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Full Length Research Paper

Nasal colonization of symptomatic pneumonia patients in University of Benin Teaching Hospital, Benin City, Nigeria by multiple antibiotic resistant *Staphylococcus aureus*

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A study of the antibiotic resistance pattern of *Staphylococcus aureus* from the nasal cavities of patients with pneumonia attending the University of Benin Teaching Hospital, Benin City, Nigeria was conducted. The survey revealed *S. aureus* to be the most predominant cause of Staphylococcal pneumonia with an occurrence rate of 38.5%. Other microorganisms encountered included *Staphylococcus epididermis*, *Streptococcus viridans* and *Brahamella catarrhalis*. Patients in age group 1 - 5 years had the highest incidence rate of 60 and 53.8% in males and females, respectively, while patients within ages 11 - 30 years had the least incidence. There was no significant difference between the rate of occurrence of staphylococcal preumonia in males and females at $p > 0.05$. High resistance levels was recorded towards tetracycline (100%), chloramphenicol (95%), erythromycin (85%) and ampicillin (80%) while moderate resistance levels was recorded towards saprfloxacin (60%), ciprofloxacin (45%), gentamycin (40%) and ofloxacin (20%). The observation in the study, calls for need for effective surveillance of antibiotic resistance.

Key words: Antibiotic resistance, *Staphylococcus aureus,* nasal cavities.

INTRODUCTION

Staphylococcus aureus is a gram -positive, non-motile coccus bacterium that causes a variety of human infections in all age groups (Boyce, 1981). When present in the host, *S. aureus* may induce clinically manifested diseases, or the host may remain completely asymptomatic. It can be present in a host and cause apparent lesions; this condition is known as colonization (Lowy, 1998). *S. aureus* constitutes part of the transient skin flora of up to one-third of the general population, the principal reservoir sites being the nasal vestibule (35%) and the perineal region (20%), as well as the unbilical, auxiliary and interdigital regions (5 - 10%), from where dissemination may occur, provoking disease and permitting transmission to other individuals (Foster, 2004).

S. aureus is an opportunistic pathogen in the sense that it causes infection most commonly in tissues and sites with lowered host resistance such as in individuals with diabetes, old malnourished persons and Transmission may be carried out by direct contact (Boyce, 1996). In hospitals, health workers (Elliot et al., 2002) caring for infected patients or handling objects that have been colonized may contaminate their hands and transmit the organism to other patients (Boyce, 1996; Tammelin et al., 2003). Asymptomatic carriers play an important role in the maintenance and spread of the organism, especially, when the carrier has professional activities related to public health (Geo et al., 2004) . *S. aureus* is encountered more frequently in institutional and hospital settings as the major cause of pneumonia (Carb et al., 1978). Staphylococcal pneumonia can occur if staphylococcal infection spreads to the lungs (Klodkowska-Farner et al., 1995). In adults greater than 65 years of age, pneumonia is the fourth most common reason for hospitalization accounting for more than 450,000 admissions per year (CDC Surveillance Summaries, 1998).

Pneumonia is an inflammatory illness of the lungs (Nester et al., 2004). The causes of pneumonia include;

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exposure to a causative agent, exposure to pulmonary irritants or direct pulmonary injury (Nester et al., 2004). The specific type of pneumonia experienced by a patient depends on variables such as the specific etiologic agent, the host reaction, the extent of involvement and the predisposing conditions (Kumar et al., 2005). Common clinical symptoms include high fever that may be accompanied with sweating, chills and uncontrollable shaking. Patients also present with cough produces greenish or yellowish sputum and a sharp or stabbing chest pain (Kumas et al., 2005). Pneumonia can be diagnosed by physical examination, chest radiography and laboratory tests (Geo et al., 2004). Treatment is based on physical examination findings, chest radiography results, and laboratory culture and sensitivity results and patients characteristics such as age, chronic illness, history of smoking and history of illness (Fine et al., 1997).

Attempts to control this disease through the use of antimicrobial agents particularly antibiotics have resulted in increased prevalence of resistance to these agents (Levy, 1998). Several investigations have been conducted to study the antimicrobial resistance pattern of *S. aureus* and it has been shown that the organism is resistant to -lactam antibiotics, amino glycosides and macrolides (Akinson and Lorian, 1984; Maple et al., 1989). *S. aureus* strains carry a wide variety of multi-drug resistant *genes* on plasmids, which can be exchanged and spread among different species of Staphylococci (Neihart et al., 1988).

The multi-resistance determinants can be transferred to new bacterial hosts. The situation made was more difficult in developing countries such as Nigeria where antimicrobial drugs are readily available to consumers across the counter with or without prescription from a medical practitioner. Such a practice has led to misuse of antimicrobial drugs with the associated high prevalence of drug resistance among the Staphylococci (Nnochiri, 1973; Adekeye, 1979; Paul et al., 1982). Hospital strains of *S. aureus* are usually resistant to a variety of different antibiotics. Few strains are resistant to all clinically useful antibiotics except vancomycin. Some workers however have reported the presence of vancomycin resistant strains (Aubry-Damon et al., 1998; Paul et al., 1982).

In this study, we evaluated the prevalence of *S. aureus,* its susceptibility pattern and some risk factors associated with its nasal colonization in patients with pneumonia at the University of Benin Teaching Hospital (UBTH), Benin City, Edo State, Nigeria.

MATERIALS AND METHODS

Antibiotic discs used and their concentrations were as follows: ampicillin (5 µg), amoxillin (25 µg), ciprofloxacin (5 µg), sparfloxacin (5 µg), chloramphenicol (10 µg), ofloxacin (5 µg), rifampicin (10 µg), tetracycline (10 µg), gentamycin (10 µg) and erythromycin (5 µg). The agar used was chocolate agar, blood agar and MacConkey agar.

Sample collection

Nasal swabs were collected from each patient diagnosed of pneumonia at the out patients department of the University of Benin Teaching Hospital, Benin City, Nigeria, using sterile swab sticks (EVEPON). All specimens were transported to the laboratory and cultured within 3 - 4 h of collection. A total of 52 samples (26 males and 26 females) were collected over a period of three months.

Isolation and characterization of bacteria

The swab specimens were inoculated onto chocolate agar, blood agar and MacConkey agar and streaked with sterile wire loop so as to obtain discrete colonies. The plates were incubated at 37˚C for 24 h under aerobic conditions. Isolates were identified according to the method of Cowan and Steel (1974). After 24 h incubation, the appearance, size, colour and morphology of colonies were recorded. Gram stain reaction, catalase test and coagulase test were carried out. Isolates that were gram-positive cocci, catalase positive and coagulated human plasma were considered *S. aureus* in this study.

Susceptibility of isolates to various antibiotics

Antibiotic discs used and their concentrations were as follows: ampicillin (5 ug), amoxillin (25 ug), ciprofloxacin (5 ug), sparfloxacin (5 ug), chloramphenicol (10 ug), ofloxacin (5 ug), rifampicin (10 ug), tetracycline (10 ug), gentamycin (10 ug) and erythromycin (5 ug).

Antibiotic susceptibility of isolates was carried out by the paper disc diffusion technique of Chigbu and Ezeronye, 2003. A 0.2 ml of 12 h peptone water culture of the test organism was used to inoculate sterile nutrient agar plates. This was spread over the entire surface of the agar using a sterile glass spreader and allowed to dry for about 15 - 30 min. The antibiotic disc (II in number) was placed far from each other to avoid their zones of inhibition from coalescing into the other. The plates were incubated at 37˚C for 24 h and zones of inhibition produced by the antibiotics were recorded.

RESULTS

Of 52 persons screened, 38.5% were positive for *S. aureus* (Table 1), which had highest incident rate. This was followed by *Staphylococcus epididermis* (7.7%), *Streptococcus viridans* (7.7%) and *Brahamela catarrhalis* (5.8%). Table 2 shows occurrence of staphylococcal pneumonia according to age and sex. Patients in age group 1 - 5 years had the highest incidence rate of 60 and 53.8% in males and females, respectively, while patients within ages 11 - 30 years had the least incidence. There was no significant difference between the occurrence of staphylococcus pneumonia in males and females at $p > 0.05$.

In their antibiotic susceptibility pattern (Table 3), high resistance levels were demonstrated towards tetracycline (100%), chloramphenicol (95%), erythromycin (85%) and ampicillin (80%). Moderate resistance was demonstrated towards amoxicillin (75%), sparfloxacin (60%), ciprofloxacin (45%), gentamycin (40%) and ofloxacin (20%).

Table 1. Microbial isolates from nasal cavity in patients with pneumonia.

Organism	No. positive	% positive
Staphylococcus aureus	20	38.5
Brahamella catarrhalis	3	5.8
Streptococcus viridans	4	7.7
Staphylococcus epidermis	4	7.7
Total	31	59.6

No. of nasal swabs = 52.

Table 2. Age and sex classification of patients with staphylococcal pneumonia.

Gender	Male			Female		
Age	No. exam	No. pos.	% pos.	No. exam	No. pos.	% Pos.
1– 5	10	6	60	13	7	53.8
6 – 10	8	3	37.5	7	2	28.6
11– 15	2	0	0	0	0	0
16– 20	1	0	0	0	0	0
21– 25	1	0	0	0	0	0
26– 30	0	0	0	0	0	0
731	4	1	25	6	1	16.7
Total	24	10	38.5	26	10	38.5

No. exam = number examined, No. pos. = number positive and % pos. = percentage positive.

Table 3. Antibiotic resistance of *S. aureus* from nasal cavity.

Antibiotic	Total no. of isolates tested	Number resistant	% resistant
Ampicillin	20	16	80
Tetracycline	20	20	100
Gentamicin	20	8	40
Erythromycin	20	17	85
Amoxicillin	20	15	75
Ciprofloxacin	20	9	45
Sparfloxacin	20	12	60
Chloramphenicol	20	19	95
Ofloxacin	20	4	20

No of *staphylococcus aureus* isolates = 20

DISCUSSION

The nasal carriage rate of 38.5% reported for *S. aureus* in this study corresponds with the findings of Chigbu and Ezeronye who reported a nasal carriage rate of 37.5% for the same organism, among his patients. Other pathogens observed in this study in addition to *S. aureus* included *S. epididermis* (7.7%), *S. viridans* (7.7%), and *B. catarrhalis* (5.8%). This observation is in accordance with the report of Uemurra et al. (2004) that the nasal vestibule is the primary ecological niche for these pathogens. The observation that *S. aureus* is the major cause of pneumonia among pneumonia patients in UBTH is in accordance with the reports of other workers (Carb et al., 1978; Akerele and Ahonkhai, 2000; Ahmed and Kudi, 2003; Akortha and Ibadin, 2008). Carb et al. (1978) reported that *S. aureus* is the most frequent cause of pneumonia in institutional and hospital settings while Ahmed and Kudi (2003) reported an incidence rate as high as 37.7% among other organisms in cases of otitis media in Gombe. The ubiquitous nature of *S. aureus* in causing nosomial infectious in hospitals is probably due to its high content of multidrug resistance plasmids and transposons (Akortha, 2007) . Also, its high content of virulence plasmids makes it very virulent and able to overcome most host defenses (Akortha and Ibadin, 2008).

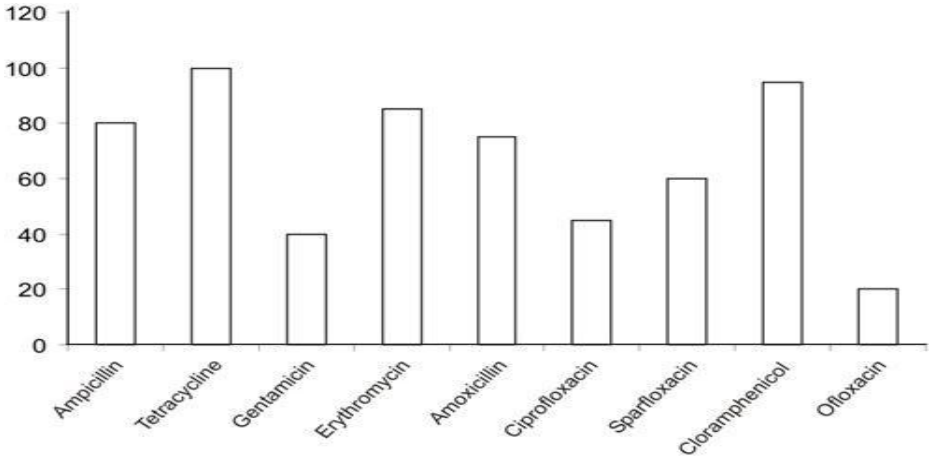

Figure 1. Mean resistance (%) of *S. aureus* isolates to various antibiotics.

We found that, all the *S. aureus* isolated from this study showed least resistance to ofloxacin, ciprofloxacin, sparfloxacin and gentamycin. This agrees with the report of Umolu et al., 2002. The quinolones (ofloxacin, ciprofloxacin and sparfloxacin) are new generation antibiotics. They are relatively expensive and less available to patients for abuse (Chigbu and Ezeronye, 2003). The susceptibility of gentamycin to *S. aureus* had been documented (Uwaezuoke and Aritiatu, 2004; Ehinmidu, 2003; Ubar and Auma, 2002). This observed relatively higher level of susceptibility in gentamycin may be due to its route of administration which is intravenous, thereby, making abuse difficult. Also, gentamycin is relatively expensive in our society where poverty still abounds.

The data obtained in this study indicated that, the bacterial isolates were resistant to tetracycline, ampicillin, amoxycilin, erythromycin and chloramphenicol. This observation is in accordance with that of other workers (Ehinmidu, 2003; Obiazu et al., 2007). This observation may be attributed in part to earlier exposure of these isolates to these drugs which may have enhanced resistance development (Krumpermann, 1983). This assertion can further be strengthened by the high level of antibiotics abuse in our locality, arising from self medication which is often associated with inadequate dosage and failure to comply with treatment (Odegbemi, 1981) and availability of antibiotics to consumers across the counters with or without prescription (Adekeye, 1979; Paul et al., 1982). No significant difference was observed between the carrier rate in male and female at $p > 0.05$ indicating that sex is not a notable factor in carriage. There is no activity or behaviour of any of the sexes which predisposes them to *S. aureus* infection. The level of multi- antibiotics resistance shown by *S. aureus* in this study is quite high. All isolates were resistant to two or more drugs. This trend had also been documented by other workers in different parts of Nigeria (Eke and Rotimi, 1987; Kesah et al., 1997; Ejah et al., 1991. The formulation and implementation of a national policy by government are fundamental to ensure rational drug use. Proper use of drugs has to be promoted by providing objective information and training.

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