



Prevalence of oxacillin/methicillin-resistant *Staphylococcus aureus* isolated in the nursing staff

Prevalência de *Staphylococcus aureus* resistente à oxacilina isolado em profissionais de enfermagem

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Objective: to estimate the prevalence of oxacillin/methicillin-resistant *Staphylococcus aureus* isolated from saliva and nasal secretion of the nursing staff. **Methods:** cross-sectional study carried out in specialized units of a university hospital. In total, 600 samples of saliva and nasal secretions were obtained from nursing professionals. **Results:** of the 100 participants, the growth of *Staphylococcus aureus* was identified in 43.0% of professionals, 7.0% were resistant to methicillin. Of these *Staphylococcus aureus* resistant to methicillin, 100.0% were nasal carriers; two professionals were nasal and saliva carriers. All professionals colonized by methicillin-resistant *Staphylococcus aureus* were indicated to perform the decolonization protocol in force at the institution of the study; six accepted to follow the protocol and only two presented negative cultures for *Staphylococcus aureus* after decolonization. **Conclusion:** the results evidenced the colonization of the nursing staff by *Staphylococcus aureus*, and the nasal cavity was identified as an important colonization site.

Descriptors: *Staphylococcus aureus*; Methicillin Resistance; Nursing.

Objetivo: estimar a prevalência de *Staphylococcus aureus* resistente à oxacilina isolado na saliva e em secreção nasal dos profissionais de enfermagem. **Métodos:** estudo transversal realizado em unidades especializadas de um hospital universitário. No total, 600 amostras de saliva e secreções nasais foram obtidas de profissionais de enfermagem. **Resultados:** dos 100 participantes, identificou-se o crescimento de *Staphylococcus aureus* em 43,0% dos profissionais, 7,0% eram resistentes à oxacilina. Desses *Staphylococcus aureus* resistentes à oxacilina, 100,0% foram carreadores nasais; dois profissionais foram carreadores nasais e na saliva. Todos os profissionais colonizados por *Staphylococcus aureus* resistente à oxacilina tiveram indicação para realizar o protocolo de descolonização vigente na instituição do estudo, seis aceitaram seguir o protocolo e apenas dois apresentaram culturas negativas para *Staphylococcus aureus* após a descolonização. **Conclusão:** os resultados demonstraram a colonização do profissional de enfermagem por *Staphylococcus aureus*, sendo a cavidade nasal apontada como um importante sítio de colonização.

Descritores: *Staphylococcus aureus*; Resistência a Meticilina; Enfermagem.

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Introduction

Due to its high virulence and high prevalence in health services, *Staphylococcus aureus* stands out among microorganisms related to infections in health care environments. Infections caused by oxacillin/methicillin-resistant *Staphylococcus aureus* (MRSA) are concerning, as it is one of the most isolated pathogens in hospital and community infections, and has also had serious implications for public health, due to the facility of this microorganism to acquire resistance to multiple drugs⁽¹⁻³⁾.

In the literature, *Staphylococcus aureus* is identified as an important human pathogen, responsible for a wide variety of infections, affecting superficial and even deeper tissues, which can cause serious infections such as pneumonia, bacteremia, endocarditis, osteomyelitis and toxic shock syndrome⁽²⁻³⁾.

Researches have identified nursing professionals, in the exercise of their care activities, as potential carriers and disseminators of resistant microorganisms, such as MRSA⁽⁴⁻⁶⁾. The hands of these professionals can be considered as the main vehicle of transmission of these microorganisms, also causing cross contamination⁽⁷⁾.

One of the main forms of dissemination of MRSA in the hospital environment is through direct contact with a colonized individual, fomites and potentially contaminated surfaces, besides the non-adherence to hand hygiene or poor hand hygiene, propitiating the transmission of the microorganism⁽⁸⁾.

In health institutions, MRSA strains can be identified in the admission of new colonized or infected clients from the community or even other services, and it is important to identify them as early as possible to avoid the spread of resistant strains in the workplace.

Given the need for research involving problems that multi-resistant microorganisms cause to health services and patients, as well as the lack of research involving the colonization of nursing professionals by *Staphylococcus aureus* in Brazil, this study was devel-

oped with the objective of estimating prevalence of methicillin-resistant *Staphylococcus aureus* isolated from saliva and nasal secretion of nursing professionals.

Methods

This is a cross-sectional study carried out in hospitalization units of adult patients with the Human Immunodeficiency Virus at a tertiary-level university hospital, located in a city in the interior of São Paulo, Brazil.

The research participants were nursing professionals (nurses, technicians and nursing assistants) who met the inclusion criteria, namely being providers of direct patient care; working in one of the study's hospitalization units; being active in the profession and being willing to participate in the three collection periods.

The data collection was performed in three periods that correspond to month zero, four and eight. Throughout the research, 21 professionals were excluded due to sick leave, layoffs, transference of sectors or refusals in participation. Thus, the study population consisted of 100 nursing professionals who accepted to participate in the three collection periods.

Data were collected from April 2014 to February 2015. In the first period of data collection (month zero), we used an instrument validated as to the form and content by three specialists on the subject and containing questions related to demographic, professional and individual aspects. The semi-structured instrument was applied in a private room at the researcher's own workplace and lasted from 15 to 20 minutes.

In the months zero, four and eight of the study, samples of saliva and nasal secretion from nursing professionals were obtained. The participant was asked to deposit three to five milliliters of saliva directly into a graduated, dry, sterile and identified test tube. To obtain nasal secretion, a dry nasal swab was inserted in each nostril (right and left) and three circular movements were performed clockwise, according

to institutional protocol. The mean sample collection time for saliva and nasal secretion was approximately five minutes for each professional.

The collected samples were immediately identified and sent to the Laboratory of Microbiology and Serology of the said hospital. During the collection and transportation of the material, the biosafety norms were respected. In this laboratory, the material was seeded in blood agar and mannitol. The Vitek® 2 automated system (BioMérieux™) was used for processing the samples, and the Vitek® GP Test Kit cards for the identification of gram-positive bacteria.

In the present study, the participant who presented at least one positive sample for *Staphylococcus aureus*, either in saliva samples and/or in nasal secretion, was considered a colonized individual. Nursing professionals colonized by MRSA were first informed by the researcher about the results of the cultures and, by agreement, these results were sent to the Hospital Infection Control Committee for the evaluation and indication of the protocol for decolonization by resistant microorganisms, recommended by the institution itself. It should be noted that adherence to the decolonization protocol is optional for the institution's employees; and, only in a situation of hospital outbreak, the Hospital Infection Control Committee may make decolonization mandatory.

The MRSA decolonization protocol implemented at the institution consists of topical application of 1.0% silver sulfadiazine in the nasal MSSA (every 12 hours for five days), associated with a chlorhexidine bath of 2.0% (once a day) throughout the body, except on the face and scalp, for a period of five consecutive days. For individuals with oral colonization by MRSA, the institution recommends 0.1% chlorhexidine mouthwash three times a day, also for five days.

The data was organized into a Microsoft Office Excel for Windows 2013 worksheet and analyzed using the Statistical Package for the Social Sciences program, version 20.0. For the data analysis, descriptive statistics were used with measures of central tendency (mean and median) and dispersion (standard

deviation - SD). To verify the association between demographic and professional variables with *Staphylococcus aureus* colonization, the Wilcoxon-Mann-Whitney test was used for the quantitative variables, since they did not follow a normal distribution, and the Fisher's Exact Test was used for the qualitative variables, with the p-value being equal to 0.05.

The study complied with the formal requirements contained in national and international standards for research involving human beings. It was approved by the Research Ethics Committee of the School of Nursing of Ribeirão Preto of the University of São Paulo, under Protocol no. 603.228/2013 and the Approval Certificate no. 20111213.3.3001.5440.

Results

Of the 100 nursing professionals participating in the research, 59 (59.0%) were nursing assistants, 22 (22.0%) nursing technicians and 19 (19.0%) nurses. Females were predominant, being 79.0% of the individuals. Age ranged from 23.5 to 61.8 years, with a median of 41.4 years (SD=8.6). The time of professional exercise in the nursing area informed by the participants ranged from 8 months to 36 years, with a mean of 12.9 years (SD=7.6).

In total, 600 samples of saliva and nasal secretion were collected during the study. The growth of *Staphylococcus aureus* was identified in 43 (43.0%) of the professionals; of these, 36.0% were methicillin-sensitive *Staphylococcus aureus* (MSSA). The prevalence of MRSA isolated in saliva and nasal secretion was 7.0%. It was observed that 100.0% of the professionals colonized by MRSA were nasal carriers; two professionals, besides being nasal carriers, were also carriers in the saliva.

Table 1 presents the demographic and professional characterization and the classification regarding colonization or not by MSSA or MRSA of nursing professionals. There was no significant difference when associating demographic and professional variables with *Staphylococcus aureus* colonization.

Table 1 – Distribution of nursing professionals according to demographic and professional characterization and colonization by methicillin-sensitive and -resistant *Staphylococcus aureus* in saliva and nasal secretion samples

Variable	Non-colonized (n=57) n (%)	Colonized (n=43)		p
		*MSSA (n=36) n (%)	†MRSA (n=7) n (%)	
Professional category				0.640
Nurse	10 (17.5)	8 (22.2)	1 (14.3)	
Nursing Technician	11 (19.3)	9 (25.0)	2 (28.6)	
Nursing assistant	36 (63.2)	19 (52.8)	4 (57.1)	
Sex				0.631
Female	46 (80.7)	27 (75.0)	6 (85.7)	
Male	11 (19.3)	9 (25.0)	1 (14.3)	
Age (years)				0.162
20 to 29	1 (1.7)	7 (19.4)	1 (14.3)	
30 to 39	24 (42.1)	14 (38.9)	1 (14.3)	
40 to 49	25 (43.9)	10 (27.8)	1 (14.3)	
≥ 50	7 (12.3)	5 (13.9)	4 (57.1)	
Schooling				0.372
Complete high school	42 (73.7)	21 (58.3)	5 (71.4)	
Complete higher education	10 (17.5)	10 (27.8)	2 (28.6)	
Complete post-graduation	5 (8.8)	5 (13.9)	-	
Work shift				0.331
Daytime	16 (28.1)	17 (29.8)	4 (57.1)	
Night	22 (38.6)	5 (13.9)	1 (14.3)	
Rotation	19 (33.3)	14 (38.9)	2 (28.6)	
Time in profession (years)				0.665
< 5	7 (12.3)	6 (16.6)	2 (28.6)	
5 to 14	27 (47.4)	15 (41.7)	1 (14.3)	
≥ 15	23 (40.3)	15 (41.7)	4 (57.1)	
Another employment relationship				0.990
Yes	8 (14.0)	5 (13.9)	1 (14.3)	
No	49 (86.0)	31 (86.1)	6 (85.7)	
Weekly load (hours)				0.228
30 to 36	21 (36.8)	18 (50.0)	4 (57.1)	
> 36	36 (63.2)	18 (50.0)	3 (42.9)	

*MSSA – methicillin-sensitive *Staphylococcus aureus*; †MRSA – methicillin-resistant *Staphylococcus aureus*

The individual mapping of the seven nursing professionals colonized by MRSA in saliva and/or nasal secretion in the collections obtained in zero, fourth and eighth months is detailed in Table 2.

Table 2 – Distribution of nursing professionals colonized by methicillin-resistant *Staphylococcus aureus* (n=7) according to the total of samples (positive or negative) of saliva and nasal secretion with the presence of the microorganism, in the three collection periods

N	Zero month		Fourth month		Eighth month	
	Nasal	Saliva	Nasal	Saliva	Nasal	Saliva
1	+	-	-	-	-	-
2	+	-	-	-	-	-
3	-	-	+	-	-	-
4	+	-	-	-	+	-
5	-	-	-	+	+	-
6	-	-	+	-	+	-
7	+	-	+	-	+	+

Considering the three sampling periods, it was observed that MRSA was present in 13 samples of saliva and/or nasal secretion of the professionals, with four samples being isolated at zero month; four in the fourth month; and five in the eighth month.

The seven professionals colonized by MRSA were indicated to perform the decolonization protocol in force at the institution of the study. However, one of the professionals declined it, referring to fear for having a history of allergic reactions to a variety of drugs. This professional who did not accept decolonization was colonized by MRSA in the nasal secretion sample at the zero month, but, at the eighth month, he presented MRSA-positive culture in the nasal secretion again.

Thus, a total of six professionals accepted to follow the protocol of decolonization, and three of them presented negative cultures for MRSA after decolonization. The guidance from the Hospital Infection Control Committee for professionals who did not decolonize at the first moment established that they should repeat the protocol one more time.

Discussion

As a limitation of the study, we can point out that the population was composed exclusively of a group of professionals from a tertiary university hos-

pital with a high degree of complexity, which does not allow generalization of the data. However, this particularity does not diminish the importance of the study in answering questions related to the colonization of nursing professionals. It is hoped that this study could serve as a propeller for improvements in nursing care and provide subsidies for the implementation of educational strategies, aiming at a greater adherence to measures of control and prevention of multi-resistant microorganisms in health institutions.

The present study demonstrated that nursing professionals are vulnerable to *Staphylococcus aureus* colonization. Studies performed in several health institutions report that the nursing team has a high rate of colonization by *Staphylococcus aureus*, among them MRSA, when compared to other categories of health professionals^(5,9). A cross-sectional study carried out in Palestine pointed out a high rate of colonization by MRSA (25.5%) among health workers, with emphasis on the nursing team, since 74.5% of the colonized were nurses⁽⁶⁾. Research carried out in a university hospital in Egypt pointed out that 13.5% of the professionals were colonized by MRSA, and a third of this colonization occurred among nurses⁽¹⁰⁾. Researchers from Nepal conducted a study with 204 health professionals, where MRSA colonization in the nursing category was 7.8%⁽¹¹⁾, similar to the prevalence of MRSA of 7.0% found in this study. Although 43.0% of the professionals presented saliva samples and/or nasal secretions with *Staphylococcus aureus*, the prevalence of 7.0% of MRSA was considered low compared to the literature.

Studies with a higher prevalence of MRSA among nursing professionals suggest that close and constant physical contact with patients contributes to the colonization and transmission of the microorganism between patients and professionals. Healthy individuals, although presenting a lower risk of infection with *Staphylococcus aureus*, can be considered

carriers and transmission vehicles of the microorganism⁽⁹⁾.

In the literature, *Staphylococcus aureus* is considered one of the main causes of nosocomial and community infections; it is a commensal bacterium of the skin and mucosa, whose colonization occurs at a level ranging from 15.0 to 36.0% of the general population^(1,12). The individual colonizes asymptotically, and nasal colonization has been a risk factor for infection in all types of patients and individuals studied, with a 2 to 12-fold increase in the risk of infection⁽¹²⁾.

Individuals with *Staphylococcus aureus* present an increased risk of infection. This increased risk has been reported in surgical and hemodialytic patients and in individuals with compromised immune systems⁽¹²⁾. Individuals with MRSA have higher risk of invasive infection when compared to those colonized by MSSA⁽³⁾.

Carriers' decolonization is considered to be effective in reducing staphylococcal infections in different populations⁽¹³⁾. An investigation has highlighted the clinical efficacy of mupirocin in preventing *Staphylococcus aureus* infections with non-surgical clients. The use of mupirocin reduced the risk of infections by the microorganism by more than 40.0%⁽¹⁴⁾.

A survey conducted in an intensive care unit of a university hospital in Taiwan found that active screening and decolonization of MRSA patients were effective in reducing infections as well as mortality and medical costs per individual⁽¹⁵⁾.

The topical application of intranasal mupirocin caused the eradication of 80.0% of those colonized by MRSA in a study carried out in Egypt involving health professionals⁽¹⁰⁾. In addition, it was evidenced that the adoption of decolonization therapy, carrier screening, contact precautions for those infected, as well as improvements in the practice of hand hygiene and greater control of antimicrobial prescription are recommended strategies to prevent the spread of MRSA in institutions^(10,16).

Conclusion

In this study, the nasal cavity was identified as an important site of colonization, since it was observed that all professionals colonized by methicillin-resistant *Staphylococcus aureus* were nasal carriers. Thus, the nasal cavity is a relevant site and indicated for collection in studies investigating the prevalence of *Staphylococcus aureus* colonization.

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Collaborations

Lopes LP and Gir E contributed to the design, development of data research and interpretation, writing, critical review of intellectual content and final approval of the version. Pio DPM, Pereira FMV, Meneguetti MG and Freitas JP contributed to the writing, relevant critical review of the intellectual content and final approval of the version to be published.

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