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Staphylococcus aureus and the oxacillin sensitivity profile in hospitalized people with HIV/AIDS

Staphylococcus aureus e o perfil de sensibilidade à oxacilina em pessoas vivendo com hiv/aids hospitalizadas

Staphylococcus aureus y el perfil de sensibilidad a la oxacilina en personas viviendo con vih/sida hospitalizadas

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ABSTRACT

Objective: Analyze nasal colonization by oxacillin-sensitive and oxacillin-resistant *Staphylococcus aureus* in people with HIV/AIDS (PWHA) at days 1 and7 of hospitalization. **Method:** A prospective observational study conducted in a hospital in the countryside of the state of São Paulo. Nasal swab samples were collected and analyzed through microbiological identification, at days 1 and 7 of hospitalization ofPWHA, between August 2011 and January 2014. Data were analyzed via IBM SPSS®, version 20.0. **Results:** Nasal secretion samples were collected from 187 (50.1%) PWHA at days 1 and 7 of hospitalization. Of these, *Staphylococcus aureus* was identified in 64 (34.2%) PWHA. **Conclusion:** At day 1 of hospitalization, 27 PWHA were identified with *Staphylococcus aureus*; 27 PWHA presented colonization by *Staphylococcus aureus* at days 1 and 7, and 10 PWHA only at day 7. Of 64 PWHA colonized by *Staphylococcus aureus*, the susceptibility profile of isolated *Staphylococcus aureus* was oxacillin-resistant in 25 PWHA.

DESCRIPTORS

HIV Infections; Hospitalization; Staphylococcus aureus; Oxacillin.

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INTRODUCTION

Human beings are natural reservoirs of *Staphylococcus aureus*, a bacterium that is especially found in the nose, vagina, pharynx and/or injured skin surfaces[1]. Once natural protection barrier is past, the microorganism can access underlying layers of the skin and, in favorable conditions, it may cause an infection[2-3].

An infection situation can be very serious in immunocompromised patients, such as those with the human immunodeficiency virus (HIV), serious burns and cancer, increasing the morbimortality rate, length of hospital stay and healthcare costs[4].

Infections caused by *Staphylococcus aureus* have been considered the major cause of morbimortality of people living with HIV/AIDS (PWHA), due to virulence factor of this microorganism and its resistance to antibiotics. Methicillin-resistant *Staphylococcus aureus* (MRSA) was first described in Europe by Jevons in 1961 as a nosocomial pathogen. Since then, microbial resistance is one of the major concerns of public health, with serious economic, social and political implications that affect individuals globally, going beyond environmental and ethnical boundaries[5].

People with HIV/AIDS present higher incidence of *Staphylococcus aureus* when compared to non-infected people[4].Thus, HIV infection is a risk factor for colonization and infection by MRSA[6-8].

Despite the outstanding progress with the antiretroviral therapy for HIV patients, several undesirable situations still require hospitalization, exposing them to the nosocomial microbiota. The main causes of PWHA hospitalization include: gastrointestinal diseases, bacterial infections and cardiovascular diseases[9].The hospitalization process requires interventions that change the natural microbiota of the patient, due to an aggravated health condition, like systemic diseases or use of medication, invasive procedures or site contamination.

A study conducted in Ireland demonstrated that the effect of an early MRSA detection facilitates screening and early patient isolation, leading to reduced cross infection[10]. Based on that, identifying colonization by multidrug-resistant microorganisms at hospital admission of PWHA allows the adoption of clinical measures, such as: isolation and decolonization techniques to prevent microorganism dissemination and, consequently, a possible infection.

It is important to recognize the particularities involving PWHA when seeking care individualization to these patients. The nosocomial environment can have a direct influence on multidrug-resistant microorganism dissemination in this population. Thus, the objective of this study was to analyze nasal colonization by oxacillin-sensitive and oxacillin-resistant *Staphylococcus aureus* in PWHA at days 1 and 7 of hospitalization, correlating it to sociodemographic and clinical findings. This study assumes that a period of 7 days or more of hospitalization can change the nasal colonization of PWHA in relation to the presence or not of oxacillin-sensitive or oxacillin-resistant *Staphylococcus aureus*.

METHOD

This is a prospective observational study conducted in two specialized units that provide care to patients with infectious diseases of a university hospital in the countryside of the state of São Paulo.

This study was approved by the Ethics Committee of the Escola de Enfermagem de Ribeirão Preto da USP, observing the recommendations in Resolution 196/96 of the Brazilian Health Council (Protocol nº 1304/2011).

This study used convenience sampling and included all participants who met the inclusion criteria: being 18 years old and over, being aware of the HIV/AIDS infection diagnosis and providing material collection at days 1 and 7 of hospitalization .The exclusion criteria were: people living with HIV/AIDS using any ventilation device and/or presenting a clinical condition preventing material collection. For participants with more than one hospitalization period, this study considered only the first one.

The participants were selected by collection assistants, who received a specific training from August 2011 to January 2014. At day 1 of hospitalization, the patient was invited to participate and received information regarding the ethical aspects of this study. After the patient approval, the participant signed an informed consent form.

Sociodemographic and clinical data were collected through individual interviews and from clinical records of the patient. Nasal secretion samples were obtained with a dry swab with sterile Stuart medium (COPAN®), rubbed on both nares, at day 1 of hospitalization to check whether the PWHA was already colonized by oxacillin-sensitive or oxacillin-resistant *Staphylococcus aureus*, and at day 7 of hospitalization to check for oxacillin-sensitive or oxacillin-resistant *Staphylococcus aureus*, as compared to the condition identified at day 1. The swabs were kept at ambient temperature (30ºC) in plastic capped containers that were sent to the microbiological analysis laboratory within 24 hours of collection, where they were placed on agar blood and mannitol plates.

The isolation and phenotypic identification of *Staphylococcus aureus* were performed using an automated method, with the help of Vitek® (BioMérieux™) system cards. Resistance to antimicrobials was tested using (BioMérieux™) AST-P585 card. When a nasal colonization by *Staphylococcus aureus* was confirmed in study participants, the Hospital Infection Control Commission was informed, which in turn, informed the patient's physician, who analyzed with the commission the institution's decolonization protocol prescription.

Data were organized on a spreadsheet produced with Microsoft Office Excel for Windows 7 using double entry and were validated subsequently. The final spreadsheet was transported and analyzed using IBM SPSS®, version 20.0

for Windows, performing operations of new variable creation, categorization and grouping, and then data analysis of descriptive and analytical statistics, using the chi-square test, *p* value of 0.05.

RESULTS

Of 373 participants analyzed in the study period, 187 (50.1%) were eligible and met the inclusion criteria; in 123 (65.7%), the cultures were negative at day 7 (Table 1).

Table 1 – Distribution of PWHA according to the nasal colonization by oxacillin-sensitive or oxacillin-resistant *Staphylococcus aureus* at days 1 and 7 of hospitalization – Ribeirão Preto, SP, Brazil, 2011-2014.

	Day 1	Day 7
Positive culture	**54 (28.8)**	**64 (34.2)**
Oxacillin-sensitive *Staphylococcus aureus*	39	39
Oxacillin-resistant *Staphylococcus aureus*	15	25
Negative culture	**133 (71.1)**	**123 (65.8)**
Total	**187 (100)**	**187 (100)**

Note: (n=187).

Of 64 (34.2%) participants with positive culture to *Staphylococcus aureus*, 27 (42.2%) showed persistent microorganism at days 1 and 7 of hospitalization, and three (4.7%) presented a different profile of oxacillin sensitivity, as at day 7, oxacillin-resistant *Staphylococcus aureus* was observed. Seven (10.9%) participants presented *Staphylococcus aureus* only at day 7 of hospitalization; however, the profile of susceptibility showed oxacillin-resistant microorganism.

Regarding participant characterization, 59.4% were male. The predominant age was ≥ 40 and ≤ 59 years in 49.7% of the sample. In terms of educational attainment, 39.0% had not completed higher education. The clinical diagnosis of HIV infection 5 years or less was observed in 38.5% of the participants; 77.0% were submitted to an invasive procedure during hospitalization; 59.9% presented detectable viral load for HIV; 69.0% presented CD4+T lymphocyte counts of 350 cell/mm^3 or less; 72.2% were taking an antimicrobial; 58.8% did not have the antiretroviral therapy prescribed during hospitalization (Table 2).

Table 2 – Distribution of PWHA at day 7 of hospitalization according to the nasal colonization by *Staphylococcus aureus* and sociodemographic and clinical variables – Ribeirão Preto, SP, Brazil, 2011-2014.

Variables	Colonized	Not colonized
	n=64(%)	n= 123(%)
Sex		
Male	47(25.2)	64(34.2)
Female	17(9.0)	59(31.5)
Age (years)		
≥ 19 and ≤ 39	34(18.1)	52(27.8)
≥40 and ≤ 59	25(13.3)	68(36.3)
≥ 60	5(2.6)	3(1.6)
School attainment		
Illiterate and/or incomplete basic education	9(4.8)	24(12.8)
Incomplete high school	13(6.9)	17(9.1)
Incomplete higher education	26(13.9)	47(25.1)
Complete higher education	16(8.5)	35(18.7)
Time since diagnosis of HIV (year)		
≤ 5	22(11.7)	50(26.7)
5 to 15	22(11.7)	41(21.9)
≥ 15	18(9.6)	31(16.5)
Did not know	2(1.0)	1(0.5)
Invasive procedure during hospitalization		
Yes	51(27.2)	93(49.7)
No	13(6.9)	30(16.0)
Viral load (copies/ml)		
Detectable	16(8.5)	25(13.3)
Undetectable	34(18.1)	78(41.7)
Not informed	14(7.4)	20(10.6)
CD4+ T lymphocyte counts (cell/mm^3)		
≤ 350	47(25.1)	82(43.8)
≥ 350	11(5.8)	26(13.9)
Not informed	6(3.2)	15(8.0)
Use of antibiotics		
Yes	43(22.9)	92(49.1)
No	21(11.2)	31(16.5)
Antiretroviral prescribed in hospitalization		
Yes	27(14.4)	50(26.7)
No	37(19.7)	73(39.0)

Note: (n=187)

The chi-square test was used, *p* value of 0.05, correlating the following variables: sex, sexual relation in the last6 months, use of antibiotics during hospitalization, antiretroviral therapy prescribed during hospitalization and invasive procedure during hospitalization with nasal colonization by *Staphylococcus aureus* (Table 3).

Table 3 – Association of PWHA at day 7 of hospitalization according to the nasal colonization by *Staphylococcus aureus* and behavioral and clinical variables – Ribeirão Preto, SP, Brazil, 2011-2014.

		Colonized		
		Yes	No	
Sex	**Male**	47	64	$p = 0.005$
	Female	17	59	
Sexual relation in the last 6 months	**Yes**	31	49	$p = 0.259$
	No	33	74	
Use of antibiotics during hospitalization	**Yes**	43	92	$p = 0.271$
	No	21	31	
Antiretroviral therapy prescribed during hospitalization	**Yes**	27	50	$p = 0.839$
	No	37	73	
Invasive procedure during hospitalization	**Yes**	51	93	$p = 0.530$
	No	13	30	

Note: (n=187)

DISCUSSION

This study analyzed the nasal mucosa as the site of colonization by *Staphylococcus aureus*. A case-control study conducted in Singapore, which attempted to identify MRSA in people with HIV/AIDS at hospital admission, showed the main site of colonization by this microorganism were the nares of participants[7].

In this study, male PWHA presented higher rates of nasal colonization by *Staphylococcus aureus*, in agreement with the findings from a study conducted in Barcelona to investigate the prevalence of MRSA in patients with HIV/AIDS[11].

Monitoring the dissemination of *Staphylococcus aureus* in this population with HIV/AIDS contributes to infection control and prevention programs and the survival of these patients[5]; for this reason, surveillance policies are viable for patients at risk for colonization and infection by multidrug-resistant microorganisms. It is essential to identify this condition of the patient at hospital admission and monitor the patient during hospitalization.

The risk factors indicated as predisposing factors for the susceptibility of people with HIV/AIDS to MRSA are: CD4+T lymphocyte count below 500 cell/mm^3, HIV viral load of 400 copies/ml or above, use of injectable drugs, old age, prior hospitalization and invasive procedures[7,12]. Based on that, most participants of this study presented most risk factors indicated as predisposing factors for colonization by MRSA in this investigated population.

At day 7 of hospitalization, *Staphylococcus aureus* was observed in 10 (15.6%) participants; of these, seven (70.0%) were oxacillin resistant, similar to a study conducted with long-term hospitalized patients who presented higher prevalence of MRSA when compared to other multidrug-resistant microorganisms[13].

Another relevant factor is that most participants did not have antiretroviral medications prescribed during hospitalization, but the literature shows one of the main causes of hospitalization of PWHA is their non-adherence to prescribed antiretroviral treatment, causing a greater exposure of these individuals to the nosocomial environment[14-15].

The limitations of this study refer to the lower number of participant follow-up at day 7 of hospitalization versus day 1, due to discharges, refusals or deaths. In addition, a study on prevalence and risk factors for MRSA in people with HIV/AIDS indicates the importance of investigating several sites of possible colonization by *Staphylococcus aureus* in this population, not only the nares[13,16].

CONCLUSION

Of 187 (100%) participants who provided nasal secretion samples at days 1 and 7 of hospitalization, 64 (34.2%) presented nasal colonization by *Staphylococcus aureus*: 27 (14.4%) at day 1, 10 (5.3%) at day 7, and 27 (14.4%) at both days 1 and 7, characterizing persistent colonization by *Staphylococcus aureus*.

Resistance to oxacillin was observed in 25 (13.3%) participants; 10 (5.3%) of these only at day 7 of hospitalization.

It is noteworthy that most participants colonized by *Staphylococcus aureus* were male, reported no sexual relations in the last 6 months, were using antibiotics, had no antiretroviral therapy prescribed and were submitted to an invasive procedure during hospitalization.

RESUMO

Objetivo: Analisar a colonização nasal por *Staphylococcus aureus* sensíveis e resistentes à oxacilina de pessoas vivendo com HIV/aids (PVHA) no primeiro e no sétimo dia de internação hospitalar. **Método:** Estudo prospectivo observacional realizado em um hospital do interior paulista. Foram coletadas e analisadas, por meio de identificação microbiológica, amostras de *swab* nasal no primeiro e no sétimo dia de internação hospitalar de PVHA, no período de agosto/2011 e janeiro/2014. A análise dos dados foi realizada por meio do IBM SPSS®, versão 20.0. **Resultados:** Em 187 (50,1%) PVHA foram coletadas amostras de secreção nasal no primeiro e sétimo

dia de internação. Destas, em 64 (34,2%) foi identificado *Staphylococcus aureus*. **Conclusão:** No primeiro dia de internação observou-se 27 PVHA colonizadas por *Staphylococcus aureus*; em 27 PVHA houve a persistência da colonização por *Staphylococcus aureus* no primeiro e no sétimo dia; em 10 PVHA, somente no sétimo dia. Das 64 PVHA colonizadas por *Staphylococcus aureus*, em 25 o perfil de suscetibilidade do *Staphylococcus aureus* isolado foi resistente à oxacilina.

DESCRITORES

Infecções por HIV; Hospitalização; Staphylococcus aureus; Oxacilina.

RESUMEN

Objetivo: Analizar la colonización nasal por *Staphylococcus aureus* sensibles y resistentes a la oxacilina de personas viviendo con VIH/Sida (PVVS) el primer y séptimo día de estancia hospitalizar. **Método:** Estudio prospectivo observacional, realizado en un hospital del interior del Estado de São Paulo. Fueron recogidas y analizadas, mediante identificación microbiológica, muestras de *swab* nasal el primer y el séptimo día de estancia hospitalaria de PVVS, en el período de agosto/2011 a enero/2014. Se realizó el análisis de los datos mediante el IBM SPSS®, versión 20.0. **Resultados:** En 187 (50,1%) PVVS, fueron recogidas muestras de secreción nasal el primer y séptimo día de estancia hospitalaria. De esas, en 64 (34,2%) fue identificado *Staphylococcus aureus*. **Conclusión:** El primer día de estancia se observó 27 PVVS colonizadas por *Staphylococcus aureus*; en 27 PVVS hubo la persistencia de la colonización por *Staphylococcus aureus* el primer y el séptimo día; en 10 PVVS, solo el séptimo día. De las 64 PVVS colonizadas por *Staphylococcus aureus*, en 25 el perfil de susceptibilidad del *Staphylococcus aureus* aislado fue resistente a la oxacilina.

DESCRIPTORES

Infecciones por VIH; Hospitalización; Staphylococcus aureus; Oxacilina.

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