHODS

2.1. Sample collection and processing

Ear swab samples were collected using a sterile swab stick from patients with various ear infections at Federal Medical center Abeokuta from January 2010 to December 2010. The ear swab samples were immediately sent to the Microbiology unit of the laboratory for processing. Upon receipt of the samples, they were inoculated on MacConkey and Blood agar plates and incubated at 37^0c aerobically, and also inoculated on Chocolate agar plates and incubated in a co_2 jar at 37^0C. The swab was then gram stained on a slide and examined. Discrete colonies of isolates were sub-cultured on Nutrient agar to obtain pure culture for characterization.

2.2. Characterization and Antibiotic sensitivity testing

Bacteria isolates were characterized based on colonial appearance, gram reaction, cultural characteristics and biochemical tests as described by Cheesbrough (1991). Biochemical tests carried out include; catalase, urease, coagulase, oxidase, citrate utilization and indole test. Antibiotic sensitivity testing was done following the Kirby-Bauer technique as described by Cheesbrough (1991) inoculated plates were tested against various antibiotics using multi-disk (Abteck biological ltd) and single disks (oxoid). Results were interpreted following NCCLS guidelines for disk diffusion (NCCLS 2003).

3. RESULTS ANALYSIS

A total number of 91 ear swab samples were processed during the study period, with male consisting of 45 and female 46. The most frequently diagnosed condition was Acute otitis media (AOM) 62(68%) cases, followed by chronic supurative otitis media(CSOM) 21(23%) cases, tetanus 4(4.5%) cases and other misalaneous cases 4(4.5%). A total of 78 isolates were recovered from samples. Incidence of Gram positive organisms (GPC) was 20(25.6%) while gram negative (GNB) gave 57(73%), one isolate of *Candida albicans* was also recovered. Gender distribution was higher in females with 42(53.8%) against male with 36(46.2%). Table 1 shows the frequency of occurrence of isolates. It showed that *Pseudomonas aeruginosa* 38(48.7%) was the most predominant bacteria species isolated from ear infection. This was followed by *Staphylococcus aureus* 20(25.6%), *Proteus spp.* 16(20.5%) and *Escherichia coli* 2(2.5%). *Klebsiella spp.* 1(1.3%) and *Candida albicans* 1(1.3%) was the least prevalent (Table 1).

Table 1: Frequency of occurrence of isolates from ear infections

Isolates	No. (%)
Candida albicans	1(1.3)
Escherichia coli	2(2.6)
Pseudomonas aeruginosa	38(48.7)
Proteus spp.	16(20.5)
Staphylococcus aureus	20(25.6)
Klebsiella spp.	1(1.3)
Total	**78(100.0)**

Table 2 shows the distribution of various isolates according to ages of subjects. A total of 78 isolates were recovered from samples, age group 1-14 years of age gave a frequency of 60(76.9%) while 15 years and above gave 18(23.1%). *Escherichia coli* 2(2.5%) was only isolated from age group 1-14 years of age. *Klebsiella spp.* 1(1.3%) and *Candida albicans* 1(1.3%) were only isolated from subjects in age group 15 years and above (Table 2).

Table 2: Frequency of Bacteria isolated from ear infections according to age.

Isolates	No. (%)	Age groups (%)	
		1-14 years	15 years & above
Escherichia coli	2(2.6)	2(100.0)	0(0.0)
Pseudomonas aeruginosa	38(48.7)	29(76.3)	9(23.7)
Proteus spp.	16(20.5)	14(87.5)	2(12.5)
Staphylococcus aureus	20(25.6)	14(70.0)	6(30.0)
Candida albicans	1(1.3)	0(0.0)	1(100.0)
Klebsiella spp.	1(1.3)	0(0.0)	1(100.0)
Total	**78(100.0)**	**59(75.6)**	**19(24.4)**

Table 3 shows the antibiotic susceptibility pattern of the isolated organisms to some commonly used antibiotics Gentamycin showed highest degree of susceptibility to all organisms tested, for

Pseudomonas, Gentamycin gave 65.8%, followed by Ceftazidime 7(46.7%), Ofloxacin 7(38.9%) the lowest was Chloramphenicol 1(2.6%), complete resistance was recorded to Amoxicillin, and Erythromycin. For *Proteus* spp, Gentamycin recorded (50%) susceptibility, Ofloxacin (40.0%), Ceftazidime (37.5%), Chloramphenicol and Erythromycin gave (18.75%), while Amoxicillin and Streptomycin recorded (6.3%), other antibiotics tested include Cefuroxime, Ceftaxone, and Amoxicillin/Clavunalate. Only *Klebsiella* spp. with an occurrence of 1 isolate showed 100.0% susceptibility to Gentamycin and Streptomycin (Table 3).

Table 3: Antibiotic susceptibility pattern of bacteria isolates from ear infections to some commonly used antibiotics.

Isolates	No. (%)	Antibiotics Sensitivity (%)									
		AMX	GEN	STR	ERY	AUG	OFX	CHL	CTX	CAZ	CEF
E. coli	2(2.6)	0.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0
P. aeruginosa	38(48.7)	0.0	65.8	29.0	0.0	15.8	38.9	2.6	0.0	46.0	20.0
Proteus sp	16(20.5)	6.3	50.0	6.3	18.7	12.5	40.0	18.7	0.0	37.5	37.5
Klebsiella sp	1(1.3)	0.0	100.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S. aureus	20(25.6)	5.0	35.0	45.0	40.0	55.0	42.9	25.0	0.0	12.5	62.5

Key: AMX = Amoxicillin, GEN= Gentamycin, CAZ= Ceftazidime, OFX=Ofloxacin, CHL=Chloramphenicol, ERY=Erythromycin, GEN=Gentamycin, STR=Streptomycin, CEF=Cefuroxime, CTX=Ceftaxone

4. DISCUSSION

This study reports a bacteria isolation rate of 84.6% and 1.1% for Fungi, however Fungal studies was not carried out specifically during this study, the 1.1% was recorded for 1 isolate of *Candida albicans* recovered. The rate in our study is similar to that of Bello et al. (2011) who reported a rate of 83% with bacteria isolates consisting 75.25%. Another similar study done at Oyo, Nigeria reported a lower rate of 65.9 % (Oguntibeju, 2003). The most frequently diagnosed ear infection in our report was Acute otitis media (AOM), followed by Chronic supurative otitis media (CSOM), this is in agreement to other reports (Oni et al 2002,).

The occurrence of gram negative organisms (GNB) was higher than for gram positive (GPC) with GNB 57(74%) and GPC 20(26%). This data is in agreement with similar reports such a study at Oyo (Oguntibeju 2003) and (Oyeleke, 2009) but is contradictory to other reports such as a study from University of Uyo teaching hospital (Ekpo et al., 2009) which reported a GPC rate 67.1%. *Pseudomonas aeruginosa* was the most predominant isolate with an occurrence of 38(49.4%), followed by *Staphylococcus aureus* 20(26%) *Proteus spp* gave 16(), the least predominant isolate was *Klebsiella spp* with 1(1.3%), this report is similar to that of Oyeleke (2009) that that gave a rate of 54%for *Pseudomonas spp* and a study done at Ibadan (Oni et al 2002). *Staphylococcus aureus* was also frequently isolated and is comparable to a study done at UUTH, Uyo (Ekpo et al 2009) which reported *Staphylococcus aureus* as the most prevalent isolate. The frequency of *Pseudo a* and *Staph a* in our study could be attributable to the ubiquitous nature of *Pseudomonas aeruginosa* and the availability of *Staphylococcus aureus* as normal flora of the mouth, nares and some other non sterile sites (Ekpo et al., 2009), the virulent nature and rapid colonization properties of these 2 organisms also contributes to their high rate of recovery.

Antibiotic susceptibility was done on all isolates using the most commonly prescribed antibiotics, generally Gentamycin was the most broadly active antibiotic on all isolates tested with a susceptibility of 65% against *Pseudomonas aeruginosa*, 50% against *Proteus* sp. and 35% against *Staphylococcus aureus*. The high sensitivity of Gentamycin has also been reported by some other authors (Oni et al 2002; Oyeleke, 2009). Streptomycin also displayed a moderately high sensitivity to some isolates tested such as *Staphylococcus aureus* and *Pseudomonas aeruginosa* 29.0%. Ofloxacin also displayed a fairly high sensitivity as well as Ceftazidime for example Ofloxacin a rate of 38.9% was reported for *Pseudomonas aeruginosa*, 40% for *Proteus* sp. and 42.9% for *Staphylococcus aureus*. Absolute resistance to Erythromycin and Amoxicillin by *Pseudomonas* was seen, as well as a poor susceptibility result of Chloramphenicol to the isolates tested, this shows an emerging resistance to these classes of antibiotics, particularly by the GNB isolates which is one of the commonest causes of ear infections.

5. CONCLUSION

This report shows the isolation pattern and antibiotic susceptibility of Ear infections in Abeokuta, the most predominant ear infection in our setting is AOM, which is characterized by persistent discharge as a result of perforation of the tympanic membrane and infection of the middle ear mucosa, if left untreated several complications could result such as ear perforation loss of hearing, meningitis and intracranial abscess (Oni et al 2002; Ekpo et al., 2009). Resistance to Chloramphenicol observed in our study is an indication of emerging resistance to this widely used antibiotic, thankfully Gentamycin and Ofloxacin still displayed a fairly good sensitivity pattern. The results from this study show the need for surveillance of this otherwise neglected infection.

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