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Research Article

Nasal carriage of Staphylococcus aureus among students of Nursing college / Kirkuk University, Iraq

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Keywords
Nursing students, nasal carriage, *Staphylococcus aureus.*

Abstract

Nasal carriage of *Staphylococcus aureus (S.aureus)* especially methicillin-resistant *S.aureus* (MRSA) among health care personnel poses a risk to the patient. To detect the prevalence of nasal colonization of "*S.aureus*" and its antibacterial susceptibility profile among nursing students attending Faculty of nursing at the Kirkuk University. Between January and February 2012, nasal swabs were collected from anterior nares of 150 students and inoculated on Mannitol salt agar, Tryptone soya broth and tube coagulase test were done for identification. Antibiotic susceptibility test was done on twenty antibiotics by Kirby–Bauer method. S. aureus isolates. The prevalence of nasal colonization of S. aureus was 25,33%, The study reported high average of *"*nasal *S.aureus"* among females than males (68.42%% & 31.57% respectively),the high average of these nasal isolates were demonstrated among 21 to 24years old (57.89%%) and the low average among 17 to 20 years old(42.1%%) and the rate of *"***nasal *S.aureus***"* isolates were higher among (third and fourth stage) students 29.72% than (first and second stages) 23.68% and 18.42% respectively. Antibiotic susceptibility testing revealed shows various resistant ranges towards beta - lactams (Penicillin, Augmentin, Ampicillin, Amoxicillin, Oxacillin (10mg), Cloxacillin, Cephalothin, Cefoxitin, Cefexime, Cefotaxime) were 34 (89.4%), 34 (89.4%) , 32 (84.2%) , 30 (78.9%) , 1 (2.6%) , 27 (71%) , 24 (63.1%) , 9 (23.6%) , 38 (100%) and 38(100%) respectively. While 3 (7.8%), 2 (5.2%) , 5 (13.1%) , 3 (7.8%), 6 (15.7%), 27(71%) and 2 (5.2%) isolates showed resistance towards non beta-lactams (Trimethoprim, Chloramphenicol, Erythromycin, Tetracycline, Rifampicin, Lincomycin and Amikacin respectively. All nasal *Staphylococcus aureus* isolates were sensitive towards Gentamycin Ciprofloxacin and Vancomycin.

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1. Introduction

Staphylococcus aureus can be found as a commensal on the skin and mucosal surfaces of human especially anterior nares, other skin sites, and the perineum.[1-2] Carriage of *S. aureus* is a risk factor for the occurrence of infections in health-care settings [1-2].

This bacterium has high ability to readily spread in communities and in different environments, in addition to their ability to infect healthy or immunocompromised groups of people, leading to increase the death-rates with a serious warning because of significant variations in the antibacterial resistance patterns [3].

The "*S. aureus"* transmission happened by hand contact as a direct way or by contaminated surfaces or fomites as indirect way, chiefly the carrier individuals of this microorganism, whom not appear on them any symptoms (asymptomatic carrier) of infection [4-5].

Colonization with "*S. aureus"* is considered as a risk agent among persons whom work in healthcare centers and hospitals. The nasopharyngeal microbiota is considered as the major site of colonization with this bacterium. The workers in hospitals represent the major way of infection, especially to patients whom are in continuously contact with them. Colonization rates among medical professionals and students are ranged between 20 to 40%, with great average of multi-antibacterial resistant isolates. [4,5,6].

Teaching process of students in medical colleges is represented the clinical practice in hospitals as a part of their teaching and this exposure them to occupational risks because they are provided the patients with different kinds of care. In development stages of undergraduate students in nursing college, they will go deeper into the medical practices in hospitals, so they will have exposed to become as microbial carriers, especially *Staphylococcus aureus* carriers [6,7].

Despite of the epidemiological detecting efforts that done to detect and control the dissemination of "*Staphylococcus aureus* "and "methicillin-resistant *Staphylococcus aureus"* (MRSA),the dissemination among medical students gradually in growing, so many studies aimed to isolation and identification certain microorganisms as a necessary process to determine these necessary points in certain population groups and certain regions [8,9].

This study aimed to detect the antibacterial resistance profile and rate of "Nasal carriage *Staphylococcus aureus*" isolates among students of Nursing college in Kirkuk city \ Iraq.

2. Materials and Methods

Samples were collected from January 2012 to February 2012. One hundred and fifty nursing students with the age range of 18-25 years, of the Faculty of Nursing, University of Kirkuk were participated in the study.

Nasal swabs were collected from both anterior nares using sterile disposable swab with transport medium. The swabs were inoculated to the Mannitol salt agar (MSA) and Tryptone soya broth (TSA) and incubated overnight at 37° C. Subculture was made from TSA to MSA. Mannitol fermented colonies were

subjected to Gram stain and tube coagulase for the identification of S. aureus. Antibiotic susceptibility test was performed on Mueller-Hinton agar by Kirby–Bauer method. Twenty antibiotic discs, Penicillin, Augmentin, Ampicillin, Amoxicillin, Oxacillin (10mg), Cloxacillin, Cephalothin, Cefoxitin, Cefexime, Cefotaxime, Trimethoprim, Chloramphenicol, Erythromycin, Tetracycline, Rifampicin, Lincomycin, Amikacin, Gentamycin, Ciprofloxacin and Vancomycin.

The antibiotic susceptibility pattern was interpreted according to Clinical and Laboratory Standards Institute guideline. [10] *S. aureus* American Type Culture Collection (ATCC® 43300) was used as a positive control.

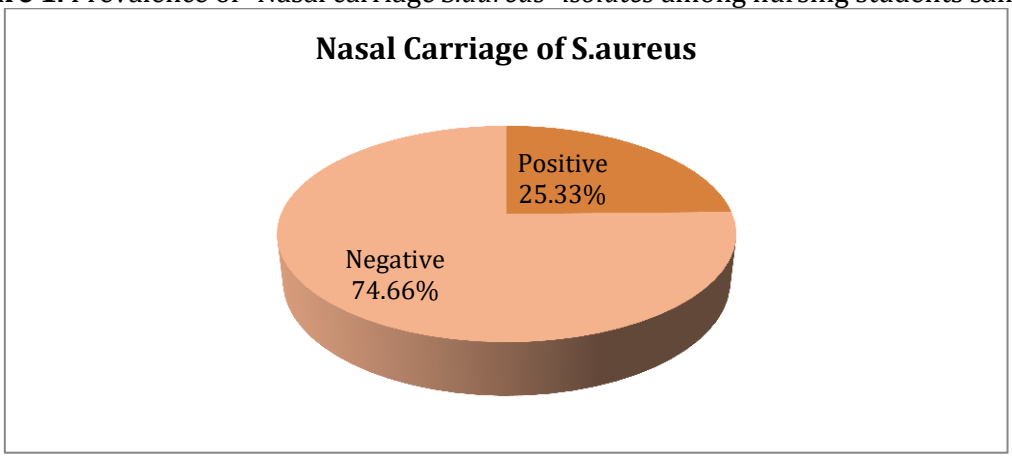
3. Data analysis

The data were analyzed using GraphPad Prism software version 6 (Chi squire tests & p-values) in addition to Microsoft Excel.

4. Results

Out of 150 nasal samples collected from nursing students, *"Staphylococcus aureus"* was isolated from 38 (25.33%) nasal samples. (Fig.1)

Figure 1. Prevalence of *"*Nasal carriage *S.aureus" isolates* among nursing students samples



In Table 1 observed the rate of *"*nasal carriage *S.aureus"* isolates according to students' gender and old. This study recorded high average in *"*nasal carriage *S.aureus"* among the female than male (68.42% & 31.57% respectively), the high average of these nasal isolates were recorded among 21 to 24years age group (57.89%%) and the low prevalence among 17 to 20 years age group(42.1%%).

Table 1. The percents of *"Nasal Staphylococcus aureus"* isolates according to students 'gender and age group.

Variable	No. of " *Staphylococcus aureus"* isolates	Percentage% N=38
Age (Years)		
17-20	16	42.1%
21-24	22	57.89%
Sex		
Female	26	68.42%
Male	12	31.57%

Table 2 showed the rate of "nasal isolates of *S.aureus"* were higher among (third and fourth stage) students 29.72% than (first and second stages) 23.68% and 18.42% respectively.

Table 2. The rate of *"Nasal Staphylococcus aureus"* isolates according to students' class stages.

Class Stages	No. of samples	NO. of nasal *S.aureus* isolates %
First Stage	38	9 (23.68%)
Second Stage	38	7(18.42%)
Third Stage	37	11(29.72%)
Forth Stage	37	11(29.72%)
Total	150	38(25.33%)

Antibiotic susceptibility tests of *"Nasal isolates of Staphylococcus aureus"* toward 20 various types of antibacterial agents are showed in Table 3. It records various resistant ranges towards beta - lactams (Penicillin, Augmentin, Ampicillin, Amoxicillin, Oxacillin (10mg), Cloxacillin ,Cephalothin ,Cefoxitin ,Cefexime ,Cefotaxime) were 34 (89.4%), 34 (89.4%) , 32 (84.2%) , 30 (78.9%) , 1 (2.6%) , 27 (71%) , 24 (63.1%) , 9 (23.6%) , 38 (100%) and 38(100%) respectively.

While 3 (7.8%), 2 (5.2%), 5 (13.1%), 3 (7.8%), 6 (15.7%), 27(71%)and 2 (5.2%) isolates showed resistance towards non beta-lactams (Trimethoprim, Chloramphenicol, Erythromycin, Tetracycline, Rifampicin, Lincomycin and Amikacin respectively.

All nasal *Staphylococcus aureus* isolates were sensitive towards Gentamycin Ciprofloxacin and Vancomycin.

Table 3. The antibiotic resistant profiles of *"Nasal Staphylococcus aureus"* isolates from nursing students

Antibiotics	Nasal S.aureus isolates N=38 (%)	Antibiotics	Nasal S.aureus isolates N=38 (%)
Penicillin	34 (89.4%)	Gentamycin	zero
Augmentin	34 (89.4%)	Trimethoprim	3 (7.8%)
Ampicillin	32 (84.2%)	Chloramphenicol	2 (5.2%)
Amoxicillin	30 (78.9%)	Erythromycin	5 (13.1%)
Oxacillin (10mg)	1 (2.6%)	Tetracycline	3 (7.8%)
Cloxacillin	27 (71%)	Rifampicin	6 (15.7%)
Cephalothin	24 (63.1%)	Lincomycin	27(71%)
Cefoxitin	9 (23.6%)	Amikacin	2 (5.2%)
Cefexime	38 (100%)	Ciprofloxacin	zero
Cefotaxime	38(100%)	Vancomycin	zero

5. Discussion

The study recorded the presence of "multi-resistant *Staphylococcus aureus"* in the nasal cavity of students in nursing college, the prevalence reported between (20% to 40%)[5,11].

"Staphylococcus aureus" is a major part of normal flora and virulent members causes serious reflections especially when infected the health care workers in health care settings and that increased rate of multi- drug resistant isolates within communities [12].

Nasal cavity is the major site for "*S. aureus"* colonization which predominantly be asymptomatic and has wide clinical importance, primarily when be in concern with hospital workers whom may transfer these microorganisms through the air and contaminated hands [11,13].

Nursing students have great action in dissemination of the "*S. aureus"*, in the community and environment of the hospital [5,14].

This study by showed that the S. aureus carriage rate was 25.33% among nursing students, Similarly, other studies such as Gualdoni *et al* 2012, Choi et al 2006 & Mariana et al 2008 that recorded a prevalence of nasal carriage *S. aureus* 25.3%, 23.4% and 26% respectively. [15,16,17]. In contrast, in the United States, "nasal carriage of *S. aureus"* among students at a Louisiana Medical University was 15.95% and in a study done in a Brazilian university the rate of nasal colonization of *S. aureus* isolated was 40.8%. [18,19]. The differences in bacterial dissemination rates among various studies related to the distinctions in geographical location and hygienic behaviors of peoples [20].

The study reported rising in the average of *"*nasal isolates of *S.aureus"* among the female than male, this results agreed with Nagi *et al*. study and disagreed with other studies such as Olsen et al and Chatterjee *et al* .[21,22,23].These variations in carriage rates may be attributed to the characteristics of the population under study, the quality of sampling and culture techniques [24].

According to gender, the rising in the average of such nasal isolates were demonstrated among 21 to 24years age group whom were in third and fourth stage because those students started their extracurricular residency in major health care units and hospitals and this agreed with many studies of Carvalho *et al*, Vaidyaa *et al* and Mediavilla *et al* [25,26,27], So the students whom are in contact with the environment of hospital had a close relation with the bacterial isolates [28-29].

In this study , nasal isolates of *S.aureus* recorded higher resistance towards "Beta-lactam antibiotics" group than" non-Beta-lactam" group, through alterations in the targets of antibacterial agents ,production of *β*-lactamase, alterations in bacterial outer membrane permeability toward the drugs also through the penicillin-binding proteins.[30]. With exception in oxacillin because in this study we used oxacillin 10mg and cefoxitin which appeared high activity towards it, this agreed with Norfarid *et al* [2], ciprofloxacin , gentamycin and vancomycin were the most affective antibiotics in this study all the bacterial isolates showed no resistance towards them , many studies showed different bacterial resistant such as Olayemi *etal* , Norfarid *et al* , Nagi *et al* and Carvalho *et al* [31,2 , 21, 25] ,these variations in the average of microorganism resistant prevalence among different studies may be related to different reasons like hygienic culture of certain population, type of clinical specimen that examined and exposure to antibacterial agents[30].

6. Conclusion

This study referred to the importance of nasal cavity in transmission *of "Staphylococcus aureus"* strains especially among clinical professionals and medical students whom are in close contact with health care settings and patients.

The rising in the average of "antibacterial-resistant *Staphylococcus aureus"*, referred to the presence of these strains in the society, this reinforces the requirement for studying the genotypes which are responsible for "*Staphylococcus aureus* "resistant towards various drugs.

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