

Full Length Research Paper

Microorganisms associated with acute otitis media diagnosed in Uyo City, Nigeria

Ekpo, M. A., Akinjogunla, O. J.* and Idiong, D. F.

Department of Microbiology, University of Uyo, Akwa Ibom State, Nigeria.

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Sixty (60) samples from both hospitalized and ambulatory patients seeking medical care in University of Uyo Teaching Hospital (UUTH) and Nedeke Paediatric Hospital (NPH) in Uyo were screened for the microorganisms associated with otitis media between June and December, 2007. The number of occurrence of bacterial species out of the total isolates ranged from 1 and 15 with the percentage frequency between 1.49 and 22.38%. The following Bacteria were isolated from otitis media samples: *Moraxella* spp., *Streptococcus* spp., *Staphylococcus* spp., *Bacillus* spp. and *Escherichia coli*, with a predominance of *Streptococcus* spp. The number of occurrence of fungal species in the samples ranged between 1 to 18 with the percentage frequency between 2.04 and 20.4%. Fungi isolated from otitis media samples were *Aspergillus* spp., *Rhizopus* spp., *Cephalosporium* spp., *Penicillium* spp., and *Candida* spp., with *Aspergillus* spp. predominating. Forty nine patients (81.6%) had a single organism isolated from the middle ear culture, while the remaining 11(18.4%) patients had two or more organisms isolated. Infection was highest among the 1 - 10 years, and the lowest among aged 31 and above. The study revealed that there were higher numbers of bacteria associated with otitis media than fungi in Uyo.

Key words: Otitis media, prevalence, infection, Nigeria.

INTRODUCTION

Otitis Media is inflammation of the middle ear. Otitis media occurs in the area between the ear drum and the inner ear, including a duct known as the eustachian tube (Richard and Robert, 1996). Otitis media is very common in childhood, with the average toddlers having two to three episodes a year and this is always accompanied by a viral upper respiratory infection (URI), mostly common cold caused by influenza virus (Richard and Robert, 1996). Children below the age of seven years are much more susceptible to otitis media (OM) since the eustachian tube is shorter and at more of a horizontal angle than in the adult and this is also because they have not developed the same resistance to bacteria, fungi and viruses as found in adults (Weiner and Collison, 2003). Breast feeding for the first twelve months of life is associated with a reduction in the number and duration of all otitis media infections (Owen et al., 1993; Dewey et al., 1995). Poor eustachian tube function can overwhelm-

ingly increase the likelihood of more frequent and severe episodes of otitis media. Progression to chronic otitis media is much more common in the group of people, who often have a family history of middle ear diseases (Dewey et al., 1995).

Over the past two decades there has been a dramatic increase in the number of consultations to the paediatricians for otitis, this probably reflects a combination of factors ranging from a change in the pattern of disease with more children in child care (Teele, et al., 1990; Dewey et al., 1995).

In general, the more severe and prolonged the compromise of eustachian tube functions, the more severe the consequences are to the middle ear and its delicate structures. The patients with acute bacterial otitis media (ABOM) present the classic "earache", pain that is severe and continuous and is often accompanied by fever (39°C or more), possibly causing febrile seizures (Kontiokari et al., 1998; Damoiseaux et al., 2000; Arroli, 2005; Damoiseaux, 2005; Rovers et al., 2006).

Otitis media has been reported to be the most common infection in young children (Gunnsteinn et al., 2004). Pri-

*Corresponding author. E-mail: papajyde2000@yahoo.com.
Tel.: +2348064069404.

Table 1. Morphological and biochemical characteristics of bacterial isolated from otitis media samples.

Cell shape	Gram s staining	Pigment	Catalase	Coagulase	Indole	Methyl red	Vogae proskaver	Nitrate	Motility	Glucose	Sucrose	Maltose	Lactose	Dextrose	Xylose	Mannitol	PROBABLE ORGANISM
Cocci	-	-	+	-	+	+	-	+	-	-	-	-	-	-	-	-	<i>Moraxella</i> spp.
Rods	-	-	+	-	+	+	-	+	+	AG	A	A	AG	AG	AG	AG	<i>Escherichia coli</i>
Cocci	+	-	+	-	-	+	-	+	-	A	A	-	AG	A	A	-	<i>Streptococcus</i> spp.
Rods	+	-	+	-	-	-	+	+	A	A	-	AG	AG	A	A	AG	<i>Bacillus</i> spp.
Cocci	+	+	+	+	+	-	+	+	-	AG	AG	AG	AG	A	-	AG	<i>Staphylococcus</i> spp.

+ Positive; AG Acid with gas; - Negative; A Acid only

Primary care providers, such as general practitioners and paediatricians, often have a monocular otoscope and perhaps a tympanometer as their diagnostic tools, which makes this distinction difficult, especially if the canal is small and there is wax in the ear that obscures a clear view of the eardrum (Bluestone et al., 1992; Richard et al., 1996; Bluestone, 1998; Ehrlich et al., 2002). Acute otitis media (AOM) can cause pain that leads to insomnia for patients, loss of balance, unresponsiveness to quiet sounds, unusual irritability, draining of fluid in the ear, eardrum perforations and result in mastoiditis, otorrhoea, and/or meningitis, brain abscess, and even death if a severe infection goes untreated long enough. Prior to the invention of antibiotics, severe acute otitis media was mainly remedied surgically by myringotomy, an outpatient procedure, which consists of making a small incision in the tympanic membrane to relieve pressure build-up (Arroll, 2005).

The aim of this research work was to isolate, characterize and identify the microorganisms associated with acute otitis media infection in Uyo.

MATERIALS AND METHODS

Collection of samples

Purulent materials were collected from sixty (60) different patients suffering from otitis media at University of Uyo Teaching Hospital and Nekede Paediatric Hospital in Uyo, Akwa Ibom over a six months period (June - December, 2007). The samples were collected with sterile swab sticks which were properly labelled indicating the source, date, time of collection, age of patients and personal history. The samples were transported in cooler boxes to the Microbiology Laboratory, University of Uyo, for analysis within 4 - 6 h after collection.

Bacterial Isolation and Identification

Culture plates (Deoxycholate Agar (Oxoid, UK), MacConkey Agar (Oxoid), Nutrient Agar (Oxoid), Blood Agar (Oxoid) was used. The swab sticks used for the collection of the samples were streaked directly on the labelled agar plates and incubated at 37°C for 24 h. After incubation, cultures were examined for significant growth.

Subcultures were prepared into plates of nutrient agar, and incubated for another 24 h. Biochemical tests were performed to identify microbes that could not be characterized by morphology; colour or type of colony after Gram's staining. Biochemical tests applied were standard catalase test, citrate utilization, coagulase, oxidase, Voges-Proskauer, Indole production, motility, sucrose, maltose, lactose, nitrate reduction, mannitol, xylose. The isolates were identified using the methods of Cowan (1985) and Fawole and Oso's (1988).

Fungal isolation and identification

The swab sticks were streaked directly on the well labeled Sabouraud Dextrose Agar (SDA) plates and incubated at room temperature. The growth was visible within 5 - 7 days. Each fungal growth was identified based on their morphological and cultural characteristics and microscopic examination was done using lactophenol staining technique (Collins and Lyne, 1984).

Statistical analysis

The prevalence of organisms was determined and expressed in percentage.

RESULTS AND DISCUSSION

From the 60 patients enrolled in the study, there were 116 isolates. Forty nine patients (81.6%) had a single organism isolated from the middle ear culture, while the remaining 11(18.4%) patients had two or more organisms isolated. Tables 1 and 2 summarized the biochemical characterization of the isolates. The results obtained from the morphological and biochemical characterization of the bacterial isolates from the otitis media samples revealed that the most common bacterial isolated were *Streptococcus* spp. (47.74%), *Moraxella* spp. (23.84%) *Staphylococcus* spp. (19.36%) followed by *Bacillus* spp. (4.47%) and *Escherichia coli* (4.47%). The bacteria with the highest percentage frequency was *Streptococcus* spp. (Table 3) and this result is similar with the previous reports by Green and Haggerty (1968). The resistance of *Streptococcus* spp. to penicillin is responsible for the high prevalence of this organism and the frequent use of antibio-

Table 2. Morphological characteristics of fungi isolated from otitis media samples.

Colony colour	Type of soma	Nature of hyphae	Special vegetative structure	Asexual spore	Speical reproductive structure	Conidia I head	Vesicle head	Probable organism
Leathery blue-green colony with red pigments	Filamentous	Septate	Broom-like appearance	Glubose conidia produced in columns	1 stage branched conidiophores	-	-	<i>Penicillium</i> spp.
Dense felt yellow green colony compact	Filamentous	Septate	Foot cell	Glubose conidia	Phialides born directly on the vesicle, secierotia	radiate	Subglobose	<i>Aspergillus</i> spp.
White becoming greyish	Filamentous	Septate	Stolons, rhizoids	Ovoid sporangiospores	Tall sporeangiophores in group, brown black sporangia	-	-	<i>Rhizopus</i> spp.
Blown white colony mycelia	Filamentous	Septate	-	philaspores	-	-	-	<i>Cephalosporium</i> spp.
Brownish green	Filamentous	Septate	-	Cylindrical conidia	Irregular conidiophore	-	-	<i>Candida</i> spp.

Table 3. Percentage frequency of bacteria causing Acute Otitis Media according to age ranges.

Age Range (years)	Bacteria isolated	Percentage (%) Occurrence
1 - 10	<i>Streptococcus</i> spp.	15(22.38%)
	<i>Staphylococcus</i> spp.	5(7.46%)
	<i>Bacillus</i> spp.	2(2.98%)
	<i>Escherichia</i> spp.	1(1.49%)
	<i>Moraxella</i> spp.	8(11.94%)
11 - 20	<i>Streptococcus</i> spp.	4(5.97%)
	<i>Moraxella</i> spp.	2(2.98%)
	<i>Staphylococcus</i> spp.	2(2.98%)
21 - 30	<i>Streptococcus</i> spp.	10(14.92%)
	<i>Bacillus</i> spp.	1(1.49%)
	<i>Escherichia</i> spp.	1(1.49%)
	<i>Moraxella</i> spp.	4(5.94%)
	<i>Staphylococcus</i> spp.	4(5.94%)
31 and above	<i>Streptococcus</i> spp.	3(4.47%)
	<i>Staphylococcus</i> spp.	2(2.98%)
	<i>Escherichia</i> spp.	1(1.49%)
	<i>Moraxella</i> spp.	2(2.98%)
Total		67(100)

tics by the patient suffering from otitis media (Green and Haggerty, 1968). The results obtained differ from the reports in the United States of American (USA) where the most frequent pathogens were *Haemophilus* spp. and

Streptococcus spp. (Giebink, 1987; Hoffman et al., 2003; Schleiss et al., 2004) and also differ from the report of Oni et al. (2002) in which the predominant organisms isolated from otitis media were *Pseudomonas* spp. *Pro-*

Table 4. Percentage frequency of fungal causing Acute Otitis Media according to age ranges.

Age Range (years)	Fungal isolated	Percentage (%) Occurrence
1 - 10	<i>Candida</i> spp.	3(6.12%)
	<i>Aspergillus</i> spp.	10(20.4%)
	<i>Rhizopus</i> spp.	2(4.08%)
	<i>Penicillium</i> spp	5(10.20%)
11 - 20	<i>Aspergillus</i> spp.	5(10.20%)
	<i>Penicillium</i> spp.	1(2.04%)
	<i>Candida</i> spp.	1(2.04%)
21 - 30	<i>Aspergillus</i> spp.	8(16.32%)
	<i>Candida</i> spp.	1(2.04%)
	<i>Penicillium</i> spp.	4(5.97%)
31 and above	<i>Aspergillus</i> spp.	3(7.46%)
	<i>Cephalosporium</i> spp.	1(1.49%)
	<i>Candida</i> spp.	2(4.47%)
	<i>Penicillium</i> spp.	3(1.49%)
Total		49 (100)

spp. *Proteus* spp., and *Staphylococcus* spp. *Staphylococcus* spp. is an opportunistic pathogen found outside the human body, but when it gains entrance into the human body, it causes infection to tissues and mucus membranes e.g. abscesses. It also causes respiratory infections like pneumonia and endocarditis. It has also been reported that *Staphylococcus* spp. may be picked from the outer ear along side with the otitis hand.

The results obtained from the morphological and cultural characterization of the fungal isolates from the otitis media samples revealed the presence of *Penicillium* spp. (26.52%), *Aspergillus* spp. (53.04%), *Rhizopus* spp. (4.08%), *Cephalosporium* spp. (2.04%) and *Candida* spp. (14.28%) (Table 4), Fungal species with the highest frequency was *Aspergillus* spp. while the fungi with the lowest percentage frequency were *Candida* spp., *Cephalosporium* spp. and *Rhizopus* spp. The results of this research also revealed that the children patients from of 1 – 10 years were more susceptible to otitis media infection than the adults and this fact was also emphasized by the report of Klein, (1994). However, the susceptibility of the children to otitis media is traceable to their immune system and to the particular constitution (shorter and straight / horizontal) eustachian tube. The study revealed that it was higher numbers of bacteria associated with otitis media in patients than fungi in Uyo and that infection was highest among the patients from 1 – 10 years age group and lowest among those of 31 and above.

In conclusion, acute otitis media (AOM) is a condition of the middle ear that is characterized by persistent discharge through a perforation of the tympanic membrane. Due to the perforated tympanic membrane, organisms can gain entry into the middle ear via the external ear canal. Infection of the middle ear mucosa subsequently results in ear discharge. Numerous studies have correlated the incidence of acute

otitis media in children with various factors such as nursing in infancy, bottle feeding when supine, parental smoking, diet, allergies and auto-mobile emissions. Untreated cases of AOM can result in a broad range of complications. These may be related to the spread of organisms to structures adjacent to the ear or to local damage in the middle ear itself. Such complications range from persistent otorrhoea, mastoiditis, labyrinthitis, facial nerve paralysis to more serious intracranial abscesses or thromboses. This research showed the micro-organisms associated with otitis media in Uyo.

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