

Staphylococcus aureus Nasal Carriers Among Medical Students in A Medical School

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SUMMARY

Staphylococcus aureus is usually considered a colonizer but can result in infections under favourable conditions, especially in the healthcare setting. Healthcare workers can be colonized by *S. aureus*, and may transmit them to patients under their care. We conducted a cross sectional study to determine the prevalence of *S. aureus* nasal carriers among medical students in Universiti Putra Malaysia (UPM) (from January to June 2011). Our study involved 209 medical students comprising of 111 and 97 pre-clinical and clinical students respectively. A self-administered questionnaire was distributed and nasal swabs were collected. Upon identification, the antibiotic susceptibility of the isolates was examined followed by categorical analysis (Chi-square and Fisher's exact tests) with factors associated with *S. aureus* nasal carriage. Twenty one (10%) *S. aureus* strains were isolated from 209 nasal swab samples. 14 isolates were from pre-clinical students while the remaining seven were from clinical students. There was no significant association between gender, ethnicity, health status, skin infection and students' exposure to hospital environment with *S. aureus* nasal carriage ($p > 0.05$). Nineteen (90.5%) isolates were resistant to penicillin and there was also no significant association between penicillin resistant and the students' groups. One (5.3%) isolate was resistant to erythromycin. There was no methicillin-resistant *S. aureus* isolated in this study.

KEY WORDS:

S. aureus, nasal carriers, nasal carriage, antimicrobial susceptibility patterns and medical students

INTRODUCTION

Staphylococcus aureus is part of the normal flora of human skin and nasal passages. It has been reported to colonize about 20% of the human population¹. Unfortunately, it is an opportunistic organism that may cause infection under favourable circumstances and easily spread through direct contact. Nosocomial infections by *S. aureus* result in morbidity of hospitalized patients, prolonging the duration of hospitalisation and increasing the cost of healthcare². *S. aureus* has been associated with surgical wound infections, hospital-associated pneumonia, catheter-associated infections and bacteraemia³. The treatment has also become complicated due to the emergence of antibiotic resistance in

particular the methicillin resistant *S. aureus* (MRSA). Healthcare workers can be colonized by *S. aureus*, and non-compliance to infection control measures may result in transmission of *S. aureus* to patients under their care. Therefore, medical students would be the best target group to preliminarily instil such awareness. For this purpose, prevalence of *S. aureus* needs to be assessed among this group for the carriage status. One interesting study was done by Stubbs et al that looked into the nasal carriage of *S. aureus* in Australian medical students⁴. The study divided medical students into five groups, according to degree of hospital exposure. The *S. aureus* carrier rates in all groups did not vary (35.2 to 42.6%) but, interestingly, there was an increase of resistant strains among medical students in their clinical years compared to those who were in pre-clinical years. In Malaysia, study on the prevalence of *S. aureus* among medical students has not been frequently reported. As these students will be interacting and exposed to hospital environments in the future, they may be the potential nasal carriers for spreading the organism to hospital patients. Therefore, this study was conducted to determine the prevalence of *S. aureus* nasal carriers among medical students at the Universiti Putra Malaysia (UPM). As for identifying potential risks of the isolates, the antibiotic susceptibility as well as factors associated with *S. aureus* nasal carriage were also measured and compared for prospective associations.

MATERIALS AND METHODS

This simple random sampling, cross-sectional study was conducted in a medical school from January to June 2011. Medical students that consented to participate in this study were divided into two groups. A group consisted of the pre-clinical (Year One and Year Two) who had not been attached to hospital and the other belonged to the clinical group (Year Three to Year Five) with clinical attachments to medical, surgical, emergency and intensive care unit. A set of guided self-administered questionnaire was distributed to each participant. The questionnaire was adapted from previous studies comprised of demographic data, medical history and hygienic practices^{5,6}. Collection of nasal sample was done by inserting a sterile cotton swab into both nostrils about 1 cm depth, followed by a few times of rotation. The swabs were then cultured on Mannitol Salt agar (MSA), a selective media for the isolation of *S. aureus*. Gram positive cocci in clusters and positive coagulase test confirmed the identity of *S. aureus*.

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Table I: Profiles of medical students screened for *S. aureus* nasal carrier status

		Medical students		
		Pre-clinical n (%)	Clinical n (%)	P values
Gender	Male	44 (39.6)	37 (37.8)	0.780
	Female	67 (60.4)	61 (62.2)	
Race	Malay	79(71.2)	57 (58.2)	0.050
	Others	32 (28.8)	41 (41.8)	
Medical and hygienic factors - subjects with:				
History of cold and fever in past 2 weeks		25 (22.5)	19 (19.4)	0.579 ^a
Antibiotics in past 2 weeks		11 (9.9)	9 (9.2)	0.859 ^a
Unhealed wound		7 (6.3)	1 (1.0)	0.066 ^b
Often touch nose		86 (77.5)	80 (81.6)	0.458 ^a
Often wash hands after touch nose		62 (55.86)	55 (56.1)	0.927 ^a

a-Chi-square test
b-Fisher's exact test

Table II: Isolation of *S. aureus* from nasal swabs of medical students

<i>S.aureus</i> isolated from nasal swabs	Medical students		P value
	Pre-clinical (total n = 111) n (%)	Clinical (total n = 98) n (%)	
Yes	14 (12.6)	7 (7.1)	0.189 ^a
No	97 (87.4)	91 (92.9)	

a- Chi-square test

Antibiotic susceptibility of the isolates was determined using disc diffusion test following the Clinical Laboratory Standards Institute Guidelines⁷. The antibiotics tested were oxacillin, penicillin, erythromycin, gentamycin, vancomycin and mupirocin⁶. This study was approved by the Ethics Committee, Faculty of Medicine and Health Sciences, University Putra Malaysia.

RESULTS

209 medical students consisting of 111 (53.1%) pre-clinical and 98 (46.9%) clinical students participated in this study. Univariate relationships were used to compare data from the questionnaire (demographic data, medical and hygienic factors) for the pre-clinical and clinical medical students, using chi-square statistics for categorical dependent variables. P values by Fisher's exact test are reported if cells had expected counts of less than five. For both tests, two-tailed p values of < 0.05 were considered as significant. Profiles of the medical students involved in this study are indicated in Table I. *S. aureus* was isolated from 21 students (10%) as shown in Table II. We found that the relationships between *S. aureus* nasal colonisation and the studied medical and hygienic factors among respective pre-clinical and clinical groups were not significant. The relationships between *S.aureus* carrier status and students' exposures to different wards (medicine, surgery, intensive care unit, psychiatry, obstetric and gynaecology, paediatrics) in our clinical group were also not significant (data not shown).

Methicillin-resistant *S. aureus* (MRSA) was not detected (oxacillin susceptibility) from the nasal swabs, while isolates were mostly sensitive to antibiotics tested except nineteen (90.5%) isolates that were resistant to penicillin and one (4.8%) resistant to erythromycin. There was no significant association between the penicillin resistance and students' exposure to hospital environment.

DISCUSSION

In Malaysia, the prevalence of *S. aureus* nasal carriage in selected population groups has been previously reported to be in the range of 20 to 30%^{6,8,9}. At the Universiti Putra Malaysia, Mariana *et al*⁸ reported a carrier rate of 26% among 100 students in the Faculty of Medicine and Health Sciences. Interestingly, this target population was not exposed to the hospital environment and had no history of previous antibiotics but three MRSA from 26 of *S. aureus* isolated were detected. Later, Neela *et al*⁹ reported a study involving 162 healthy students at the same faculty and found a higher prevalence rate of 31.5%. The increase was then inferred to be due to the inclusion of throat sample. Nevertheless, these studies did not involve medical students. In the recent years, Santhosh *et al*¹⁰ reported nasal colonization rate of 23.7% among Malaysian pre-clinical students studying in India who have yet to be exposed to healthcare environment. This current study targeted medical students with both pre-clinical and medical students. Therefore, any significant differences in these two groups would indicate a different risk potential in the two environments; community and hospital settings. Nevertheless, this study found only an overall rate of 10% among the medical students, and a lower rate for clinical students (7%) as compared to pre-clinical (13%) but not at significant level. The incidence of antibiotic resistance was also negligible. Due to the studies reported prior to this study on the prevalence of *S. aureus*^{6,8,9}, awareness could have been triggered in the medical students to follow precautionary measures such as washing hand after touching the nose. The later was included in the questionnaire (Table I) which shows about an equal figure for such habit among both pre- and clinical students but previous similar studies are not available for comparison. An extended study to correlate hygienic habit with prevalence of *S. aureus* is however needed involving more participants to reliably establish such an association.

Meanwhile, Wertheim *et al*¹¹ reported that *S.aureus* carriage rates were influenced by ethnicity, presence of skin diseases and diabetes. However, these factors and others that were investigated in this study showed no significant association with *S. aureus* nasal carrier status. Our findings were in agreement with the study by Choi *et al*⁶ that looked into the association of *S. aureus* nasal carriage and history of recent fever and antibiotic use as well as presence of skin or soft tissue disease and non-healing wound that also showed no association. Furthermore, none of our students was diabetic.

CONCLUSION

As a whole, the prevalence of *S. aureus* nasal carriage among medical students at UPM at the current setting was low as compared to previous studies on selected Malaysian populations. There could be a changing pattern of colonization but this study was limited in sampling size, time and place to rule out such a pattern. Thus, a larger sample size involving more subjects from various medical schools is necessary to determine the prevalence of *S. aureus* carriers in medical students' population as well as the potential temporal change. Associated factors such as socio-demographic, health status, skin infection, personal hygiene and exposure to hospital environment will further enhance our understanding on the attributes that determine *S. aureus* nasal carrier state but this study showed no correlation.

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REFERENCES

1. Kluytmans J, Van Belkum A, Verbrugh H. Nasal carriage of *Staphylococcus aureus*: epidemiology, underlying mechanisms, and associated risks. *Clinical Microbiology Reviews*, 1997. 10(3): 505-520.
2. Cosgrove SE, Sakoulas G, Perencevich EN, Schwaber MJ, Karchmer AW, Carmeli Y. Comparison of mortality associated with methicillin-resistant and methicillin-susceptible *Staphylococcus aureus* bacteremia: a meta-analysis. *Clinical Infectious Diseases*, 2003. 36(1): 53
3. Boucher H, Miller LG, Razonable RR. Serious infections caused by methicillin-resistant *Staphylococcus aureus*. *Clinical Infectious Diseases*, 2009. 51(Supplement 2): S183.
4. Stubbs E, Pegler M, Vickery A, Harbour C. Nasal carriage of *Staphylococcus aureus* in Australian (pre-clinical and clinical) medical students. *Journal of Hospital Infection*, 1994. 27(2): 127-34.
5. Bischoff WE, Wallis ML, Tucker KB, Reboussin BA, Sherertz RJ, Bischoff WE. *Staphylococcus aureus* nasal carriage in a student community: prevalence, clonal relationships, and risk factors. *Infection Control and Hospital Epidemiology*, 2004. 25(6): 485-91.
6. Choi CS, Yin CS, Bakar AA, *et al*. Nasal carriage of *Staphylococcus aureus* among healthy adults. *Journal of Microbiology, Immunology, and Infection*, 2006. 39(6): 458.
7. Clinical and Laboratory Standards Institute (CLSI). Performance standards for antimicrobial susceptibility testing, 21st informational supplement. Wayne PA. CLSI document M100-S21, 2011: 1-37.
8. Shamsudin MN, Sekawi Z, van Belkum A, Neela V. First community-acquired methicillin-resistant *Staphylococcus aureus* in Malaysia. *Journal of Medical Microbiology*, 2008. 57(9): 1180-1.
9. VasanthaKumari N, Alshrari AS, Rad EG, *et al*. Highly dynamic transient colonization by *Staphylococcus aureus* in healthy Malaysian students. *Journal of Medical Microbiology*, 2009. 58(11): 1531-2.
10. Santhosh DV, Shobha KL, Bairy I, Rao G, Anand KM, D'Souza J. Nasal screening and survey of pre-clinical medical students from Malaysia for nasal carriage of coagulase positive MRSA and rate of nasal colonization with *Staphylococcus* species. *Journal of Clinical and Diagnostic Research*, 2007. 6: 494-9.
11. Wertheim HFL, Melles DC, Vos MC, *et al*. The role of nasal carriage in *Staphylococcus aureus* infections. *The Lancet Infectious Diseases*, 2005. 5(12): 751-62.