

Coagulase positive Staphylococcal-induced Otitis media in the General Hospital Maiduguri, Nigeria and Antibiotic susceptibility patterns of the Aetiological agent.

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Abstract: Investigations were carried out on *Staphylococcus*-induced otitis media in patients attending the Ear, Nose and Throat Department of the General Hospital Maiduguri, Nigeria, between August-September 2008. The antibiotic sensitivity of the aetiological agent was also determined. A total of 108 swab samples were collected aseptically from ear discharges of male and female out-patients with major complaints of infections of the middle ear (otitis media) and clinically diagnosed of having chronic suppurative otitis media with or without discharges. Out of the 108 patients examined, 42 (38.89%) were positive for *Staphylococcus species*. Results also showed that more males suffered from *Staphylococcus* induced otitis media when compared to the female patients and are most prevalent among teenagers in the age group of 1-15years. Antimicrobial susceptibility test result revealed that the causative organism was susceptible to Ciprofloxacin, Ofloxacin, Norfloxacin and Clindamycin. The organism was resistant to Ampiclox, Cephalixin, Cotrimoxazole and Amoxicillin. Hence, precautionary measures such as more stringent diagnostic criteria, judicious use of antibiotic and effective infection control are recommended.

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Introduction

Otitis media is the infection associated with the malfunctioning of the middle ear due to pathogenic micro-organisms that are resident in the middle ear (Celin *et al.*, 1992; Isah and Abubakar, 2003). In otitis media, the middle ear is usually affected as a result of colonization by pathogenic organisms which can ultimately result in deficiency or impaired hearing (Damoiseaux, 2005). Otitis media differs in complication and this depends on the level of severity and duration of the infection in relation to the causative organisms, hence, otitis media can be differentiated into chronic suppurative otitis media (CSOM) and acute otitis media (AOM) (Oni *et al.*, 2002).

Staphylococcus aureus (*S. aureus*) is a pathogen of major concern because of its ability to cause a diverse array of diseases ranging from minor infection to life threatening septicaemia and its ability to adapt to adverse environmental conditions (Franklin, 2003). Historically, *S. aureus* has gained increased resistance to antibiotics, in the early 1940s, when benzylpenicillin was introduced, staphylococcal

infections were treatable with this drug. However, by 1948, penicillin-resistant strains were prevalent. During the 1950s, *S. aureus* developed resistance to available agents such as streptomycin, erythromycin, and tetracycline. When methicillin and other semisynthetic penicillins were introduced during the 1960s, staphylococcal infections again appeared to be treatable. However, in the 1970s and 1980s, methicillin-resistant *S. aureus* (MRSA) strains emerged (McGowan and Jr, 1988). Infections particularly those caused by antibiotic resistant gram-positive bacteria such as methicillin resistant *S. aureus* (MRSA) and vancomycin resistant enterococci (VRE) are a growing concern, particularly in units in which patients are immunocompromised either due to transplantation or as a result of trauma (due to severe burns) or disease such as acquired immune deficiency syndrome (Neely and Maley, 2000). One critical factor for transmission of a micro-organism from a person (patient or healthcare workers) to the environment and then to a susceptible individual is the ability of the microbes to survive in that environment. Studies have shown the survival of gram-positive bacteria of which *S. aureus*

is a member, on various surfaces such as bedrails and stethoscope (Noskin *et al.*, 1995) and on garments of healthcare workers. A recent study reported that 65% of nurses who had performed patient care activities on patient with MRSA in a wound or urine, contaminated their nursing uniforms or gowns with MRSA (Boyce *et al.*, 1997).

In recent times, it has been reported that *S. aureus* that were susceptible to vancomycin are now developing resistance to the same drug. The presence of *S. aureus* strains among MRSA that were heterogeneously resistant to vancomycin (hetero-VRSA) has been reported in Japan (Hiramatsu *et al.*, 1997) and Spain (Ariza *et al.*, 1999). These may be responsible for the therapeutic failure experienced with vancomycin in the treatment of MRSA infection.

Development of antibiotic resistance by *S. aureus* is common in developing countries, more especially Nigeria where antimicrobial agents are readily available to the consumers across the counter without prescription from a medical practitioner. Such a practice has led to the abuse of antimicrobial drugs with the associated high prevalence of drug resistance among staphylococci (Paul *et al.*, 1982). The objectives of this study are to ascertain the level of involvement of coagulase positive staphylococci in Otitis media in the General Hospital Maiduguri, Nigeria and to determine the antibiotic susceptibility of the aetiological agent.

Materials and Methods

Sample collection

A total of 108 swab samples were collected aseptically from male and female out-patients attending the Ear, Nose and Throat (ENT) Department of the General Hospital, Maiduguri, with major complaints of infection of the middle ear (otitis media) and clinically diagnosed of having chronic suppurative otitis media with or without ear discharges. The patients' ages ranged from 1-60 years. The study was carried out during the months of August to September, 2008.

The external ear was cleaned and a sterile swab stick was carefully introduced into the ear and rotated to collect the discharge, the swab stick was then carefully removed to avoid contact of the stick with the external meatus and aseptically replaced into the container and transported to the laboratory in an ice pack to prevent deterioration of the samples.

Isolation and identification of *Staphylococcus*

The swab samples were streaked onto Mannitol Salt Agar (Oxoid, Hampshire, England) and incubated for 24 hours at 37^oC. Yellowish discrete colonies on MSA were gram stained and examined for presence of gram positive cocci in bunches (presumptive *Staphylococcus* organisms). Pure cultures of the presumptive staphylococci were subjected to biochemical analysis. Biochemical tests such as catalase, coagulase (slide and tube methods) and mannitol fermentation were carried out on the isolates using standard microbiological methods to confirm the presence of pathogenic staphylococci.

Antimicrobial Susceptibility Testing

Antimicrobial susceptibility testing was carried out with disk diffusion method using Mueller-Hinton agar (Oxoid, Hampshire, England) and in accordance with the procedure outlined by Clinical Laboratory Standards Institute (CLSI, 2008). Commercially available disk (Alternative Laboratories, Nigeria) used in the study included: Ofloxacin (10µg), Cephalexin (20µg), Norfloxacin (10g), Clindamycin (5µg), Cotrimoxazole (25µg), Amoxicillin (20µg), Ampiclox (20µg), Erythromycin (10µg), Gentamycin (10µg) and Ciprofloxacin (5µg).

Zones of inhibition were measured and interpreted according to the CLSI recommendation.

Results

Out of the 108 swabs taken from the patients, 42 (38.89%) were positive for coagulase positive staphylococci (CPS) as shown in Table 1. Also out of the 54 males sampled 25 (46.3%) were positive for CPS-induced otitis media infection while from the same number of females sampled, 17(31.4%) were positive for CPS-induced otitis media infection (Table 1). Another significant observation was that, the majority of the positive patients, 35 (32.41%) were teenagers within the age group of 1-15years which constituted 80 (74.1%) out of the 108 patients examined. This is followed by 19 patients within the age group of 16-30 years accounting for 5(4.63%) positive patients while 6 patients in the age group of 31-45years accounted for 2(1.85%) positive patients. None of the patients within the age group of 46-60 was positive for CPS as the cause of otitis media infection.

Table 1: Age and sex distribution in relation to otitis media infection among the out-patients Attending ENT Department of General Hospital, Maiduguri, Nigeria.

Age distribution (years)	No of males		No of females		Total number of patients		
	sampled	positive	sampled	positive	sampled	positive	(%)positive
1-15	44	22	36	13	80	35	32.41
16-30	7	3	12	2	19	5	4.63
31-45	1	0	5	2	6	2	1.85
46-60	2	0	1	0	3	0	0.00
Total	54	25	54	17	108	42	38.89

Table 2. Antibigram of Coagulase positive staphylococci isolated from out-patients attending ENT Department of General Hospital, Maiduguri, Nigeria. (n=42)

Antibiotics	No of sensitive Isolates (%)
Ofloxacin (10µg)	32(76.2%)
Cephalexin (20µg)	17(40.5%)
Norfloxacin (10µg)	31(73.8%)
Clindamycin (5µg)	27(64.2%)
Cotrimoxazole(25µg)	17(40.5%)
Amoxicillin (20µg)	14(33.3%)
Ampiclox (20µg)	18(42.9%)
Erythromycin (10g)	22(52.4%)
Gentamycin (10µg)	22(52.4%)
Ciprofloxacin (5µg)	35(83.3%)

Results of the sensitivity profile of the staphylococci are presented in Table 2. The staphylococci were highly sensitive to Ciprofloxacin (83.3%), Ofloxacin (76.2%), Norfloxacin (73.8%) and Clindamycin (64.2%), moderately sensitive to Erythromycin (52.4%) and Gentamycin (52.4%). The organism was resistant to Ampiclox (42.9%), Cephalexin (40.5%), Cotrimoxazole (40.5%) and highly resistant to Amoxicillin (33.3%).

Discussion

Series of studies have been carried out in different parts of the world and majority of the outcomes of the work has shown the significance of this bacterial

as the aetiological agents of suppurative otitis media. In Kano, Nigeria, 27(19.85%) of the isolates from ear infection were positive for *S. aureus* (Habibu and Takalmawa, 2002) while in Abia, Nigeria, 37.5% isolates from both ear and nasal swabs were positive for the organism (Chigbu and Ezeronye, 2003). This present study showed a high prevalence (32.41%) of otitis media in children within the age group of 1-15years when compared to patients of other age groups. This observation can be ascribed to physiological, anatomical and socio-cultural reasons. Based on physiological and anatomical structures, the immune system of the children within this age group (specifically, 6-18months) are not well developed compared to those in the higher age groups. In

addition to these, the Eustachian tube of younger children is shorter and more horizontal than in older children, therefore the organism from the nasopharynx can reach the middle ear more readily in younger children (Li *et al.*, 2001). The socio-cultural aspect involves the behavioural nature of the children which includes playing with or inserting contaminated objects into the ears, swimming in dirty, contaminated and stagnant rivers. The high incidence of otitis media in developing countries had earlier been attributed to the high level of poverty among the populace resulting in the inability to manage the infection at the early stages. Overcrowding seen in the hospital is said to be another contributing factor because is easily contacted by the immunocompromised patients that regularly attend hospitals or by patients hospitalised and are frequently in contact with contaminated hospital instruments or fabrics. All these conditions are readily available in the hospital environment of the present study.

The higher prevalence of CPS in males than females observed in the present study contrast with the earlier report of Oyeleke (2009) in a similar study carried out in Minna, Nigeria. Of the five organisms identified in 26 isolates, namely, *Pseudomonas sp.*, *Klebsiella sp.*, *Proteus sp.*, *Escherichia coli* and *S. aureus*, only one was *S. aureus* and was from a female out-patient. However, the result of the present study corroborated similar study carried out at the University of Benin Teaching Hospital, Edo State, Nigeria and Ibadan, Oyo State, Nigeria (Oni *et al.*, 2002).

The result of this study demonstrated that majority of *Staphylococcus* strains isolated from otitis media patient attending the ENT department of General Hospital, Maiduguri, showed a high level of sensitivity to Ciprofloxacin (83.3%), Ofloxacin (76.2%), Norfloxacin (73.8%), and Clindamycin (64.3%). Most of these antibiotics are third generation antibiotics and are rare in circulation. At the same time they are expensive, thus making it unaffordable to the low income earners who may abuse their use, this make it difficult for the organisms to develop resistance to them. The development of moderate susceptibility to Erythromycin and Gentamycin despite the fact that they are not third generation antibiotics is an indication that they are not being abused or commonly prescribed. This study revealed that CPS isolated from this study is resistant to the commonly prescribed antimicrobial agents such as Cephalexin, Cotrimoxazole, Amoxicillin and Ampiclox. It is therefore not advisable to prescribe these agents to patients with otitis media caused by CPS-induced

infection in the studied area without first carrying out antibiotic sensitivity test on the isolate.

Patients with antibiotic resistant CPS pose a unique problem in terms of epidemiology of the disease as well as its treatment. Most of these patients may be asymptomatic carriers and could serve as source of infection to other susceptible population as well as other hospitals (Yang *et al.*, 2008). Based on the present study therefore, there is the need to control the use of antibiotics in the health institution under investigation. To achieve a good prognosis following treatment, antibiotic sensitivity test should be carried out before any of the readily available antibiotics is prescribed.

Conclusion

This study revealed that otitis media caused by MRSA is highly prevalent among the lower age group, (1-15years) and there is prevalence of antibiotic resistant strains which poses a problem in treatment. Since otitis media is a nosocomial infection it is recommended that overcrowding in the health institution should be avoided to reduce the spread of the infection within the hospital. The problems of drug resistance require adequate attention especially in children whose condition did not improve after a full course of antimicrobial therapy. Hence, more stringent diagnostic criteria, judicious use of antibiotic and effective infection control precautionary measures are recommended.

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