Concise Communications

Nosocomial Infection Among Children With Symptomatic Human Immunodeficiency Virus Infection

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ABSTRACT

A prospective cohort study was conducted during a 15-month period to compare nosocomial infections (NIs) among pediatric patients without (n = 989) and with (n = 50) symptomatic human immunodeficiency virus (HIV) infection. Patients with symptomatic HIV infection presented higher overall NI incidence density rates (relative risk, 1.65; $P = .0001$), and may represent a population at high risk for the acquisition of NI (*Infect Control Hosp Epidemiol* 2002;23: 689-692).

As of September 1999, 5,778 cases of human immunodeficiency virus (HIV) had been reported among children 13 years or younger in Brazil, for a cumulative incidence of 117.6 cases per 100,000 population.[1] Individuals with advanced HIV infection or with acquired immunodeficiency syndrome (AIDS) may be more prone to nosocomial infections (NIs), given the underlying immunodeficiency, frequency of hospital admissions, increased length of stay, frequent use of invasive devices, and treatment with broad-spectrum antimicrobials.[2] Studies evaluating adults with HIV infection or AIDS have indicated that NIs are more frequent among these patients compared with adults not infected with HIV.[3-6] To the best of our knowledge, there are no published studies that have attempted to evaluate rates of NIs among symptomatic HIV-infected pediatric patients.

METHODS

Setting

The Instituto de Puericultura e Pediatria Martagão Gesteira is a 55-bed, pediatric university hospital. Since 1988, it has been an AIDS referral center to which children found to be HIV positive at other institutions in the city of Rio de Janeiro are referred.

Definitions and Diagnostic Criteria

The study period was defined as May 1, 1995, to July 31, 1996. All patients admitted to the Instituto de Puericultura e Pediatria Martagão Gesteira during the study period were included. NIs were classified by the Centers for Disease Control and Prevention definitions.[7] A case of symptomatic HIV infection was defined according to the 1994 Pan American Health Organization pediatric AIDS case definition,[8] and had to meet one of the following criteria:

1. Presence of at least one major sign: *Pneumocystis carinii* pneumonia, candidiasis of the esophagus, lymphoid interstitial pneumonitis, Kaposi sarcoma, or parotid hypertrophy.
2. Presence of two or more characteristic manifestations: recurrent bacterial and viral infections (two or more severe infections, such as sepsis, pneumonia, osteomyelitis, or meningitis) during a 2-year period; *Mycobacterium tuberculosis* disease (miliary or extrapulmonary); disseminated varicella zoster; disseminated *Cytomegalovirus* infection; or neurologic manifestations (developmental delay, progressive encephalopathy, microcephaly, or neuroradiographic abnormalities).
3. Presence of at least one characteristic manifestation and two or more associated signs, defined as oropharyngeal candidiasis, failure to thrive, prolonged fever for more than 1 month (intermittent or constant), generalized lymphadenopathy, hepatomegaly, or splenomegaly.
4. Presence of three or more associated signs and an epidemiologic risk factor, defined as being born to a mother who was HIV positive, used intravenous drugs, or had sexual contact with intravenous drug users or HIV-positive men; being a victim of sexual abuse; or having received blood or blood products before 1985.
5. Presence of HIV-positive serology and one characteristic manifestation or two or more associated signs.

Death was defined as related to NI according to the following criteria: (1) cause of death—the NI was not under control at the time of death or was under control but the consequences of infection were sufficient to cause death; (2) related to or associated with death—the underlying disease was directly responsible for the outcome, despite the existence and contribution of active infections; and (3) not related to death—the morbidity associated with the underlying illness was clearly more severe than the infectious process and capable of directly causing death.

Data Collection

Data on NI and HIV infection were prospectively collected through an active surveillance system conducted by members of the hospital infection control team, who visited each ward three times a week. All admitted patients were observed until discharge. Whenever HIV infection was suspected, standard serologic tests for HIV were performed (enzyme-linked immunosorbent assay and Western blot). Patients whose serologic status could not be ensured were excluded.

For each patient, the following variables were col-

TABLE 1
DISTRIBUTION OF DIAGNOSES AT ADMISSION AMONG 1,316 PATIENTS ADMITTED TO THE INSTITUTO DE PUERICULTURA E PEDIATRIA MARTAGÃO GESTEIRA, FEDERAL UNIVERSITY OF RIO DE JANEIRO, BRAZIL, FROM MAY 1, 1995, TO JULY 31, 1996

Diagnosis	Group I*	(%)	Group II†	(%)	P
Respiratory tract diseases	326	(21.5)	55	(31.7)	.002
Infectious diseases	261	(17.3)	21	(12.1)	.084
Neoplasias	142	(9.4)	6	(3.5)	.009
Gastrointestinal diseases	118	(7.8)	28	(16.1)	< .001
Bone, joint, and connective tissue diseases	106	(7.0)	—	—	< .001
Neurologic diseases	85	(5.6)	3	(1.7)	.030
Hematologic diseases	75	(5.0)	2	(1.2)	.022
Cardiovascular diseases	71	(4.7)	1	(0.6)	.011
Genitourinary diseases	65	(4.3)	2	(1.2)	.045
Skin and subcutaneous tissue diseases	62	(4.1)	5	(2.9)	.441
Dismorphologic and chromosomal diseases	57	(3.8)	—	—	.009
Endocrinologic, nutritional, and metabolic diseases	46	(3.0)	20	(11.6)	< .001
Ear and mastoid diseases	34	(2.2)	26	(15.0)	< .001
Eye diseases	4	(0.3)	—	—	—
Others	61	(4.0)	4	(2.4)	.563
Total	1,513	(100)	173	(100)	—

*Patients without symptomatic human immunodeficiency virus.
†Patients with symptomatic human immunodeficiency virus.

lected: gender, age, admission diagnoses, site of hospital infection, and dates of admission and discharge, date of transfer to another hospital, or date of death. For patients with symptomatic HIV, CD4 cell counts (at admission or in the previous 6 months) were also collected.

Data Analysis

All data were entered into Epi-Info software (version 6.04b; Centers for Disease Control and Prevention, Atlanta, GA). Categorical variables were analyzed using the chi-square or Fisher's exact test (two-tailed). The Student's *t* test or the Mann–Whitney test was used when appropriate. The NI mortality rate was calculated by dividing the number of patients with deaths related to NI by the total number of patient admissions during the study period and multiplying by 100.

RESULTS

Between May 1, 1995, and July 31, 1996, there were 1,316 hospital admissions among 1,039 patients. The distribution of diagnoses at admission is shown in Table 1. There were 1,228 admissions identified among 989 patients without symptomatic HIV infection (group I) and 88 among 50 patients with symptomatic HIV infection (group II) for a total of 19,726 patient-days. Of these, 1,832 were in group II (9.9%). The mean number of hospital admissions per patient was 1.24 for group I and 1.76 for group II (P = .002). The median age of the patients with symptomatic HIV infection was significantly higher (51 months [range, 39 days to 14 years] vs 37.8 months [range, 3 days to 16 years, 7 months]; P = .012). There was no difference in gender distribution between the two groups (54% of the patients in group I vs 53% of the patients in group II were male).

Among patients in group II, 36 (72%) were already known to be infected with HIV on admission. Serologic testing for HIV was performed among 235 patients with no prior diagnosis of HIV infection on admission. Twenty of these patients tested positive, with 14 fulfilling Pan American Health Organization criteria for symptomatic HIV infection during hospitalization.

NIs

There were 568 NIs, of which 486 occurred in group I (86.6%) and 82 in group II (14.4%). NIs occurred in 21.4% (263 of 1,228) of the admissions in group I and in 36.4% (32 of 88) of the admissions in group II (P = .001). The number of NIs per patient was also higher in group II (0.49 vs 1.64, respectively; P < .001). The median length of hospital stay prior to NI was 7 days for group I (range, 2 to 68 days) and 9 days for group II (range, 3 to 39 days) (P = .30).

The global cumulative incidences were 40.74 and 98.80 NIs per 100 discharges for groups I and II, respectively (P < .001). Overall incidence densities of NI were 27.15 and 44.76 NIs per 1,000 patient-days for groups I and II, respectively (relative risk, 1.65; 95% confidence interval [CI_{95}], 1.30 to 2.08; P = .0001). The incidence density of NI was higher in group II even after stratification for age, and for the following sites: digestive tract, oral cavity, and sinuses (Table 2). We performed a second analysis, excluding these three sites from both groups. In this second analysis, no significant difference in the incidence density was found between the two groups: 21.91 versus 27.29 NIs per 1,000

TABLE 2
INCIDENCE DENSITY OF NOSOCOMIAL INFECTIONS AMONG 1,316 PATIENTS WITH SYMPTOMATIC HUMAN IMMUNODEFICIENCY VIRUS AND WITHOUT SYMPTOMATIC HUMAN IMMUNODEFICIENCY VIRUS AT THE INSTITUTO DE PUERICULTURA E PEDIATRIA MARTAGÃO GESTEIRA, FEDERAL UNIVERSITY OF RIO DE JANEIRO, BRAZIL, FROM MAY 1, 1995, TO JULY 31, 1996

Site of NI	Incidence* (No.) Group I†		Group II‡		RR (CI_{95})	
Vascular	3.30	(59)	6.00	(11)	1.82	(0.96 to 3.47)
Bloodstream	3.74	(67)	4.91	(9)	1.31	(0.65 to 2.63)
Respiratory tract	6.87	(123)	6.55	(12)	0.95	(0.53 to 1.72)
Skin	4.25	(76)	6.00	(11)	1.41	(0.75 to 2.66)
Gastrointestinal	2.57	(46)	6.55	(12)	2.55	(1.35 to 4.81)
Oral cavity	2.40	(43)	9.27	(17)	3.86	(2.20 to 6.77)
Ear and mastoid	1.51	(27)	2.73	(5)	1.81	(0.70 to 4.70)
Sinuses	0.28	(5)	1.64	(3)	5.86	(1.40 to 24.52)
Eye	0.50	(9)	—		—	
Systemic	0.34	(6)	—		—	
Urinary tract	0.28	(5)	0.55	(1)	1.95	(0.23 to 16.72)
Central nervous system	0.22	(4)	—		—	
Myocarditis	—		0.55	(1)	—	
Surgical site	0.89	(16)	—		—	
Total	27.16	(486)	44.76	(82)	1.65	(1.30 to 2.08)

NI = nosocomial infection; RR = relative risk; CI_{95} = 95% confidence interval.
*No. of NIs per 1,000 patient-days.
†Patients without symptomatic human immunodeficiency virus, comprising a total of 17,894 patient-days.
‡Patients with symptomatic human immunodeficiency virus, comprising a total of 1,832 patient-days.

patient-days for groups II and I, respectively (relative risk, 1.25; CI_{95}, 0.93 to 1.67; $P = .14$).

Laboratory-confirmed bloodstream infection constituted 38.2% (29 of 76) of the bloodstream infections with similar distributions among the two groups (group I, 26 of 67; group II, 3 of 9). Gram-negative bacilli were the most commonly isolated pathogens (24 of 31).

Characteristics Related to HIV Infection

The route of HIV acquisition among the 50 patients with symptomatic HIV was perinatal in 39 (78%) and blood transfusion in 5 (10%); in 6 patients (12%), the route of acquisition could not be determined. Seventy-eight (88.6%) symptomatic HIV admissions occurred among children with signs or symptoms of severe immunodeficiency.[9] Severe CD4 lymphopenia was present in 62% of these admissions, ranging from 0% to 17% (median, 4%). Absolute numbers of CD4 cells ranged from 0 to 460 cells/mm^3 (median, 128 cells/mm^3). No significant association was found between CD4 counts and NI presentation in this group.

Outcome

The median length of hospital stay was 10 days (range, 1 to 210 days) for group I and 14 days (range, 1 to 122 days) for group II ($P = .03$). For those patients who acquired NI, the hospital stay was longer in both groups (8 vs 22 days for group I, $P < .001$; 9 vs 26.5 days for group II, $P < .001$). Death occurred in 34 (2.8%) of the admissions in group I and in 12 (13.6%) of the admissions in group II ($P < .001$). NIs were considered to be the cause of death in 6 patients in group I (3 pneumonia and 3 primary bloodstream infection) and 2 patients in group II (1 gastrointestinal and 1 bloodstream infection). NIs were indirectly related to death in 1 patient with primary bloodstream infection (group I) and 1 patient with gastrointestinal infection (group II). The mortality rate related to NI was 0.57% in group I and 3.41% in group II (relative risk, 5.98; CI_{95}, 1.57 to 22.73; $P = .025$).

DISCUSSION

A new hospital population has emerged following the HIV epidemic. This population may be at higher risk for infections related to the process of care, which can eventually worsen outcome.[2] A similar association has been reported among adult patients infected with HIV.[3-6] The clinical manifestations of symptomatic HIV infection, and possibly the epidemiology of NIs, in children are different from those in adults.

The symptomatic HIV group had 2.2 times more frequent NI than did the non-symptomatic HIV group. Similar results have been shown in studies involving adults.[3,4] In the current study, the duration of hospitalization prior to the acquisition of NI was similar to that described by others[10] and did not differ between the two groups. The three NIs for which patients in group II were at higher risk (gastrointestinal, oral, and sinusitis) are frequent community-acquired diseases among HIV-infected pediatric patients and their incidence as NI might reflect the natural history of AIDS.

Mortality related to NI was higher among patients

with symptomatic HIV, in accordance with other studies in adults.[5] This finding may suggest that patients with symptomatic HIV could progress more often to death. In terms of length of stay, patients who had NI in both groups had a significantly more prolonged stay. However, it should be emphasized that outcome assessment did not control for possible confoundings.

Patients with symptomatic HIV may be at higher risk for NIs and their complications. Advanced anti-retroviral treatment approaches have modified the natural history of HIV infection. A limitation of the current study is that these newer approaches were not available in our institution at the time the study was conducted. Another important limitation is that, because of the small sample size, the study might not have had the power to detect significant differences in NI rates in sites other than those possibly related to the natural history of HIV infection. Nonetheless, delineating the epidemiology of NIs among pediatric patients with symptomatic HIV may be a useful tool for future preventive measures and control of NI in this population.

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Chlorhexidine Resistance in Antibiotic-Resistant Bacteria Isolated From the Surfaces of Dispensers of Soap Containing Chlorhexidine

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ABSTRACT

Bacterial contamination with pan-resistant *Acinetobacter* and *Klebsiella*, multidrug-resistant *Pseudomonas*, and methicillin-resistant *Staphylococcus aureus* (MRSA) was noted on the surfaces of dispensers of hand soap with 2% chlorhexidine. Gram-negative isolates could multiply in the presence of 1% chlorhexidine. In contrast, MRSA was inhibited in vitro by chlorhexidine at concentrations as low as 0.0019% (*Infect Control Hosp Epidemiol* 2002;23:692-695).

The contamination of dispensers of non-medicated soap has been associated with an increased risk of hand carriage with the contaminating microorganism.[1] We describe the surface contamination of dispensers containing germicidal soap with microorganisms, some of which were resistant to the germicidal agent and to most antibiotics.

METHODS

As part of an investigation into mechanisms of potential transmission of pan-resistant *Acinetobacter*, swabs for culture were collected from the surfaces of wall-mounted dispensers that contained hand soap with 2% chlorhexidine.

A total of 28 soap dispensers had specimens obtained for culture from a variety of clinical and support areas, including patient rooms (20), pantries (3), utility rooms (3), and staff bathrooms (2). No samples were collected from the operating room scrub sinks because these units employed a foot pedal dispenser.

The dispensers were plastic, rectangular, wall-mounted units with a push button for dispensing. The germicidal soap was contained in pre-filled disposable bags supplied by the manufacturer, which are discarded and replaced when empty. No other soap was used in these dispensers. The dispensers were scheduled to be cleaned weekly, but the significant amount of soap residue found on their underside near the dispensing orifice and in crevices around the dispensing button raised questions about the effectiveness of the cleaning process.

A single sterile swab moistened with sterile saline was used to sample both the area around the soap dispenser button and the underside near the dispensing orifice. These were areas that could contain a residue of moist soap and were areas of hand contact during the process of dispensing the product. No data were collected on the specific bacterial flora at each site of the dispenser; rather, the culture results represent a composite of flora at both sites. No hand cultures of staff were performed as part of this study.