Nasal Carriage of Staphylococcus aureus among Students of a TertiaryInstitution in Edo State

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Abstract
Staphylococcus aureus is ubiquitous and may be a part of human flora found in the axillae, the inguinal and perineal areas, and the anterior nares. Healthy carriers are potential source of Staphylococcus aureus infection and spread to other body sites as well as to other individuals. This study was undertaken to evaluate the prevalence of nasal carriage of Staphylococcus aureus among students of College of Medical Sciences, Ambrose Alli University, Ekpoma, Edo State. The study population comprises of students within the age range of 17 - 25 years with a number of 80 males and 80 females. A total of one hundred and sixty (160) nasal swabs from Faculty of Basic Medical Sciences students were used in the study. Nasal swabs were collected in good light vision from subjects bending their heads backward to collect the specimens deep down the anterior passages using a sterile swab stick. Both right and left nostrils were used. Out of the eighty (80) swabs sticks sampled, thirty (30) yielded growth out of which twenty-eight (28) were Staphylococcus aureus and the other two (2) are Streptococcus species. Out of the sampled males, 34 (42.5%) were positive to Staphylococcus aureus and out of the female samples, 22 (27.5%) were positive to Staphylococcus aureus. The percentage prevalence of the male samples from the total number of samples collected in the study was higher (21.25%) than that of the female samples (13.75%) in the study. From the study students within the age range 17 – 19 years had the lowest percentage prevalence 10.0% of Staphylococcus aureus, students within the age range 23 – 25 years had 11.3% while those of age range 20 – 22 years had the highest percentage prevalence of 13.8%. In conclusion, a relatively high prevalence rate of Staphylococcus aureus in nasal carriage was recorded among the investigated students of College of Medical Sciences, Ambrose Alli University, Ekpoma, Edo State. Moreover, 10% of the investigated carriers harboured Staphylococcus aureus in their anterior nares increasing the likelihood of transmission of the pathogen. These findings resurges the imperative need for protective measures by school among their students.

Keywords: Nasal, Staphylococcus aureus, Students, Tertiary, Institution

Introduction

Staphylococcus is a versatile microorganism which is an important hospital and community pathogen (Neely & Maley, 2000). Direct invasion through breaks in the skin or mucus membrane leads into the production of superficial local infections such as folliculitis, furuncles and abscesses. Antibiotic treatment of these infections has become difficult as multidrug resistance is a common feature in Staphylococcus aureus (Francois & Schrenzelg 2008). Staphylococcus aureus is ubiquitous and may be a part of human flora found in the axillae, the inguinal and perineal areas, and the anterior nares. Von Eiff et al, (2001) described 3 patterns of carriage: those who always carry a strain, those who carry the organism intermittently with changing strains, and a minority of people who never carry Staphylococcus aureus (Bayer et al., 1998). Persistent carriage is more common in children than in adults (Iwase et al., 2010).

Nasal carriers may be divided into persistent carriers with high risk of infection and intermittent or non-carriers with low risk of infection (Blot et al., 2002). Persistent nasal carriage depends on host genetic determinants (Liu et al., 2005).

Some enzymes such as penicillinase produced by Staphylococcus aureus is responsible for its resistance to penicillin group of antibiotics (Foley & Perret, 2006). Penicillinase positive Staphylococcus aureus infections are currently being treated using penicillinase resistant drugs such as methicillin, oxacillin and nafcillin. Staphylococcus aureus has been shown to develop resistance to these antibiotics as well (Shafiei et al., 2011).

Staphylococcus is present in the nose of 30% of healthy people and may be found on the skin. It causes infection most commonly at sites of lowered host resistance, such as damaged skin or mucous membrane (Humphrey, 2007). Although 50 – 60% of patients with MRSA are merely colonised (i.e. they carry the bacteria but do not have symptoms or an illness), serious infections such as those involving the blood stream, respiratory tract and bones or joints do occur (Humphrey, 2007). S. aureus causes boils, pustules, styes, impetigo, infections of wounds (cross-infections), ulcers and burns, osteomyelitis, mastitis, septicaemia, meningitis, pneumonia and pleural empyema. Also, toxic food poisoning (rapid onset, no fever), toxic shock syndrome and toxic skin exfoliation (Chessbrough, 2000).

Healthy carriers are potential source of Staphylococcus aureus infection and spread to other body sites as well as to other individuals. Staphylococcus aureus have been found frequently as aetiologic agent of a variety of human infections. Centre for disease control (CDC) reported Staphylococcus aureus as primary source of infections, which could be transferred from individual to another. The organism also elaborates toxins that can cause specific diseases or syndromes and likely participate in the pathogenesis of staphylococcal infection. Enterotoxin-producing strains of S aureus cause one of the most common food-borne illnesses (food poisoning). The most common presentation is acute onset of vomiting and watery diarrhea 2-6 hours after ingestion. The symptoms are usually self-limited. The cause is the proliferation of toxin-producing organisms in uncooked or partially cooked food that an individual carrying the staphylococci has contaminated (Matthews et al., 1997).

Staphylococcus aureus has been found frequently as an aetiological agent of a variety of human infections. Methicillin/resistance and penicillinase producing strain are potential source of nosocomial infections in patients and healthcare workers. Centre for disease control (CDC) reported MRSA as primary source of nosocomial infections, which could be transferred from patients to patients, patients to health workers, health workers to health workers and health workers to patients. Failure of antibiotics activities in treatment of Staphylococcus aureus infections is increased due to resistance, a defining characteristic of penicillinase producing Staphylococcus aureus. This study is therefore set to evaluate the prevalence of nasal carriage of Staphylococcus aureus among students of College of Medical Sciences, Ambrose Alli University, Ekpoma, Edo State. Considering various reports on the nasal carriage of Staphylococcus aureus, this study is set to evaluate the prevalence of nasal carriage of Staphylococcus aureus among students of College of Medical Sciences, Ambrose Alli University, Ekpoma, Edo State.

Materials and Methods

Study Area

The area of study is Ekpoma, the Headquarters of Esan West Local Government area of Edo State. It is located at latitude $6^{o}45^{I}$N and longitude $6^{o}.08^{I}$E. It is moderately populated with about 190,000 people. The peoples' occupation being teaching, drivers, bike riders, artisans, farming and trading. The main sources of water in the locality are rainfall and well. The well is augmented by irrigation scheme provided by the Government for public use. Ambrose Alli University, Ekpoma is situated in this region. It is usually cold at night and very hot during the day. It also has undulating topography (World Gazetteer, 2007). Faculty of Basic Medical Sciences is one of the faculties in College of Medical Sciences, Ambrose

Alli University, Ekpoma, Edo State with four Departments which include, Departments of Nursing Science, Human Physiology, Human Anatomy and Medicine and Surgery.

Study Population

The study population comprises of College of Medical Sciences students within the age range of 17 - 25 years with a number of 80 males and 80 females. A total of one hundred and sixty (160) nasal swabs from Faculty of Basic Medical Sciences students were used in the study.

Ethical Approval

This was obtained from the Ambrose Ali University Health Research and Ethic Committee of Ambrose Ali University (A.A.U.), Ekpoma, Edo State, Nigeria. Also, informed consent was sought from the students. The aim and objectives, economic importance and benefits of the study to the subjects and society were well stated also the subjects consent were sought, only those students that gave their consent were enrolled.

Sample Collection/Analysis

One hundred and sixty subjects were enrolled for this study without any sign of illness. Samples were taken by cotton swab from the nasal cavities and properly labelled with subjects' name, sex, age, and serial number were used for sample collection. Nasal swabs were collected in good light vision from subjects bending their heads backward to collect the specimens deep down the anterior passages using a sterile swab stick. Both right and left nostrils were used. The swab sticks were carefully returned to their sterile containers, sealed with adhesive tape and labelled accordingly. Collected specimens were taken to the laboratory where bacteriological analysis was carried out immediately.

The sample analysis was done in the Microbiology Laboratory of the Department of Medical Microbiology, Faculty of Medical Laboratory Science, Ambrose Alli University, Ekpoma, Edo State for bacteriological examination. Swabs were cultured on Manitol salt agar (MSA) and sub cultured on Nutrient agar (for antibiotics sensitivity) and incubated at 37°C. Different biochemical tests were applied; catalase test, coagulase test. Microorganisms were recognized on the basis of macroscopic, microscopic and differential tests.

Method for detection of Staphylococcus aureus

The colonies that were yellow pigmented or cream white (Cheesbrough, 2000) were sub-cultured onto mannitol salt agar and selected for catalase (using H_2O_2) and coagulase tests (using plasma). Mannitol fermenting and slide coagulase positive isolates were identified as Staphylocuccus aureus.

Antibiotic Sensitivity Testing

Antibiotic discs such as Erythromycin, Gentamycin, Streptomycin, Ciprofloxacin, Ampicillin, Septrin, Zinnacef, Amoxycilin and Rocephin (manufactured by Abtek Biologicals Ltd) were used to test the susceptibility of Staphylococci aureus isolates obtained. The test isolates were inoculated into sterile peptone water broth. The antibiotic discs were placed aseptically on the seeded culture plate. They were incubated at 37^0C for 18-24hours and examined for zones of inhibition. The zones of inhibition were measured in millimetres and recorded. Antibiotic zones less than 10mm in diameter were recorded as been resistant (R) by the organism while those with diameters of 10mm and above were recorded as sensitive (S).

Data Analysis

The collected data was expressed as Frequency and percentage. Comparison of qualitative variables was made using chi-square test. In all cases studied, the difference having $p<0.05$ were considered statistically significant using interactive calculation Chi square tool software (version 18).

Results

Based on standard bacteriological analytical methods used in the investigation of one hundred and sixty (160) samples of nasal swab, the following results were arrived at.

Table 1 presents the distribution of Staphylococcus aureus among studied population. Out of the the one hundred and sixty (160) swab sticks sampled, sixty (60) yielded growth out of which fifty-six (56) were Staphylococcus aureus and the other four (4) were Streptococcus species.

Table 2 shows the distribution of Staphylococcus aureus among studied subjects in relation to Sex. Out of the one hundred and sixty (160) nasal swab sticks sampled, eighty (80) Males and Females were sampled each. Out of the sampled males, 34 (42.5%) were positive to Staphylococcus aureus and out of the female samples, 22 (27.5%) were positive to Staphylococcus aureus. The percentage prevalence of the male samples from the total number of samples collected in the study was higher (21.25%) than that of the female samples (13.75%) in the study.

The distribution and percentage prevalence of Staphylococcus species among studied subjects with respect to Age. From the study students within the age range 17 – 19 years had the lowest percentage prevalence 10.0% of Staphylococcus aureus, students within the age range 23 – 25 years had 11.3% while those of age range 20 – 22 years had the highest percentage prevalence of 13.8% (table 3).

Table 1: Distribution of Staphylococcus aureus among studied population

Sample Type	Number Sampled	Number of Growth	Number of Staphylococcus aureus
Nasal Swabs	160	60	56

Table 2: Distribution of Staphylococcus aureus among studied subjects in relation to sex

Sex	Number of Sample	Staphylococcus aureus isolated (%)	Total Percentage Prevalence of Infection
Male	80	34 (42.5)	42.5
Female	80	22 (27.5)	27.5
TOTAL	160	56	35

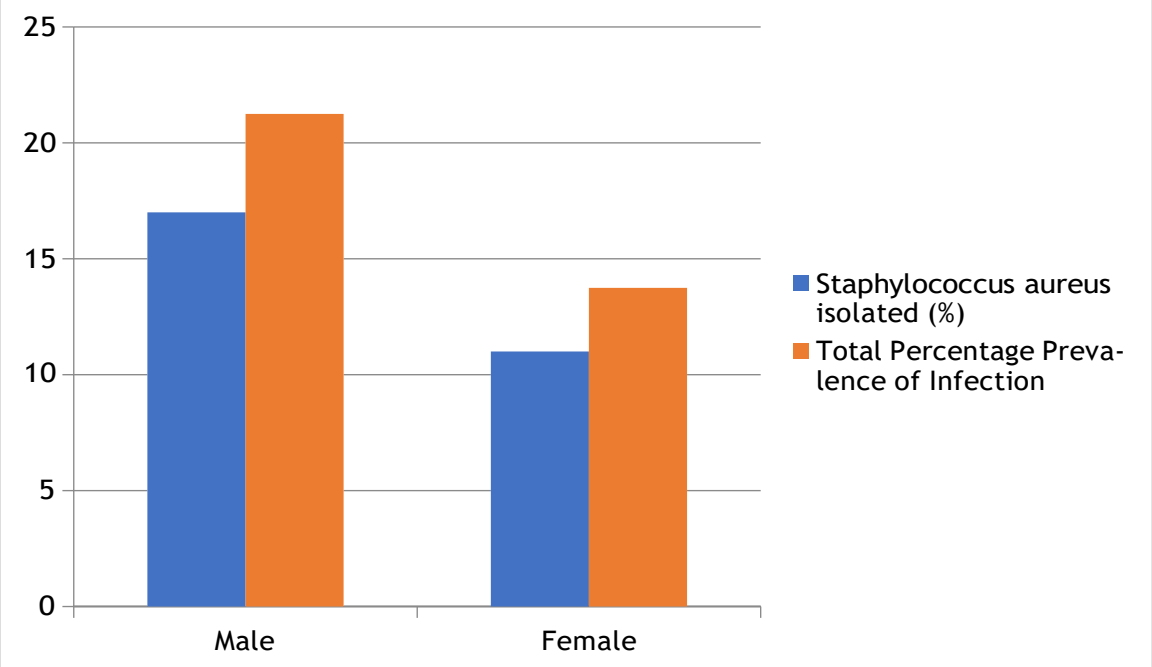

Figure 1: Distribution of Staphylococcus aureus (%) and Total Percentage Prevalence of Infection.

Table 3: Distribution and Percentage Prevalence of Staphylococcus species among Studied Subjects with respect to Age group/range

Age (Years) Group/Range	Number of Samples Collected	Number of Staphylococcus aureus	Total Percentage Prevalence
17 - 19	40	16	40.0
20 – 22	60	22	36.7
23 - 25	60	18	30.0
TOTAL	160	56	35.0

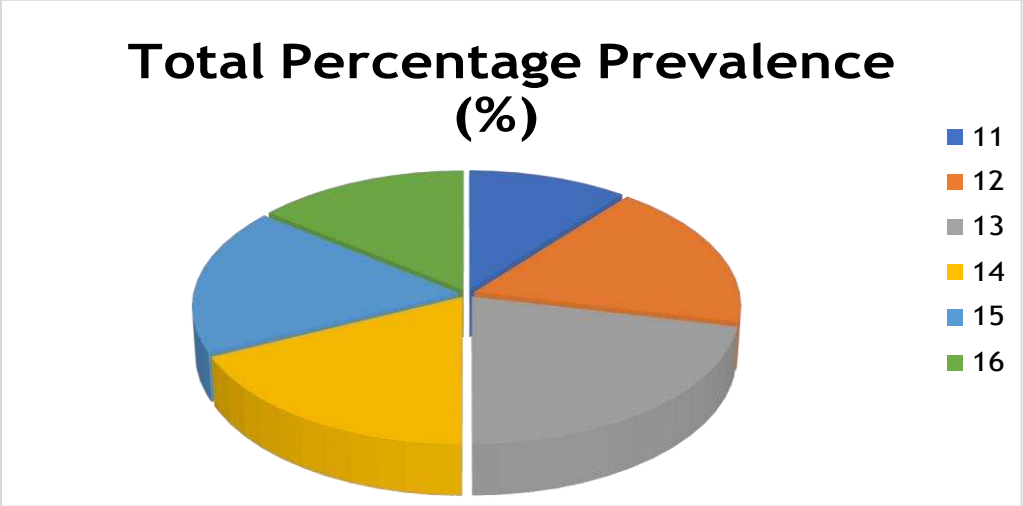

Figure 2: Total Percentage Prevalence (%) of Staphylococcus species among Studied Subjects with respect to Age

Table 4: Antibiotics Susceptibility profile of Staphylococcus aureus Isolated

Antibiotics	Frequency	Percentage Susceptibility
Erythromycin	20/28	71.4
Gentamycin	24/28	85.1
Streptomycin	14/28	50
Ampiclox	22/28	78.5
Rifampicin	24/28	85.1
Ciprofloxacin	22/28	78.5
Amoxil	28/28	100
Levofloxacin	24/28	85.1
Norfloxacin	22/28	78.5
Chloramphenicol	8/28	28.5

Discussion

Staphylococcus species are regional flora of the skin and mucus membrane of the body, certain species have been found frequently as aetiological agents of a variety of human and animal infections. The most common among these infections are the superficial supportive infection caused by Staphylococcus aureus. Infection can lead to life threatening conditions and disease spectrum which includes abscesses, septicemia, osteomyelitis, endocarditis and cellulitis, pneumonia, in addition to various toxin mediated diseases as toxic shock syndrome and staphylococcal food poisoning. The variety of such spectrum of clinical manifestations is mostly dependent on the numerous virulence factors produced by each strain (Vasconcelos and da Cunha, 2010). The ingestion of the preformed toxins produced by Staphylococcus aureus (enterotoxigenic strains) in food often results to the development of food poisoning.

Findings from this investigation indicate a significant ($P< 0.05$) distribution of Staphylococcus aureus of 34 (21.25%) prevalence from male subjects with the highest occurrence when compared to the female subjects 22 (13.75%) which is in agreement with investigation reported by Moustafa et al., (2013) of 10.5% nasal carriage of Staphylococcus aureus in women. The findings from this study in relation to area of study, was not in agreement with findings report by Eke et al., (2015), with a wide variation of 60% prevalence from 100 nasal swab analysis of primary school children in Ekpoma. Previous studies have shown that gender, age, marital status or level of education had no significant effect with respect to the nasal carriage of Staphylococcus aureus (Eke et al., 2015). This study has revealed that nasal nares of secondary school students harbour Staphylococcus aureus 28(35%).

Prevalence and distribution of Staphylococcus aureus in relation to gender showed lesser occurrence in female 22 (13.75%) than in males 34 (21.25%). This was not in agreements with the findings by Eke et al., (2015), which reported male to have higher prevalence than the females in Ekpoma. The disparity of this report may be due to the types of gender of the subjects who consented more to participate as at that time of study.

The sensitivity pattern of Staphylococcus aureus isolated from this study had high susceptibility to Amoxil, Gentamycin, Rifampicin, Levofloxacin, Norfloxacin, Ciprofloxacin, Ampiclox and Erythromycin and intermediate to Streptomycin, and resistant to Chloramphenicol which is in agreement with the study reported by Eke et al., (2015). From this research it has been revealed that nasal nares harbours Staphylococcus aureus which are probable source of the enterotoxigenic stains causing boils, impertigo, pimples etc observed in children these days.

Conclusion

From all the organisms known to cause skin and nasal infections, Staphylococcus aureus is the most prevalent among them that is easily isolated. It colonizes the skin and mucosal surfaces of healthy individuals. Evidence from the results obtained have shown that the nasal nares have high carrying capacity of Staphylococcus aureus. In conclusion, a relatively high prevalence rate of Staphylococcus aureus in nasal carriage was recorded among the investigated students of College of Medical Sciences, Ambrose Alli University, Ekpoma, Edo State. Moreover, 10% of the investigated carriers harboured Staphylococcus aureus in their anterior nares increasing the likelihood of transmission of the pathogen. These findings resurges the imperative need for protective measures by public school among their students.

From this study, multi drug resistant Staphylococcus aureus are on the increase rising in comparing with other studies done. With this increase prevalence rate of multi drug resistant Staphylococcus aureus, within the next two decades there might not be any reliable treatment left for most Staph. aureus infections. It is hereby recommended that combination therapy with good therapeutic effect should be considered for the treatment of Staphylococcus aureus.

Conflict of interest

The authors declare no conflicts of interest. The authors alone are responsible for the content and the writing of the paper.

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