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A Bacteriological Study of Cases of Otitis Media in Akungba-Akoko Community, Ondo State Nigeria**Fadipe D.O.^{1*}, Olajubu F.A.², Akinseye J.F.³ and Fadipe A.O.⁴**

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Author for Correspondence *: dipedare@gmail.com/+234-701-987-3132**Abstract**

This study was a six years retrospective review of the routine microbiological, culture and sensitivities of ear swab samples collected from patients that attended the Health Centre of Adekunle Ajasin University, Akungba-Akoko for treatments of ear-related infections. Ethical clearance was obtained from the ethical committee of Adekunle Ajasin University, Akungba-Akoko. Clinical Laboratory records of 63 cases of ear swab samples taken through standard procedures were selected for the study to examine them for spectrum bacterial isolates. Age and gender distribution of cases of infections and the antibiotic susceptibility pattern of isolates was studied. Out of 63 samples, 8(12.7%) did not yield bacterial growth, while 55 (87.3%) gave bacterial growth of different species. Staph aureus had the highest occurrence of 50.8%, followed by Pseudomonas spp 28.6% and other Coliforms species has the least. The antibiotics with very good in vitro sensitivity included the Quinolones, Erythromycin, Cefixime, Rifampicin, Streptomycin and Gentamycin. While Augmentin, Nitrofurantoin, Ampiclox, Septrin, Ampicillin, Nalidixic acid, Cloxacillin and Tetracycline did not show remarkable sensitivity pattern among the organisms isolated. The most common bacterial isolates were Staphylococcus aureus and Pseudomonas spp and the antibiotics identified as having the highest in vitro sensitivity pattern are recommended for first line management of these types of infections where they are indicated, in blind therapy.

Keywords: Bacteriological study, Otitis media, AAU, Akungba-Akoko.

Introduction

Otitis media simply means an inflammation of the middle ear (the space between the external auditory canal and the inner ear); it can be associated with an infection where it is caused by bacteria that migrate

into the middle ear via the Eustachian tube. Occasionally, otitis media may be caused by fungi (*Aspergillus* or *Candida*) or other pathogens such as herpes virus, in this situation usually, either there is a problem with immune function or there is a hole (perforation) in the ear drum (Harmes *et al.*, 2013).

The middle ear is defined as the area between the eardrum and the inner ear. It consists of the eardrum, the hollow cavity behind it with three small middle ear bones (ossicles) and the Eustachian tube. Children are more susceptible to otitis media because their ears and immune systems are not yet fully developed making them more susceptible to infections compared to adults. The Eustachian tubes and adenoids of children put them at risk for ear infections.

A child's Eustachian tubes are shorter and horizontal in orientation than in the adult making it difficult for fluid to drain out of the ear. The adenoids, located in the back of the upper throat near the Eustachian tubes, are large in children and can therefore easily interfere with the opening of the Eustachian tubes. Children generally "grow out" of ear infections by the time they are 7-10yrs old (Bluestone, 2004).

The cause of acute otitis media (AOM) is related to childhood anatomy and immune function. Either bacteria or viruses may be involved. Risk factors include: exposure to smoke, use of pacifiers, and attending daycare. Otitis media with effusion (OME) frequently occurs following AOM but may also be related to viral upper respiratory infections, irritants such as smoke, or allergies (Minovi and Dazert, 2014; CDC, 2013). Looking at the eardrum is important for making the correct diagnosis (Coker *et al.*, 2010). Signs of AOM include bulging or a lack of movement of the tympanic membrane from a puff of air (CDC, 2013; Lieberthal *et al.*, 2013). New discharge not related to otitis externa also indicates the diagnosis

(Lieberthal *et al.*,2013). Discharge from the ear, can be caused by acute otitis media with perforation of the ear drum, chronic suppurative otitis media, tympanostomy tube otorrhea, or acute otitis externa. Trauma, such as a basilar skull fracture, can also lead to discharge from the ear due to cerebral spinal drainage from the brain and its covering (meninges). The common cause of all forms of otitis media is dysfunction of the Eustachian tube (Bluestone, 2005). This is usually due to inflammation of the mucous membranes in the nasopharynx, which in turn can be caused by a viral URI or possibly by allergies (John, 2013). Due of the dysfunction of the Eustachian tube, the gas volume in the middle ear is trapped and parts of it are slowly absorbed by the surrounding tissues, leading to negative pressure in the middle ear. Eventually the negative middle-ear pressure can reach a point where fluid from the surrounding tissues is sucked in to the middle ear's cavity (also called tympanic cavity), causing a middle-ear effusion. This is seen as a progression from a Type A tympanogram to a Type C to a Type B tympanogram. By reflux or aspiration of unwanted secretions from the nasopharynx into the normally sterile middle-ear space, the fluid may then become infected - usually with bacteria.

A number of measures decrease the risk of otitis media including: pneumococcal and influenza vaccination, exclusive breastfeeding for the first six months of life, and avoiding tobacco smoke (Lieberthal *et al.*,2013). In those with otitis media with effusion antibiotics do not generally speed recovery (CDC, 2013; van Zon *et al.*, 2011). The use of pain medications for AOM is important (Lieberthal *et al.*,2013). This may include: paracetamol (acetaminophen), ibuprofen, benzocaine ear drops, or opioids (Lieberthal *et al.*,2013). In AOM antibiotics may speed recovery but may result in side effects (Venekamp *et al.*, 2013). Antibiotics are often recommended in those with severe disease or under two years old. In those with less severe disease they may only be recommended in those who do not improve after two or three days (CDC,2013). The initial antibiotic of choice is typically amoxicillin. In those with frequent infections tympanostomy tubes may decrease recurrence (Lieberthal *et al.*,2013).

Materials and Methods

Cultural method:

The bacterial isolates studied in this work were clinical isolates from cultured specimens of ear swabs taking from either the right or left ear or both as the case may be. Patients first reported to the Doctors

with complaints of either pain in any of the ears or suppurative discharge from either of the ears or any other symptoms indicating that otitis media could be presumptively diagnosed. Patients who had commenced either oral or topical application of antibiotics were turned down or advised to discontinue the use of such drugs for a minimum of five days prior to swabbing the affected ear(s).

Routine Cultural Methods, using Multipurpose Media like Blood agar, Chocolate agar and Mac-Conkey Agar were used for these swabs. All cultured media were incubated aerobically at 37°C for 18-24 hours with duplicate culture plates of Chocolate agar incubated in increased carbon dioxide atmosphere for 18-24 hours.

The bacterial isolates were identified microbiologically by standard methods and their sensitivities to various common antibiotics were determined by the Modified Kirby-Bauer technique as reported by Monica Cheesbrough (2000).

Antibiotic sensitivity testing

The sensitivity testing was carried out by the Modified Kirby-Bauer techniques. Four to five pure isolated colonies of 18-24 hours agar plate culture of the same morphological type were selected by touching the tip of each colony with a wire loop and transferred to a tube containing sterile physiological saline.

Such tube was then incubated at 37° C for 2-3 hours to produce moderately cloudy suspension that was standardized by diluting in saline to give visually equivalent to the McFarland 0.5. This equates to approximately 10⁸ organisms per ml (NCCL 2007).

A sterile cotton-tipped applicator was dipped on to the adjustment suspension and inoculated onto a dried sensitivity agar (SA) plate (Lab. M) by streaking the swab over the entire surface of the agar. The multi disc containing these antibiotics (under studied) was placed on to the SA plate, using some sterile forceps. The plate was then inverted and placed in the incubator at 37° C for 16-18 hours and thereafter examined. The diameter of growth inhibition was then measured with a transparent ruler and recorded. Antibiotic which caused inhibition with minimum diameter of 10mm was taken to be sensitive and those below 10mm were taken to be resistant.

Result

Table 1: Gender Distribution of Patients

Gender	Number of Patients	Percentage
Male	37	58.7%
Female	26	41.3%
Total	63	100.0%

Males accounted for 58.7% (37) of the participants

Table 2: Age Distribution of Patients

Age	Number of Patients	Percentage
1month-10years	20	31.75%
11yrs-18years	7	11.11%
18years and above	36	57.14%
Total	63	100.0%

The majority 57.14% (36) of the specimen received were from adults above 18years old, followed by children below the age of 10years.

Table 3: Types of Organisms Isolated

Organism	No	Percentage %
No Growth	8	12.7
<i>Staph. aureus</i>	32	50.8
<i>Streptococcus</i> spp	2	3.2
<i>Pseudomonas</i> spp	18	28.6
<i>Klebsiella</i> spp	1	1.6
<i>Escherichia coli</i>	1	1.6
<i>Proteus</i> spp	1	1.6
Total	63	100

Eight (12.7%) of the specimen yielded no growth, *Staph aureus* accounted for 32 (50.8%) of the isolated organisms, followed by *Pseudomonas* spp 18(28.6%) and *Streptococcus* spp 2(3.2%) while *Klebsiella*, *Proteus* spp and *Escherichia coli* were the least with 1.6% each.

Table 4: Sensitivity Pattern of Isolates to Antibiotics

No	Antibiotics	<i>Staph. Aureus</i>	<i>Streptococcus</i> spp	<i>Pseudomonas</i> spp	<i>Klebsiella</i> spp	<i>Escherichia coli</i>	<i>Proteus</i> Spp
1	Levofloxacin	S-11	S-ND	S-4	S-ND	S-1	S-ND
		R-2	R-ND	R-0	R-ND	R-0	R-ND
2	Ampicillin	S-4	S-ND	S-1	S-ND	S-ND	S-0
		R-8	R-ND	R-3	R-ND	R-ND	R-1
3	Streptomycin	S-9	S-1	S-7	S-1	S-0	S-ND
		R-6	R-0	R-4	R-0	R-1	R-ND
4	Septrin	S-2	S-1	S-2	S-1	S-ND	S-0
		R-8	R-1	R-8	R-0	R-ND	R-1
5	Chloramphenicol	S-7	S-ND	S-5	S-1	S-1	S-1
		R-11	R-ND	R-3	R-0	R-0	R-0
6	Augmentin	S-1	S-1	S-3	S-ND	S-ND	S-ND
		R-9	R-0	R-8	R-ND	R-ND	R-ND
7	Ofloxacin	S-17	S-1	S-9	S-ND	S-ND	S-1
		R-4	R-0	R-2	R-ND	R-ND	R-0
8	Ampiclox	S-3	S-1	S-1	S-ND	S-0	S-ND
		R-7	R-1	R-5	R-ND	R-1	R-ND
9	Pefloxacin	S-10	S-1	S-5	S-ND	S-ND	S-ND
		R-2	R-0	R-1	R-ND	R-ND	R-ND
10	Nitrofurantoin	S-2	S-0	S-0	S-ND	S-ND	S-0
		R-3	R-0	R-4	R-ND	R-ND	R-1
11	Erythromycin	S-16	S-1	S-2	S-1	S-1	S-ND
		R-6	R-1	R-3	R-0	R-0	R-ND
12	Gentamycin	S-20	S-2	S-9	S-1	S-1	S-1
		R-12	R-0	R-5	R-0	R-0	R-0
13	Ciprofloxacin	S-20	S-2	S-14	S-1	S-1	S-1
		R-4	R-0	R-2	R-0	R-0	R-0
14	Ceftriaxone	S-6	S-1	S-3	S-ND	S-ND	S-ND
		R-5	R-0	R-3	R-ND	R-ND	R-ND
15	Amoxicillin	S-3	S-0	S-4	S-1	S-0	S-0
		R-7	R-1	R-5	R-0	R-1	R-1
16	Nalidixic Acid	S-1	S-ND	S-2	S-ND	S-ND	S-ND
		R-1	R-ND	R-1	R-ND	R-ND	R-ND
17	Clindamycin	S-6	S-1	S-1	S-ND	S-ND	S-ND
		R-3	R-0	R-1	R-ND	R-ND	R-ND
18	Tetracycline	S-4	S-ND	S-1	S-ND	S-ND	S-0
		R-3	R-ND	R-2	R-ND	R-ND	R-1
19	Cloxacillin	S-1	S-ND	S-ND	S-ND	S-ND	S-ND
		R-7	R-ND	R-ND	R-ND	R-ND	R-ND
20	Cefixime	S-9	S-1	S-2	S-ND	S-ND	S-1
		R-3	R-0	R-2	R-ND	R-ND	R-0
21	Norfloxacin	S-6	S-ND	S-5	S-ND	S-1	S-ND
		R-6	R-ND	R-0	R-ND	R-0	R-ND
22	Sparfloxacin	S-2	S-ND	S-2	S-ND	S-ND	S-ND
		R-2	R-ND	R-3	R-ND	R-ND	R-ND
23	Rifampicin	S-3	S-ND	S-3	S-1	S-1	S-ND
		R-0	R-ND	R-2	R-0	R-0	R-ND

Keys: S – Sensitivity,
R- Resistant,

Black/Bold - Antibiotics with very good activity,
Green colour -Antibiotics with moderate activity,
Red colour - Antibiotics with poor activity,
ND - Antibiotics not tested.

Discussion

Otitis media is the most frequent diagnosis in sick children in the U.S., especially affecting infants and preschoolers. Almost all children have one or more bouts of otitis media before age 6. From this study, about 59% of the subjects are male, while about 32% are children under the age of 10, supporting the earlier works (Minovi and Dazert, 2014; Monasta *et al.*, 2012). However, bacterial species isolated from this study differ from the earlier incriminated species like *Streptococcus pneumoniae*, *Haemophilus influenzae*, and *Moraxella catarrhalis* (Lieberthal *et al.*, 2013). The isolation of bacterial species like *Staph aureus* and *Pseudomonas* sp were in higher percentages and thus calls for concern.

These two species of bacteria are noted for their ability to carry and even transfer to others, antibiotic resistant plasmid. Little wonder then that the antibiotics of choice in the treatment of OME (Amoxicillin or Amoxicillin-Clavulanate) are not effective as seen in this study, rather the Quinolones (Ofloxacin, Ciprofloxacin, Norfloxacin, Sparfloxacin, Levofloxacin and Pefloxacin), Gentamicin, Erythromycin, Rifampicin and Cefixime are the antibiotics seen to be effective against the isolated bacterial species isolated in this study.

There is therefore the need for concerted efforts at educating the inhabitants of this community on personal hygiene, hygienic care of children and the danger of indiscriminate use of non-prescribed antibiotics.

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