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Research Article

Distribution and Antibiotics Susceptibility Pattern of *Staphylococcus aureus* Isolates from Health Care Workers in Owerri, Nigeria.

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Abstract

The importance of *Staphylococcus aureus* as a persistent nosocomial and community-acquired pathogen has become of global health concern. It has a remarkable capacity of evolving different mechanisms of resistant to most antimicrobial agents. This study was aimed at determining the carrier rate of *S. aureus* among apparently healthy hospital staff members in five major hospitals in Owerri, Imo State Nigeria. A total of 156 nasal swab specimens collected from the health care workers (HCW) (78 males and 78 females) were cultured on manitol salt agar. *S. aureus* was identified by using standard microbiological techniques. Antibiotics susceptibility testing was carried out by Kirby-Bauer dick diffusion method. The overall carrier rate of *S. aureus* among the HCW was 47.4%. The antibiotic susceptibility test result shows that erythromycin was most active drug while highest resistance was observed in oxacilin. Statistical analysis showed that average number of resistance phenotypes per isolate was not significantly different in any of the sampled hospitals ($P<0.05$). The high carrier rate of *S. aureus* and antibiotics resistant observed in this study emphasizes the need for continues surveillance of the antibiotic susceptibility of *S. aureus* aimed at recommending appropriate and effective therapy in the treatment of staphylococcal infections

Keywords: *Staphylococcus aureus,* Antibiotic Resistance, Health Care Workers.

Introduction

Staphylococcus aureus is a major pathogen in skin and soft tissue infections, it has long been recognized as an important pathogen in human disease. Staphylococcal infections occur frequently in hospitalized patients and they have severe consequences, despite giving antibiotic therapy. One of the important sources of staphylococci for nosocomial infection is nasal carriage among hospital personnel. *S. aureus* permanently colonizes the anterior nares of about 20–30% of the general population. Almost 25% of health care workers (HCWs) are stable anterior nasal carriers of *S. aureus*. Hospital workers are more likely to be colonized than persons in the general population, presumably because of increased exposure (Shittu and Johnson 2006). In hospitals where hygiene conditions are not provided, nasal MRSA/methicillin-sensitive *S. aureus* (MSSA) colonization is seen in the hospital personnel and patients. With regard to MRSA/MSSA carriers, both the individual carriers themselves and the other people around them are at risk, and this bacterium leads to nasal colonization and can then propagate through contaminated hands and hospital materials (Kirecci and Miraloglu, 2010) The progressive emergence and rapid dissemination of antibiotic-resistant *S. aureus* and its association with the use and consumption of antibiotics constitute a major health concern and

have been considered a global crisis. (Shagufta and Jayaraji, 2010). MRSA has been a major cause of nosocomial infections since the early 1960s. *S. aureus* constitutes a major public health Identification of patients and healthcare workers (in outbreak settings) colonized with *S. aureus*, combined with hand hygiene and other precautions have been shown to be effective in reducing the transmission and controlling the spread of staphylococcal infections. In the current study we conducted a cross sectional study to determine the nasal carriage rate of *S. aureus* among apparently healthy hospital staff members in five major hospitals in Owerri, Imo State Nigeria.

Materials and Methods

Specimen Collection, Cultivation and Identification of *S. aureus.*

The study population included health care workers from five major hospitals in Owerri southeast, Nigeria who voluntarily accepted to enroll in the study. The sampling procedures were in accordance with guidelines of the National Health Research Ethics Committee, Nigeria (www.nhrec.net) and all subjects provided their oral informed consent before participating in the study; confidentiality was preserved.

Sterile cotton swabs were used for specimen collection. The specimens were obtained by rotating the swab gently, five times, in both nares of the study participants, so that the tip was entirely at the level of the nasal ostium (about 2.5 cm from the edge of the nare).

After collection of the swab specimens, it was inoculated onto manitol salt agar (Oxoid, England) within 1 h of sampling and was incubated at 37 °C overnight . The plate was then left at room temperature and colonies were selected for the coagulase test using the slide method. Those colonies that were manitol fermenters (golden or cream coloured) and coagulase-positive were taken to be *S. aureus*, while those colonies that were white (mannitol non-fermenters) and coagulase-negative were considered to be other staphylococci (Cheesbrough, 2006).

threat and MRSA is currently the most commonly identified antibiotic-resistant pathogen in many parts of the world.

Antimicrobial Susceptibility Testing

Laboratory antimicrobial susceptibility testing was performed using modified Kirby– Bauer disk diffusion method, which is recommended by the Clinical and Laboratory Standards Institute (CLSI, 2008). Colonies confirmed to be *S. aureus* were suspended in tryptone broth until matching with a standard turbidity (0.5 McFarland). The suspension was used to inoculate Mueller–Hinton agar (Oxoid, England). Antibiotic susceptibility testing for erythromycin (15 µg), oxacillin (1 µg), chloramphenicol (30 µg), tetracycline (30 µg), and gentamicin (10 µg) (Oxoid, England) was performed by Kirby–Bauer disk diffusion method. In this study *Staphylococcus aureus* ATCC 25923 was used as control (Cheesbrough, 2006).

Statistical analysis

Comparative resistant rates for *S. aureus* strains from the different hospitals were statistically analyzed by T-test and results were considered significant at 95% confidence level.

Results

A total of 156 nasal swab specimens of health care workers from five major hospitals in Owerri were collected and screened during the course of the study. From these, a total of 74 yielded *Staphylococcus aureus* in the culture, showing a general prevalence rate of 47.4% (Table 1). The prevalence of the *S. aureus* nasal carriage was slightly higher among the male HCWs (48.7%) than among the female HCWs (46.2%). The difference in the nasal carriage of *S. aureus* among the various hospital HCWs was not statistically significant. The identities of these Staphylococcal isolates were confirmed by standard biochemical methods. The antibiotic susceptibility test result shows that erythromycin was most active drug while highest resistance was observed in oxacilin. Statistical analysis showed that average number of resistance phenotypes per isolate was not significantly different in any of the sampled hospitals $P<0.05$ (Table 2).

Table 1. The Distribution of *S. aureus* Among the Health Care Workers of the Various Hospitals In Owerri

Sample source	M A L E S		F E M A L E S	
	No. Sampled	No. Positive %	No. Sampled	No. Positive %
Federal Medical Center, Owerri	17	10 (58.8)	13	09(69.2)
General Hospital, Owerri	15	06(40.0)	15	04(26.7)
Ezem Medical Center, Owerri	13	06(46.2)	17	09(52.9)
St. Joseph's Hospital, Owerri	16	08(50.0)	20	07(40.0)
St. Dominic Hospital, Owerri	17	08(47.1)	13	07(53.8)
Total	78	36(48.7)	78	36(46.2)

Table 2. The Antibiotics Susceptibility Pattern of *S. aureus* Isolated from Various Hospitals.

Sample Source	A C		N T		I B G		I O		T E		I O		C S	
	%S	%R	%S	%R	%S	%R	%S	%R	%S	%R	%S	%R	%S	%R
St. Dominic Hospital, Owerri	50	50	30	70	70	30	50	50	20	80				
St. Joseph's Hospital, Owerri	20	80	20	80	30	70	40	60	10	90				
Ezem Medical Center, Owerri	04	96	11	89	26	74	100	00	00	100				
General Hospital, Owerri	70	30	50	50	40	60	40	60	20	80				
Federal Medical Center, Owerri	10	90	25	75	90	10	90	10	00	100				

Key: T=Tetracycline, C=Chloramphenicol, E=Erythromycin, O=Oxacilin, G=Gentamycin

Discussion

In this study, we found that 47.4% of the HCWs carried *S. aureus* in their anterior nares. It is worthy mentioning that all the HCWs who had a history of antibiotic usage during the period of our study were positive for staphylococcal nasal carriage. This put both the patients and the workers at risk. They might act as potential sources for the nosocomial spread of infection, especially to those with open wounds who are admitted to a surgical unit. The nasal carriage rate of *S. aureus* found in the present study is higher than those found in studies conducted in Gaborone Hospital, Botswana (35.8%) Truong *et al.*, 2011, Valdivia Hospital, Chile (34.9%) Yazgi *et al.*, 2003, a study in Ethiopia (28.8%) Shibabaw *et al.*, 2014, in Chile (27.5%), Tejero *et al* 1991, a study in Nepal (25%), Shakya *et al.*, 2010 and a study in Nairobi Hospital, Kenya (18.3%) Omuse *et al.*, 2012. All of the differences between the different countries and hospitals may be explained by microbiological methods (from sampling technique to culture media) and local infection control standards.

Increased resistance to chloramphenicol, oxacilin and tetracycline observed in this study might be due to increased contact between the HCWs and patients and due to the replacement of sensitive strains by more virulent or resistant strains in hospital settings. The higher resistance of the isolates against these commonly used antibiotics might be due to the mutation or gene transfer of the strain, misuse and/or overuse of antibiotics, and a lack of standardized antimicrobial susceptibility testing before the prescription of drugs and increasing treatment costs. Antibiotic use provides selective pressure favoring resistant bacterial strains. Inappropriate use increases the risk of the selection and dissemination of antibiotic-resistant bacteria, which are placed at competitive advantage.

In conclusion, the single most important factor for preventing nosocomial infections is compliance of the health professionals with the sanitary and the antibacterial guidelines. To achieve this, the health professionals should be informed about the potential consequences of the nosocomial infections, both inside and outside the hospital,

and their cooperation should be sought to diminish the carriage of *Staphylococcus aureus*. Simple preventive measures like hand washing before and after the patient examination, the use of sterile aprons and masks in the postoperative wards, awareness during the examination of immunocompromised patients, and avoiding touching one's nose during work, can reduce the disease transmission rate considerably. All the HCWs should be periodically educated and trained about the maintenance of hygiene and infection control and the effects of the use or rather, the misuse of antibiotics. Finally, there is a need for the development, adoption, and enforcement of appropriate control polices in the hospital wards/departments where there is no existing or effective infectious disease control.

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