

Colonization of *Staphylococcus aureus* in nasal cavities of healthy individuals from district Swabi, KP, Pakistan

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Abstract

Objective: To determine the prevalence of staphylococcus aureus in nasal carriers of healthy individuals and to evaluate their antibiotic susceptibility pattern.

Methods: The cross-sectional study was conducted at the University of Swabi, Swabi, Khyber Pakhtunkhwa, Pakistan, from October 2016 to April 2017, and comprised samples collected from nasal cavities of healthy students aged 19-26 years with the help of a sterile swab. For antibiotic susceptibility test, Kirby-Bauer disc diffusion test was performed according to the guidelines of the Clinical and Laboratory Standards and Institute.

Results: Of the 200 samples, staphylococcus aureus was detected in 41(20.5%). Among them, 27(65.85%) strains were isolated from male samples and 14(34.14%) from female samples. All (100%) strains were found to be sensitive to Cefoxitin and Linezolid, while all (100%) were resistant to Penicillin.

Conclusion: *Staphylococcus aureus* nasal colonization was found more in male than female isolates. Cefoxitin and Linezolid were the most effective drugs against the isolates, which were all resistant to Penicillin.

Keywords: *Staphylococcus aureus*, Antibiotic, CLSI, Resistant, Sensitive. (JPMA 70: 1154; 2020)

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Introduction

Staphylococcus (S.) aureus is a source of nosocomial disease and main human pathogen, which is dispersed in nature far and wide. It is a gram-positive, coagulase-positive and catalase-positive, facultative-anaerobic organism and under the microscope it is characterised as a single, or in pairs or clusters of cocci, non-motile, non-spore-forming bacteria.¹

S.aureus causes many different infections including skin and soft tissue infections, bacteraemia, endocarditis, pneumonia, and osteomyelitis etc.²

Over the last 200 years the *S. aureus* rate of infection has increased. It has been identified that nasal cavities are the potential source of *S. aureus*, one of the common colonisers present in the human host. It was proved that about 30-40% persons are carriers of *S. aureus*.³

The main pool of infecting organisms is the host's own colonising isolate.⁴ About 25% of healthy humans are carriers of *S. aureus* in the nose, which may also be present in the throat, axilla, groin, gut and perineum.⁴

The person who is immune-compromised or patients recovering from surgery or serious diseases are more at risk of infections with the colonised bacteria.^{5,6} Methicillin-resistant staphylococcus aureus (MRSA) has

higher occurrence in healthcare settings than in the community. A study in the United Kingdom reported that about 2% patients were colonised by MRSA,⁷ whereas in the United States, 4% were colonised.⁸ Colonised persons are not only at a higher risk of infection,⁹ but they are also the pool of transmission. MRSA transmits from person to person through direct contact, tools, teams, guests or environment.¹⁰

MRSA prevalence varies from region to region because of geographical location, nature of infection and sample size. In the developed countries, the prevalence of MRSA is also increasing, with studies reporting 34% in the US, 26.6% in Europe and 45% in the western Pacific region.¹¹

According to Centers for Disease Control and Prevention (CDC), annually there are more than 90,000 life-threatening infections and almost 19,000 deaths related to MRSA in the US.¹² Many people who carry staph are considered colonised. These germs do not show any staph infection. Patients who are colonised are not just at the risk of infection⁹ but are also pools and reservoirs of infections.

The current study was planned to find the prevalence of nasal colonisation of *S. aureus* in under-graduate healthy students.

Subjects and Methods

The cross-sectional study was conducted at the Department of Microbiology, University of Swabi, Swabi, Khyber Pakhtunkhwa, Pakistan, from October 2016 to

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April 2017, and comprised samples collected from nasal cavities of healthy students aged 19-26 years with the help of sterile swabs. After approval from the departmental ethics committee and informed consent of the participants, samples were collected from volunteering students, while those working in any healthcare centre or who had been admitted to any hospital in the preceding 5-6 months were excluded.

Levine's technique was used for sample collection.¹³ The samples were collected from nasal cavities with the help of sterile swabs. The collected samples were transported to the microbiology laboratory within 1 hour for further investigation. For screening of *S. aureus*, Mannitol salt agar (MSA) medium (Oxide UK) was used. All samples were inoculated onto MSA plates and were incubated at 37°C for 24 hour. Mannitol fermenter bacteria were considered *S. aureus*. For further confirmation, different biochemical tests were also performed including catalase, coagulase and deoxyribonuclease (DNase) tests. Antibiotic susceptibility test (AST) was done using Kirby-Bauer disk diffusion method according to the CLSI guidelines.¹⁴ The zone of inhibition was measured with the help of a scale and various antibiotics were used against the isolated *S. aureus* strains to check for sensitivity and resistance patterns.

Data was analysed using SPSS version 25, and was presented as frequencies and percentages.

Results

Of the 200 samples, 139(69.5%) and 61(30.5%) came from males and females respectively. Overall, *S. aureus* was detected in 41(20.5%) samples; 27(65.85%) male and 14(34.14%) female (Figure-1).

Overall, 41(20.5%) samples had *S. aureus*, 122(61%) had

Table: Antibiotic susceptibility pattern of *Staphylococcus aureus* isolated from healthy individuals (N=41).

Antibiotic	Susceptible	Intermediate	Resistant
Penicillin	0	0	41 (100%)
Ampicillin	4(9.75%)	0	37 (90.25%)
Levofloxacin	28 (68.29%)	5 (12.19%)	8 (19.51%)
Ciprofloxacin	13 (31.70%)	4 (9.75%)	24 (58.53%)
Gentamicin	31 (75.60%)	0	10 (24.40%)
Erythromycin	9 (21.95%)	3 (7.31%)	29 (70.73%)
Chloramphenicol	36 (87.80%)	0	5 (12.20%)
Cotrimoxazole	4 (9.75%)	2 (4.87%)	35(85.36%)
Linzolid	41 (100%)	0	0
Doxycycline	20 (48.78%)	1 (2.43%)	20 (48.78%)
Vancomycin	38(92.86%)	2 (4.87%)	1 (2.43%)
Cefoxitin(Fox)	41(100%)	0	0

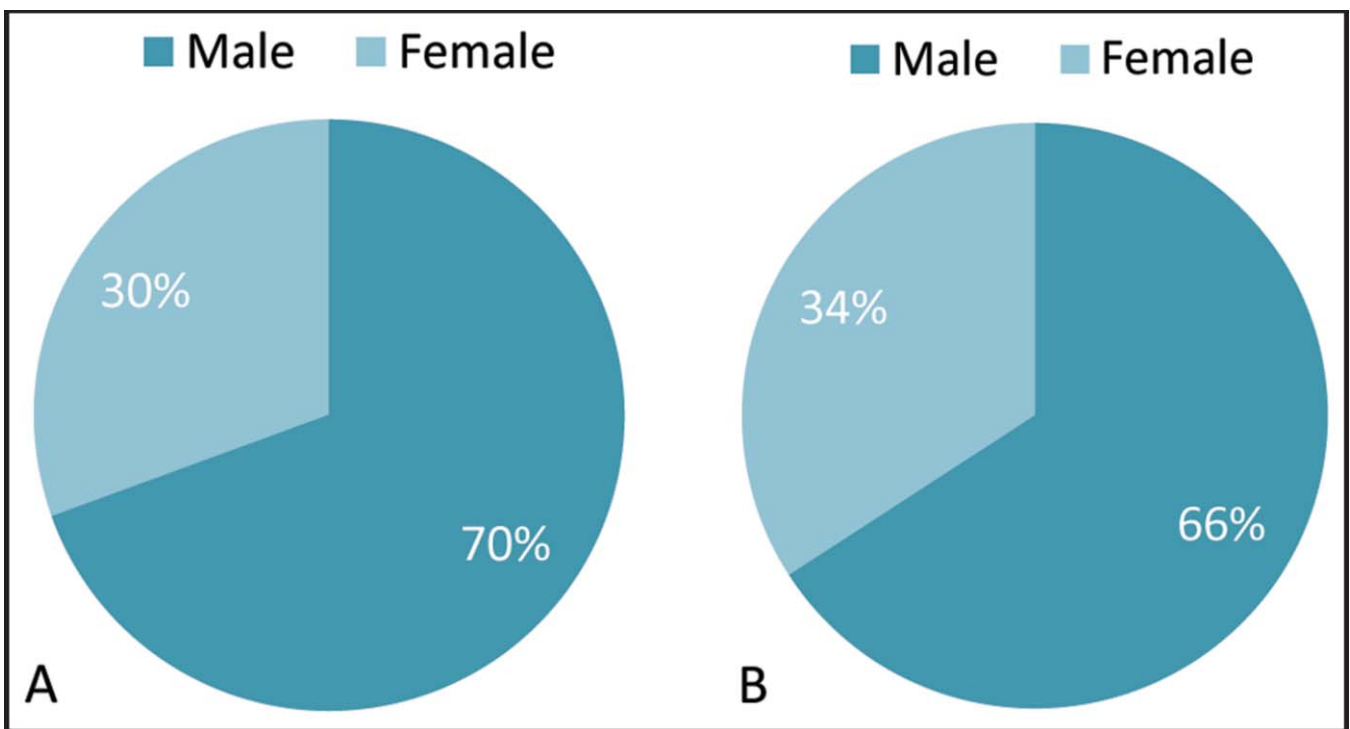


Figure-1: (a) Gender-wise percentage of the collected sample. (b) Gender-wise distribution of *Staphylococcus aureus*.

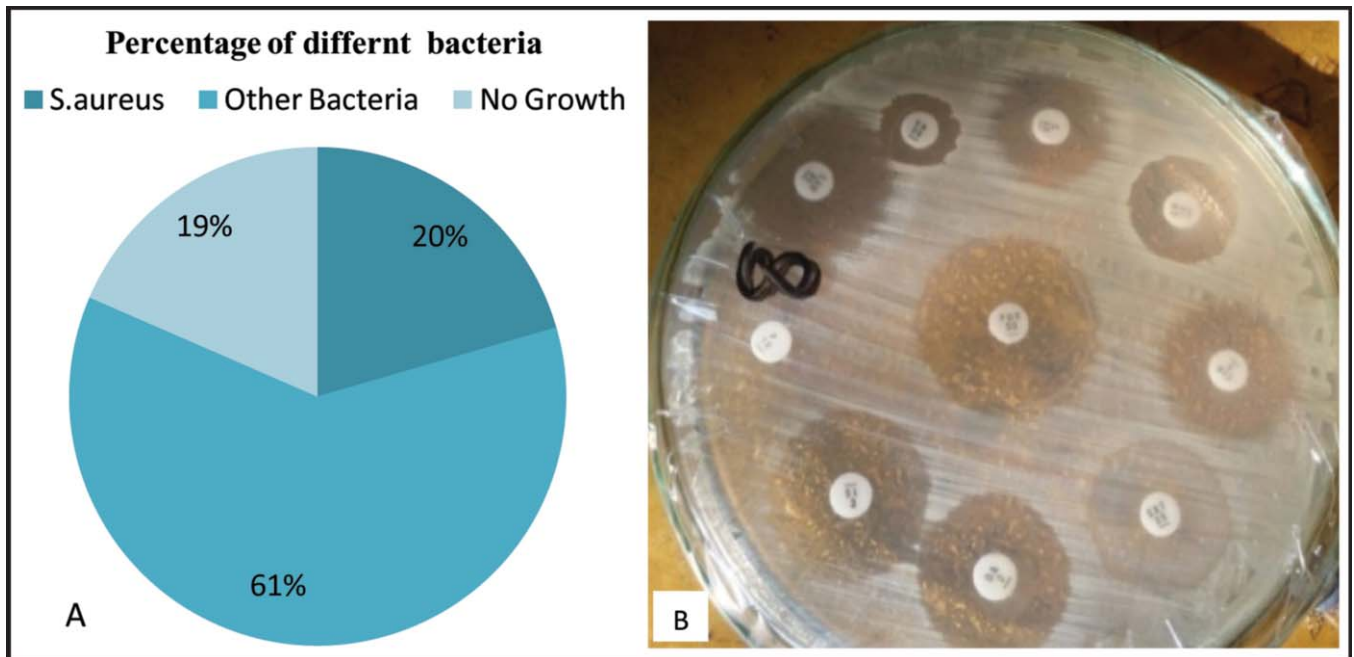


Figure-2: a) Percentage of different bacteria present in collected samples. b) Antibiotic susceptibility pattern of *Staphylococcus aureus*.

other bacterial strains and 37(18.5%) showed no growth (Figure-2).

All (100%) strains were found to be sensitive to Cefoxitin and Linezolid, while all (100%) were resistant to Penicillin (Table).

Discussion

S. aureus is the most common normal flora in humans which is present 20-90% in the nose or on skin surface.¹⁵ It can cause serious infections in colonised people. Nasal colonised humans of *S. aureus* live asymptotically.¹⁵ *S. aureus* is one of the ubiquitous organisms which grow smoothly on human skin as well as in mucous membrane.¹⁶ The chances of development of skin and soft tissue staphylococcal infections are increased by the nasal carriers of *S. aureus* in both non-hospitalised and healthy individuals. It is also the major risk factor for recurrent furunculosis.¹⁷ Different studies have been carried out on the threats of infections due to nasal colonisation of *S. aureus* in surgical patients i.e. general, orthopaedic, heart and neuro-surgeries.¹⁸ In short, nasal colonisation of *S. aureus* is the common risk factor in the development of staphylococcal infections in both community and healthcare settings. This increases the risk of infections by 2 to 10 times.¹⁹

In the current study the prevalence of *S. aureus* among the healthy students was recorded as 41(20.5%), and no

MRSA strain was found which can be compared to findings of a study which reported that about 10-35% of healthy people carried *S. aureus* in their nasal carriage.²⁰

Kitti et al. reported in 2011 that in 15% *S. aureus* isolates, only 1% strains were MRSA and the remaining 99% strains were methicillin-sensitive staphylococcus aureus (MSSA) in young Thai individuals²¹ which can be compared to the findings of the current study. Similarly, Sheng et al. also conducted a study in 2011 and found no MRSA in subjects aged 19-29 years.²² The results of the study are consistent to the findings of the present study.

Another study conducted in Lahore, Pakistan, reported 2.89% population as MRSA-colonised.²³ The results of the previous study are opposite to the findings of current study in which no MRSA was found, indicating that the prevalence of MRSA varies from region to region.

Peichowicz et al. conducted a study on the prevalence of MRSA in clinical and pre-clinical students, and reported that the prevalence of MRSA in clinical and pre-clinical students was 21% and 0% respectively.²⁴ The prevalence of MRSA in pre-clinical students of the study can be compared to the results of the current study.

According to the present study *S. aureus* showed high resistance to Penicillin, Ampicillin and Doxycycline which were 100%, 90.2% and 78% respectively. These isolates showed 70.7% resistance to both Cotrimoxazole and

Erythromycin respectively and 68.2% to Levofloxacin. Linezolid, Cefoxitin and Vancomycin were found the most effective drugs against *S. aureus* isolates.

All the *S. aureus* strains were resistant to Penicillin and 92.80% strains were found sensitive to Vancomycin in the present study which can be compared with the findings of previous studies.^{25,26} Asadullah et al. conducted a study in Peshawar region and reported that seven isolates were intermediate sensitive to Vancomycin which can be compared to the findings of the present study.²⁷

In the present study, all *S. aureus* strains were sensitive to Linezolid and Cefoxitin which is in line with literature.^{28,29}

In the current study 24(58.53%) *S. aureus* strains were resistant to Ciprofloxacin and 10(24.4%) were resistant to Gentamicin. Rajesh Tenguria et al. in 2013 reported that 65.9% *S. aureus* isolates were resistant to Ciprofloxacin and 25.1% strains were resistant to Gentamicin.³⁰ The results can be compared with the findings of the current study.³⁰

In the current study, 90.2% and 70.73% *S. aureus* isolates were found resistant to Ampicillin and Erythromycin respectively, which can be compared to the findings of an earlier study.^{31,32}

The limitations of the current study include convenience sampling method and the fact that minimum inhibitory concentration (MIC) for Vancomycin was not performed due to material constraints.

Conclusion

The prevalence of *S. Aureus* in the nasal carriage was 20.5% and among these strains there was no MRSA. Cefoxitin and Linezolid were the most effective drugs against the isolates, which were all resistant to Penicillin.

Disclaimer: The text is based on a BS thesis, and the abstract was presented at the National Conference on Emerging Trends in Pharmacy, which was arranged by Department of Pharmacy, University of Malakand, on October 8-11, 2017.

Conflict of Interest: None.

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