

Nasal carriage of *Staphylococcus Aureus* by hospital personnel of three health institutions in Yaounde Cameroon

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Abstract

Nasal carriage of *Staphylococcus aureus* (NC-SA) by hospital personnel can be an important source of nosocomial infections. This study aimed at determining the prevalence and risk factors associated with nasal carriage of *Staphylococcus aureus* among hospital personnel of three health institutions in Yaounde, Cameroon. A cross-sectional descriptive study was performed from the month of June to August 2008. The specimens from the anterior nares of 245 consenting hospital personnel were cultured on Mannitol salt agar. *S. aureus* identification was based on morphology, Gram stain, catalase production, presence of clumping factor and protein A, and biochemical properties. Fifty-eight personnel had a nasal carriage of SA, an overall prevalence of (23.7%). The difference in prevalence among study sites was statistically significant ($p=0.013$). There was no significant association between carriage and sex ($p=0.426$), age ($p=0.790$), cigarette consumption ($p=0.519$), history of *S. aureus* infection ($p=0.666$) and duration of hospital staff in service ($p=0.695$). The prevalence of NC-SA in this population of health personnel was similar to estimates earlier reported for the general population. However, the study showed the need for the health personnel to be routinely educated on aseptic practices and improved good hospital health practice regulatory compliance with the aim of reducing the potential to transmit SA to vulnerable groups patients who are often more susceptible to infection than the general population.

Keywords: *Staphylococcus aureus*, nosocomial infection, nasal carriage, Yaoundé hospital.

INTRODUCTION

Staphylococcus aureus infections have become a major problem worldwide with important implications in hospitals (Chong et al., 2006). Due to its great variability, occurring at different periods, places and antimicrobial resistant patterns, epidemics of suppurative diseases and postoperative wound infections in many hospitals have been recorded (Alghaithy et al., 2000; Bhatia et al., 2003; Adebola and Josiah, 2008).

Hospital personnel, who could be either transient or persistent carriers of *S. aureus* and at a single or multiple

sites, may serve as an important reservoir (Kotilainen et al., 2001; Goyal et al., 2002). The dissemination of this organism to patients is most likely to occur during routine patient care (Philippe et al., 2003). Several studies conducted using Spa typing, confirmed transmission of *S. aureus* from hospital staff to newborns (Graham et al., 2002; Andreas et al., 2007). Nasal carriage of *S. aureus* among hospital personnel is particularly important to establish new clones, as well as track the origin of infection during outbreaks (Solayide et al., 2005). Overcrowding, understaffing and low hand-washing compliance among health care workers, are some postulated reasons for enhanced transmission rates of 1999; Boyce and Didier, 2002; Andrej and Andrase,

Table 1. Frequency of Nasal isolation of *S. aureus* amongst study population

Study site	Number of subjects screened	Number of positives	Prevalence (%)	p-value
Biyem-Assi hospital	47	15	6.1	0.013
Central hospital	107	31	12.7	
General hospital	91	12	4.9	
Total	254	58	23.7	

2004). Nosocomial infection for patients signifies increased duration of hospitalization with far reaching effects on cost, morbidity and mortality. Studies has demonstrated that hospitalized patients with *Staphylococcus aureus* infection have five times the risk of in-hospital mortality compared with inpatients without this infection (Robert et al., 1999; Henry et al., 2002; Gary et al., 2005 Dilara et al., 2005).

Screening and treating for SA carriage in health personnel as a control measure is both contentious and confounded by lack of enough background knowledge on prevalence rates especially in resource- limited settings. In Cameroon, little information is available on the proportion of hospital personnel colonized by SA and possible risk factors. This study aimed at determining the prevalence and potential risk factors associated with nasal carriage of *Staphylococcus aureus* among hospital personnel of three health institutions in Yaounde, Cameroon.

METHODOLOGY

A cross-sectional descriptive study with a sample size of 245 participants was conducted after an Ethical approval of Research protocol from the Institutional Review Board (IRB), over a period of three months that spanned from June to August 2008. Specimens were collected from the anterior nares of hospital personnel as follows, the Biyem-Assi district hospital (49), the Yaounde Central hospital (107), and the Yaounde General hospital (91). Prior to sample collection, each participant filled a consent form and a self-administered questionnaire to enable the collection of demographic data and medical history.

Mannitol Salt Agar (MSA) was the medium used for the isolation of potential *S. aureus* colonies. After incubating for 24-48 hours, the cultured colonies were isolated for further analyses. Presumptive identification was based on the colonies characteristics on Mannitol agar, Gram stain and production of catalase. Definitive identification was based on the presence of DNA using the DNase test, the presence of protein A and clumping factor using SLIDEX® Staph plus (bioMerieux Marcy - l'Etoile,France) , and biochemical properties with the help

of API staph identification System for *Staphylococcus aureus* (bioMerieux Marcy -l'Etoile,France).

Data collected were entered into a spreadsheet and analyzed using SAS Version 8 (SAS Institute, Cary, NC, USA). Proportions were compared using Chi-Square tests while means were compared using a two-sample t-test. The levels of statistical significance were set at a p-value ≤ 0.05 .

RESULTS

Out of the two hundred and forty five health personnel that took part in the study, fifty-eight (23.7%) tested positive for *S. aureus*. Table 1 illustrates the number of subjects screened per study site and the overall prevalence. The Yaounde Central Hospital recorded the highest prevalence (12.7%) of *S. aureus*, while the Yaoundé General Hospital recorded the least (4.9%). These differences in prevalence rate turn out to be statistically significant (p-value < 0. 0113).

Demographic and personal habits as risk factors for nasal colonization by *S. aureus* are expressed in table 2. There was no statistically significant association ($p=0.426$) between sex and colonization rate, although females had a higher prevalence (25.5%) than males, (21.5%). For marital status, we obtained ($p=0.886$) when the prevalence of singles (22.2%) was compared against married (22.7%) subjects. Prevalence in the interval of hand wash was higher for those who had intervals greater than two hours (41.65%), than with intervals of less than an hour (16.2%). This difference was however not statistically significant ($p=0.370$). The prevalence by methods of hand wash, water and antiseptic as against water only was virtually the same. Prevalence amongst subjects with a self-reported history of staphylococcal infection (25.0%) was only slightly higher than those (21.4%) without a history of infection ($p=0.666$). The rates for alcohol consumption, and non alcohol consumption were 26% and 22% ($p=0.519$) respectively.

The relationships between age, duration in service and the presence or absence of *S. aureus* are demonstrated in table 3. The mean age of the positives was slightly higher than for the negatives. This difference was however insignificant ($p=0.790$). The mean duration

Table 2. Risk factors associated with of *S. aureus* nasal carriage amongst study population

Characteristics value	Variables	Total	Positive (%)	P-Value
Gender	Male	104	22(21.50)	0.426
	Female	141	36(25.53)	
Marital status	Married	123	28(22.76)	0.886
	Single	122	30(25.21)	
Interval of hand wash	<an hour	185	33(16.21)	0.370
	> hour	60	25(41.67)	
method of hand wash	H2O	176	42(23.80)	0.911
	H2O+disinfectant	69	16(23.20)	
History of SA	No	118	25(21.41)	0.666
	Yes	42	11(25.00)	
Cigarette smoking	Not known	85	22(26.80)	0.519
	No	222	54(24.30)	
Alcohol Consumption	Yes	23	4(18.30)	0.799
	No	160	36(22.60)	
	Yes	85	22(26.20)	

p-value from a pearson Chi square test

Table 3. Mean age and duration in service against *S. aureus* infection

Characteristic	Mean (SD)		p-value
	Positives	Negatives	
Age (years)	36.9 (10.1)	36.5 (9.7)	0.790
Duration in Service (years)	6.9 (6.7)	6.5 (6.0)	0.695

SD: Standard deviation; p-value obtained using two sample t-test since these were continues variables

in service for the positives was found to be slightly higher than the mean duration in service for the negatives (p=0.695)

DISCUSSION

This study illustrates that, hospital personnel remain an important asymptomatic reservoir for *S. aureus*. In our study, the rate of nasal colonization of *S. aureus* among the study population was 23.7% (58/245). This result was similar to 23 and 25% registered in the USA and the UK respectively, but lower than 35.7% reported in an Iranian hospital (Mohamed et al., 2006). 37.3% in an Indian hospital and 50 % in a Nigerian hospital. The high prevalence in the Nigerian study might have been due to a small sample size. The prevalence in this study was however within the reported range of 15 to 56% for Health personnel (Goyal et al., 2002; Kluytmans et al., 1997; Chigbu et al., 2003). It was also within the 15 to 40% reported range for the general population in previous studies (Wertheim et al., 2005).

Generally, a considerable variation of nasal carriage of *staphylococcus aureus* prevalence exists within regions, countries and even hospitals. Our study equally demonstrated this, registering a significant difference (p=0.0113) in prevalence among the three hospitals from

where subjects were recruited. The highest prevalence of nasal carriage was registered at the Yaounde Central Hospital (12.9%). This hospital is the most crowded among the study sites, a factor that favors the transmission of *S. aureus* (Denise, 2005; Renaud et al., 2006).

We structured our questionnaire to establish demographic and associated risk factors related to nasal carriage of *S. aureus*. In some previous studies, nasal colonization was found to be more frequent in males and unmarried person (Adebola et al., 2008; Bischoff et al., 2004). However, our study did not identify sex and marital status as a risk factor for nasal colonization by this bacterium. Contrary to our findings, age was identified in earlier studies as a significant risk factor for colonization (Peacock et al., 2003; Kuehnert et al., 2006).

Similarly all the other risk factors under evaluation, were found not be associated with nasal carriage of *S. aureus* among the study population. The reason for this discrepancy may be explained by the small sample size and the choice of variables used as risk factors for evaluation.

Our study had some limitations. First, most demographic data and risk factors under study were selected on the basis of the literature regarding nasal colonization among Health personnel. Therefore, other factors beyond those that were analyzed might also be

relevant for nasal colonization. Also, body sites other than internal nares were not examined in this study. Finally, the impact of nasal carriage of *S. aureus* on transmission and nosocomial infection in patients receiving healthcare in this milieu was not evaluated.

In conclusion, Health personnel remain an important reservoir for possible transmission of *S. aureus* within the hospital milieu. Generally, none of the factors analyzed was found to be associated with nasal colonization of *S. aureus*. However, based on previous studies that have established relationships between the risk factors and nasal colonization of *S. aureus*, these health personnel need to be routinely educated on aseptic practices and compliance improved to reduce the potential to transmit *S. aureus* to patients who are often more susceptible than the general population (Adebola and Josiah, 2008; Philippe et al., 2003). Further studies are needed to identify the most cost effective control measures and to evaluate the impact of nasal carriage of *S. aureus* transmission and nosocomial in patients receiving healthcare services in this setting.

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