

Brief Report

High Prevalence of Nasopharyngeal Colonization by *Staphylococcus aureus* Among Children with HIV-1 Infection in Extreme Southern Brazil

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Summary

Objectives: To compare nasopharyngeal colonization between children with HIV-1 infection and those without HIV-1 infection, with special emphasis on nasopharyngeal carriage of *Staphylococcus aureus*. **Methods:** This hospital-based cross-sectional study was carried out in the Paediatric Day Hospital of a teaching hospital. Nasopharyngeal swabs were collected in 93 children aged up to 18 years old born to HIV-positive mothers (31 children with HIV-1 infection and 62 age-matched non-infected children). **Results:** The prevalence of nasopharyngeal colonization by *S. aureus* was higher among children with HIV-1 infection compared with those without HIV-1 infection (45.16% vs. 12.9%, $p = 0.001$). After adjusting all potential confounders, HIV-1 infection was an independent risk factor for nasopharyngeal colonization by *S. aureus*, with a prevalence ratio of 4.29 (95% confidence interval: 1.72–10.70). **Conclusion:** Children with HIV-1 infection had a higher prevalence of nasopharyngeal colonization by *S. aureus* than children without HIV-1 infection. Most of the isolated strains of *S. aureus* were methicillin-susceptible.

Key words: nasopharyngeal colonization, *Staphylococcus aureus*, *Streptococcus pneumoniae*, HIV, cross-sectional study.

Introduction

Patients infected with the Human Immunodeficiency Virus (HIV) have higher risk of invasive diseases caused by *Staphylococcus aureus* and *Streptococcus pneumoniae* [1–3]. The mechanism for this increased bacterial infection burden remains unknown, but the impaired mucosal immunosurveillance which allows persistent colonization has been postulated as one of the responsible factors [4]. A number of studies have been recently conducted to investigate nasopharyngeal colonization by *S. pneumoniae* in children with HIV infection [4–6]. These studies failed to demonstrate higher rates of nasopharyngeal carriage of

S. pneumoniae among these patients. However, to the best of our knowledge, only one study investigated nasopharyngeal carriage of *S. aureus* in HIV-1 positive children and showed higher carriage rate of this bacterium compared with HIV-1 negative children [7].

We conducted the present study to compare nasopharyngeal colonization between children with HIV-1 infection and those without HIV-1 infection, with special emphasis on nasopharyngeal carriage of *S. aureus*.

Methods

This hospital-based cross-sectional study was carried out in the Paediatric Day Hospital of the Federal University of Rio Grande, in the extreme south of Brazil, between March and October 2006. The study protocol was approved by the hospital ethic committee and written informed consent was obtained from the parent of each child.

Study population consisted of children aged up to 18 years old born to HIV-positive mothers who attended the Paediatric Day Hospital regularly.

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We include all 31 children infected with HIV-1. We recruited 2 controls for each index participant matched by age, and then 62 children without HIV-1 infection were included (power = 80%, α level = 0.05, for detecting a difference of 20% in the prevalence of nasopharyngeal colonization by *S. aureus*). The diagnosis of HIV-1 infection in children was based on the recommendation of the Brazilian Ministry of Health [8].

The same investigator (N.A.) interviewed the child's parent before specimen collection using a standardized questionnaire. The following data of the child were obtained: age, gender, race, family income, household size, presence of siblings younger than 5 year at the house, maternal smoking, use of day-care facilities, vaccination, antibiotic use in the last 30 days and hospitalization in the last 3 months.

Nasopharyngeal specimen was collected by the same investigator (N.A.) using a flexible calcium alginate swab. The swabs were streaked onto sheep blood agar, azide blood agar and mannitol salt agar plates and incubated aerobically at 37°C for 24 h. Colonies morphologically suggestive of *S. pneumoniae* and *S. aureus* were isolated and identified using optochin susceptibility and tube coagulase testing, respectively. Antibiotic susceptibility was performed by the disk-diffusion method. All laboratory procedures were performed according to National Committee for Clinical Laboratory Standards recommendations (NCCLS) [9].

Statistical analysis was carried out using the intercooled Stata 8.0 for Windows (Stata Corporation, College Station, TX, USA). Chi-square and Fisher's exact tests were used for categorical data and two-tailed unpaired Student's *t*-test was used for continuous data. The risk for nasopharyngeal colonization was estimated by prevalence ratio (PR). Poisson regression was used to calculate crude PR

and Poisson regression with robust variance was used to derive adjusted PR, controlling for the effects of the potential confounders.

Results

Table 1 shows characteristics of the study sample. The prevalence of nasopharyngeal colonization by *S. aureus* was higher among children with HIV-1 infection compared with those without HIV-1 infection (45.16% vs. 12.9%, $p = 0.001$), but no significant difference was found between the two groups in terms of the prevalence of nasopharyngeal colonization by *S. pneumoniae* (Fig. 1). After adjusting for all potential confounders, HIV-1 infection was an independent risk factor for nasopharyngeal

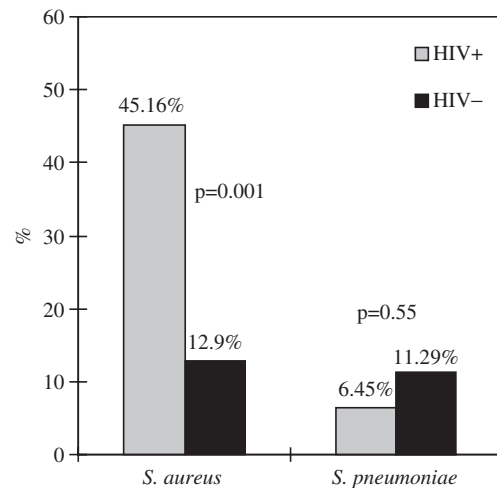


FIG. 1. Prevalence of nasopharyngeal colonization by *S. aureus* and *S. pneumoniae* among children with HIV-1 infection and those without HIV-1 infection.

TABLE 1
Characteristics of the study sample

Characteristics	HIV+ group (n = 31)	HIV- group (n = 62)	p-value
Age, year (mean, 95% CI)	8.20 (6.70–9.60)	6.91 (5.95–7.87)	0.13
Gender, male (%)	61.29	46.77	0.19
Race, white (%)	64.52	79.03	0.13
Presence of siblings <5 year at home (%)	50.00	46.77	0.77
Household size, persons (mean, 95% CI)	4.90 (4.16–5.65)	4.72 (4.24–5.21)	0.67
Monthly family income, R\$ ^a (mean, 95% CI)	489.35 (339.5–639.2)	477.13 (358.7–595.6)	0.89
Maternal smoking (%)	48.39	40.74	0.49
Use of prenatal care (%)	51.61	67.74	0.03
Use of antiretroviral drugs during pregnancy (%)	17.86	52.46	0.002
Hospitalization in the last 3 months (%)	3.23	0	0.33
Antibiotic use in the last 30 days (%)	9.68	0	0.04
Routine vaccination ^b (%)	100.00	100.00	–

^aR\$: Brazilian currency (real) which is currently equal to 0.58 US dollar.

^bRoutine vaccination: pneumococcal conjugate vaccine is not currently included in the routine infant vaccination schedule in Brazil.

TABLE 2
Association between HIV-1 infection and nasopharyngeal colonization by *S. aureus* and *S. pneumoniae*

Nasopharyngeal colonization	Crude PR (95% CI)	Adjusted PR (95% CI) ^a
<i>S. aureus</i>	3.50 (1.47–8.34)	4.29 (1.72–10.70)
<i>S. pneumoniae</i>	0.57 (0.12–2.75)	0.42 (0.13–1.33)

^aPR adjusted for child age, gender, race, use of day-care facilities, presence of siblings younger than 5 year at home, maternal smoking, family income, household size, antibiotic use in the last 30 days and hospitalization in the last 3 months.

colonization by *S. aureus*, with a PR of 4.29 [95% confidence interval (CI): 1.72–10.70] (Table 2).

Seven out of nine (77.78%) isolated strains of *S. pneumoniae* (two in the HIV+ group and seven in the HIV– group) were resistant to SMZ+TMP, but all of them were sensitive to the tested beta-lactamic antibiotics (penicillin G, amoxicillin, oxacillin and cephalosporins).

All of *S. aureus* strains identified in the 22 children (14 in the HIV+ group and 8 in the HIV– group) were methicillin-susceptible, except one in each group that was resistant to this antibiotic.

Discussion

This study demonstrated a significant higher prevalence of nasopharyngeal colonization by *S. aureus* among children with HIV-1 infection than those without HIV-1 infection (45.16% vs. 12.9%). After adjusting all potential confounders, children with HIV-1 infection had four times more chance of being colonized by *S. aureus* than those without HIV-1 infection. These results are similar to that reported by a previous study from South Africa in which 31.4% of HIV-1 positive children had nasopharyngeal carriage of *S. aureus* compared to 13.8% among HIV-1 negative children [7]. The clinical relevance of high-nasopharyngeal bacterial burden by *S. aureus* in children infected by HIV remains unclear. The above mentioned study showed that, among children with HIV-1 infection, *S. aureus* carriers had 77.4% increase in the rate of *S. aureus* bacteraemia compared to the non-carriers, however, that result did not reach statistical significance [7]. Low statistical power may have contributed to the negative result.

This study showed a lower rate of nasopharyngeal colonization by *S. pneumoniae* in children with HIV-1 infection than that reported by the previous studies [4–6]. We did not find any clinical or laboratory condition associated with this finding. A high-carriage rate of *S. aureus* and a low-carriage rate of *S. pneumoniae* in children with HIV-1 infection shown by this study may suggest the phenomenon of bacterial interference between two pathogens as reported in health children [7, 10, 11].

Among seven isolates of *S. pneumoniae*, six were resistant to SMZ+TMP, but all seven isolates were susceptible to penicillin G, amoxicillin and other beta-lactamics. The high rate of bacterial resistance to SMZ-TMP is probably related to previous exposure to this antibiotic during follow-up. All 22 strains of *S. aureus*, except one in each group, were methicillin-susceptible. This rate is higher than that reported by the study from South Africa [7]. Low rate of antibiotic use in the last 30 days and absence of hospitalization in the last 3 months may have contributed to higher methicillin-susceptibility of *S. aureus* in this group of patients.

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