



Prevalence of Nasal *Staphylococcus aureus* Colonization amongst Medical Students of Igbinedion University Okada

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Authors' contributions

This work was carried out in collaboration between all authors. Author POS designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors BHO and MO managed the analyses of the study. Authors HOO and KOO managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Background: Epidemiological data of Methicillin-resistant *S. aureus* (MRSA) prevalence among students is relatively few. This study was carried out to determine the prevalence of *S. Aureus* and MRSA nasal colonization among healthy students.

Method: One hundred and twenty nasal samples were collected from healthy students without symptoms of nasal infections and analysed by standard microbiological techniques. A study questionnaire was administered comprising the demographic information of each student.

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Results: Of the 120 nasal specimens, *S. aureus* was isolated in 80 (66.6%) with high colonization rate among Medical Laboratory Science students and 39 (48.8%) identified as MRSA with colonization rate found to be higher among medical laboratory science students (Medical Laboratory Science vs Pharmacy: 76.9% VS. 23.1%) and females found to have a higher prevalence of MRSA than males (female vs male: 64.1% vs. 35.9%) and Students within the age group of 18-20 years had the highest prevalence of MRSA of 76.9%. *S. aureus* in this study was observed to be most susceptible to amoxicillin (81.5%) and least susceptible to Ceftazidime (6.2%).
Conclusion: The study revealed high MRSA colonization among students. Personal hygiene and prudent use of antibiotics should be encouraged. Further studies are recommended to evaluate the findings.

Keywords: Nasal carriage; S. aureus, MRSA; antibiotic resistant strain.

1. INTRODUCTION

S. aureus is part of the normal flora of human skin and nasal passages. Unfortunately, it is an opportunistic organism that may cause infection under favorable circumstances and easily spread through direct contact. The anterior nares is the primary niche of *S. aureus* and it is reported that about 20% of the human population is persistently colonized with *S. aureus* in the anterior nares [1]. *S. aureus* is a major causative agent of superficial and systemic infections [2]. Methicillin-resistant *S. aureus* (MRSA) is a term given to *S. aureus* strains of medical importance uniquely characterized with high virulent factor and methicillin-resistant mechanism. MRSA is any strain of *S. aureus* that has developed, through horizontal gene transfer and natural selection, multiple drug resistance to beta-lactam antibiotics. β -lactam antibiotics are a broad spectrum group which includes some penams – penicillin derivatives such as methicillin and oxacillin, and cepheims such as the cephalosporins [3]. Strains unable to resist these antibiotics are classified as methicillin-susceptible *S. aureus*, or MSSA.

MRSA is a leading cause of nosocomial infections worldwide and has also emerged as a community-associated pathogen [4] responsible for several difficult-to-treat infections in humans.

Certain demographic variables that may influence MRSA colonization may include: sex, occupation, age group, ethnicity, nasal abnormalities, as well as risk factors such as genetic makeup, immunological status, repeated needle injections, hormonal status in women, recent hospitalization, insulin dependent and non-insulin dependent diabetes mellitus, hemodialysis, HIV status, *S. aureus* skin infections, nose picking and multiple antibiotics administration has been linked with nasal

carriage of *S. aureus* [5]. This study gives baseline of information on MRSA nasal colonization of students and these findings could aid in further studies.

The objective of this study was to determine the prevalence of nasal *S. aureus* colonization among University Students, as well as risk factors and antimicrobial susceptibility pattern of the *S.aureus* isolates to selected antimicrobial agents.

2. METHODOLOGY

2.1 Study Site

The cross-sectional study was conducted from July to September 2017 at the medical laboratory science department of the Igbinedion University Okada, Edo state, Nigeria. The Study was conducted with approval of the ethical committee alongside self-administered questionnaire and consent form which was given to each student to get their demographic information. One hundred and twenty nasal samples were obtained from anterior nares of healthy male and female undergraduate students who showed no symptoms of any infection.

2.2 Sample Collection

Sterile swab sticks were inserted carefully into the anterior nares of the nose and rolled severally, removed and analysis carried out on them.

2.3 Sample Analysis

The nasal samples were inoculated directly onto mannitol salt agar plates and incubated for 48 hours at 37°C. Yellowish colonies on mannitol salt agar were identified as *S. aureus* strain

based on colonial morphology, Gram reaction and biochemical tests including catalase, coagulase and voges proskaeur. Antimicrobial susceptibility test for *S. aureus* was performed on Mueller-Hinton agar (oxiod) and plates were incubated at 35°C for 24 hours. The antimicrobial susceptibility testing for *S. aureus* was performed using the disc diffusion method as recommended by the Clinical Laboratory Standards Institute Guidelines (CLSI 2011) to the following antibiotics: Ceftazidime, cloxacillin, gentamicin, ceftriaxone, erythromycin, cefuroxime, ofloxacin, amoxicillin and oxacillin (Abtek Biologicals Ltd).

2.4 Data Analysis

Data obtained were analyzed using Chi-square and Fischer exact test and odd ratio analysis as appropriate, using the statistical software INSTAT. Statistical significance was set at ($P<.005$).

3. Results

Of the 120 nasal specimens, 80(66.6%) isolates were *S. aureus* and 39(48.8%) of which were MRSA. Medical Laboratory Science students were found to have a higher nasal colonization rate of *S. aureus* than Pharmacy students. In this study MRSA prevalence was observed to be higher among medical laboratory science students (Medical Laboratory Science vs Pharmacy: 76.9% VS. 23.1%). Females were found to have a higher prevalence of MRSA than males (female vs male: 64.1% vs. 35.9%: OR =2.721). Gender was not identified as a risk factor for nasal colonization of MRSA in this study. Students within the age group of 18-20 years had the highest prevalence of Oxacillin (methicilin) resistance of 76.9%. Indeed the prevalence of MRSA in this study was observed to decrease with increase in age of student. Generally however, age did not significantly affect the prevalence of MRSA in this study ($P=0.1337$). The antimicrobial susceptibility/resistance pattern of the 80 *S. aureus* isolates showed that the susceptibility rate was highest for amoxicillin (81.5%) and lowest for Ceftazidime (6.2%).

4. DISCUSSION AND CONCLUSION

The overall prevalence of nasal *S. aureus* colonization in this study is 66.6%. This is higher than previous reports of 32.9% [6]; 14.0%; 56.3% [7] and 56.7% [8]. It is however lower than 80% [9].

Table 1. Demographic variables versus MRSA frequency

| Subjects (n=39) | Frequency (%) |
|----------------------------|---------------|
| Department | |
| Medical Laboratory Science | 30(76.9%) |
| Pharmacy | 9(23.1%) |
| AGE | |
| 18-20 | 30(76.9%) |
| 21-23 | 6(15.4%) |
| 24-26 | 3(7.7%) |
| Gender | |
| Males | 14(35.9%) |
| Females | 25(64.1%) |

Table 2. Antibiotic susceptibility profile of *S. aureus* isolates

| Antibiotics | Susceptibility frequency |
|--------------|--------------------------|
| Ceptazidime | 5(6.2%) |
| Ceftriaxone | 42(52.2%) |
| Gentamicin | 54(62.5%) |
| Cefuroxime | 30(32.5%) |
| Erythromycin | 33(41.3%) |
| Cloxacillin | 41(51.3%) |
| Ofloxacin | 38(47.5%) |
| Amoxicillin | 65(81.5%) |
| Oxacillin | 41(51.2%) |

These variations may be due to differences in level of hygiene between study participants in these studies. It could also be a function of geographical location, infection control policies (or lack of) and possible exposure levels.

The prevalence of MRSA in this study was 48.8%. This is higher than 46.7% [10]; 16% but lower than 100.0%. MRSA is responsible for the largest outbreak of hospital-acquired infection that the world has ever seen [11]. Although found to be higher among Medical Laboratory Science students, the prevalence of MRSA was not significantly affected by course of study of student. Females were observed to have a higher nasal colonization rate of MRSA (64.1%) than males (35.9%). This finding is in line with reports by Eibach et al. [12] where a significantly higher prevalence of MRSA was observed among females (61.4%). Young students (18-20 years) were observed to have the highest prevalence of MRSA which is the predominant age range of student population found in the university.

In this study, Medical Laboratory Science students had a higher prevalence percentage

ratio of nasal *S. aureus* colonization than students in the College of Pharmacy. This could be as a result of frequent contact with patients and Infectious samples during training by the students of Medical Laboratory Science which is limited in the Department of Pharmacy.

In one study conducted among University students in Obafemi Awolowo University Nigeria [13], students in college of Pharmacy were also observed to have a lower nasal colonization rate than students from all other colleges/faculties.

The antimicrobial susceptibility profile of nasal *S.aureus* isolates showed that they were least susceptible to Cefazidime and most susceptible to amoxicillin (81.5%) in contrast to findings from the study conducted in Owerri, Nigeria [11] which showed that nasal *S. aureus* were most susceptible to gentamicin.

This study has certain limitations. First the number of students included and department was small which could not serve as a good representation of Nasal colonization. Also oxacilin is just a phenotypic characterization of MRSA with limited sensitivity rate.

In conclusion, based on the methods employed in identification MRSA in this study, results showed high prevalence of MRSA. Hence periodic or frequent decolonization of students that were tested positive for MRSA with topical administration of mupirocin is encouraged. Sensitization on the risk of Oxacillin-resistant *Staphylococci* infection should be scaled up among Medical students and general improvement in hygiene of students is recommended as well as nose picking by students should also be avoided or discouraged.

CONSENT AND ETHICAL APPROVAL

The Study was conducted with approval of the ethical committee alongside self-administered questionnaire and consent form which was given to each student to get their demographic information. One hundred and twenty nasal samples were obtained from anterior nares of healthy male and female undergraduate students who showed no symptoms of any infection.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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