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Pediatric Injuries From Needles Discarded in the Community: Epidemiology and Risk of Seroconversion

Jesse Papenburg, MD<sup>a,b</sup>, Denis Blais, BScN<sup>c</sup>, Dorothy Moore, MD, PhD<sup>d</sup>, Mohammed Al-Hosni, MD<sup>e</sup>, Céline Laferrière, MD<sup>d</sup>, Bruce Tapiero, MD<sup>c</sup>, Caroline Quach, MD, MSc<sup>a,b</sup>

<sup>a</sup>Infectious Diseases Division, Department of Pediatrics, and <sup>b</sup>Department of Microbiology, Montreal Children’s Hospital, McGill University Health Centre, Montreal, Quebec, Canada; <sup>c</sup>Infectious Diseases Division, Department of Pediatrics, and <sup>d</sup>Department of Microbiology, Hôpital Sainte-Justine, University of Montreal, Montreal, Quebec, Canada

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### What’s Known on This Subject

Although anxiety exists concerning the perceived risk of transmission of bloodborne viruses after community-acquired needlestick injuries, seroconversion seems to be rare.

### What This Study Adds

We report the largest cohort monitored for HIV, HBV, and HCV seroconversion after a community-acquired needlestick injury, providing the first North American data from which to estimate the risk of transmission of bloodborne viruses in these injuries.

### ABSTRACT

**OBJECTIVES.** Although anxiety exists concerning the perceived risk of transmission of bloodborne viruses after community-acquired needlestick injuries, seroconversion seems to be rare. The objectives of this study were to describe the epidemiology of pediatric community-acquired needlestick injuries and to estimate the risk of seroconversion for HIV, hepatitis B virus, and hepatitis C virus in these events.

**METHODS.** The study population included all of the children presenting with community-acquired needlestick injuries to the Montreal Children’s Hospital between 1988 and 2006 and to Hôpital Sainte-Justine between 1995 and 2006. Data were collected prospectively at Hôpital Sainte-Justine from 2001 to 2006. All of the other data were reviewed retrospectively by using a standardized case report form.

**RESULTS.** A total of 274 patients were identified over a period of 19 years. Mean age was 7.9 ± 3.4 years. A total of 176 (64.2%) were boys. Most injuries occurred in streets (29.2%) or parks (24.1%), and 64.6% of children purposely picked up the needle. Only 36 patients (13.1%) noted blood on the device. Among the 230 patients not known to be immune for hepatitis B virus, 189 (82.2%) received hepatitis B immunoglobulin, and 213 (92.6%) received hepatitis B virus vaccine. Prophylactic antiretroviral therapy was offered beginning in 1997. Of the 210 patients who presented thereafter, 82 (39.0%) received chemoprophylaxis, of whom 69 (84.1%) completed a 4-week course of therapy. The use of a protease inhibitor was not associated with a significantly higher risk of adverse effects or early discontinuation of therapy. At 6 months, 189 were tested for HIV, 167 for hepatitis B virus, and 159 for hepatitis C virus. There were no seroconversions.

**CONCLUSIONS.** We observed no seroconversions in 274 pediatric community-acquired needlestick injuries, thereby confirming that the risk of transmission of bloodborne viruses in these events is very low. *Pediatrics* 2008;122:e487–e492

**COMMUNITY-ACQUIRED NEEDLESTICK INJURIES (CA-NSIs) are an emerging phenomenon with important public health implications. The incidence of CA-NSI is thought to parallel those of illicit injection drug use and the inappropriate disposal of used needles and syringes.**<sup>1-3</sup> Children may be particularly at risk for CA-NSI because of manipulation of discarded needles and syringes.

The perceived risk of transmission of bloodborne viruses, including HIV, hepatitis B virus (HBV), and hepatitis C virus (HCV) after a needlestick can cause considerable anxiety and distress in both parent and child. In Canada, the prevalences of HIV, HBV, and HCV infections in the general population are estimated to be ~0.18%,<sup>4</sup> 2.00%,<sup>5</sup> and 0.80%,<sup>6</sup> respectively.

Prevalences for HIV, HBV, and HCV are known to be considerably higher in injection drug users (IDUs). The seroprevalences of these viruses in IDU in Montreal have been reported recently to be 16%, 48%, and 65%,
respectively. Approximately 16% of this population is coinfected with HIV and HCV. In 1998, there was estimated to be ~10,000 IDUs in Montreal. The risks of seroconversion surrounding occupational needlestick injuries have been studied, and guidelines regarding the management of such injuries exist. However, published North American data on pediatric CA-NSI are limited to 2 cases of such injuries. With this study, we sought to describe the epidemiology and risk of seroconversion in pediatric CA-NSI.

**METHODS**

**Study Setting**

Montreal is an economically and culturally diverse urban center. Its metropolitan area has a population of ~3.6 million people, an estimated 20% (720,000) of whom are children aged ≤18 years. The area is served by 2 university-affiliated pediatric tertiary care hospitals: the Montreal Children’s Hospital (MCH) and Hôpital Sainte-Justine (HSJ). Therefore, the vast majority of children with CA-NSIs that occur in the greater Montreal area are seen in these 2 centers.

**Study Population**

Pediatric patients aged 0 to 18 years with a CA-NSI were studied. At MCH, case subjects were identified using a prospective registry of all of the CA-NSIs and the infectious disease clinic records, because the Division of Infectious Diseases follows all of the patients presenting to the emergency department with this type of injury. At HSJ, cases were identified using the emergency department registration records and a prospective registry of all of the CA-NSIs. CA-NSI was defined as any injury that occurred outside of a medical setting with a needle potentially contaminated with blood.

**Study Design**

This is a case series describing CA-NSI in children identified at the 2 pediatric tertiary care teaching hospitals in Montreal. A retrospective chart review was performed for patients presenting from 1988 to 2006 at MCH and from 1995 to 2000 at HSJ. Data were collected prospectively from 2001 to 2006 at HSJ. Standard data extraction sheets were used to collect the following variables: patient demographics (date of birth, gender, and postal code of residence), description of the injury (type of device, presence of blood on the device, bodily site of injury, bleeding at the site of injury, and location where the injury took place), circumstances surrounding the injury, prophylaxis offered (HIV chemoprophylaxis, HBV vaccine, and hepatitis B immunoglobulin [HBIG]), laboratory and clinical adverse effects of antiretroviral prophylaxis, patient’s baseline HBV vaccination status, and follow-up serology test results (HIV, HBV, and HCV) 6 months after the injury.

Protocols for the management of CA-NSI were established in 1991 at MCH and in 2001 at HSJ. HBIG and HBV vaccines were offered in the emergency department when appropriate. Baseline blood samples were drawn on which serologies would be performed only if later tests for hepatitis B surface antigen or HIV were positive. HCV testing was added in 1995. As of 1997, the option of antiretroviral chemoprophylaxis was also included, based on the treating physician’s HIV risk assessment of the needlestick injury. The prophylactic regimen suggested was a 28-day course of lamivudine (3TC) and zidovudine (AZT), with the potential addition of a protease inhibitor (PI) such as nelfinavir or lopinavir/ritonavir. Patients who were prescribed antiretroviral agents had the following blood tests done at baseline and 2, 4, and 6 weeks: complete blood cell count with differential, aspartate aminotransferase, alanine aminotransferase, alkaline phosphatase, serum urea nitrogen, creatinine, and amylase. All of the patients were subsequently referred to the infectious disease clinic for completion of HBV vaccination (if required); monitoring for antiretroviral toxicity (if indicated); serologic testing for HIV at 6 weeks, 3 months, and 6 months after the injury, and serologic testing for HBV (if indicated) and HCV at 6 months after the injury.

**Statistical Analysis**

Descriptive statistics (mean, median, and standard deviation), relative risk with 95% confidence interval (CI), and t test were used for univariate analysis (SAS 8.0 [SAS Institute, Cary, NC]).

**RESULTS**

We identified 274 pediatric patients with CA-NSI between 1988 and 2006 (Fig 1). The average number of CA-NSIs per year from 2003 to 2006 was lower than the average per year over the preceding 5 years (27.0 vs 18.8; P = .03). A total of 118 patients were treated at HSJ (60.6%) and the remainder at MCH. Patient age ranged from 1.0 to 17.7 years, with a mean (± SD) of 7.9 years (± 3.4) and a median of 7.3 years (Fig 2). A total of 176 patients (64.2%) were boys. Most injuries occurred in a street or alley (29.2%) or in a park (24.1%), and 64.6% of the patients had purposely picked up the needle (Tables 1 and 2). The majority of patients (73.4%) sought medical attention on the day of the injury. Blood was reported on the needle or syringe in only 36 cases.
The most common site of injury was a hand (71.9%). Seventy-one patients (25.9%) reported an injury that bled. Among the 230 patients who were not known to be HBV immune, 213 (92.6%) received 1 dose of HBV vaccine, and 189 (82.2%) received HBIG. Of those 213 patients who were vaccinated with 1 dose of HBV vaccine, 169 (79.3%) completed the series of 3 doses during their follow up in our clinics.

Antiretroviral chemoprophylaxis was available as of 1997. In the 210 patients who presented thereafter, an offer of prophylaxis to 87 patients (41.4%) was documented, and 82 (94.3%) of these patients accepted (Fig 3). Prophylaxis was of 4 weeks duration and consisted of zidovudine and lamivudine. Prophylaxis was generally well tolerated, with gastrointestinal symptoms being the most common adverse effect (Table 3). Only 4 patients (4.9%) discontinued the regimen because of adverse effects (Fig 3). However, an additional 6 children (7.3%) discontinued the medications for unspecified reasons. The incidence of clinical adverse effects or laboratory toxicity was similar in those who were prescribed a PI in their chemoprophylaxis regimen (50%) compared with those who were not (36.5%), with a relative risk for any adverse effect of 1.37 (95% CI: 0.64–2.92). Moreover, the incidence of early discontinuation of antiretroviral chemoprophylaxis was also similar in the 2 groups (12.5% vs 16.2%) with a relative risk of 0.77 (95% CI: 0.11–5.18). Both groups were similar in mean age (9.2 vs 8.2 years; \( P = .54 \)) and gender distribution (62.5% male vs 63.5% male).

Follow-up serologic results at 6 months for HBV, HCV, and HIV were available for 167 (72.6% of nonimmune patients), 159 (67.7% of patients presenting after HCV testing available), and 189 patients (69.0%), respectively. There were no seroconversions 6 months after the injury. Sixty-eight patients (24.8%) were lost to follow-up.

**DISCUSSION**

We describe the largest reported cohort monitored for HIV, HBV, and HCV seroconversion after a CA-NSI. We did not detect any cases of infection with bloodborne viruses. Our results are consistent with previous European,\(^2,17–23\) Australian,\(^24,25\) and South African\(^26\) reports that did not identify any seroconversions among their patients. Although pediatric CA-NSI can raise considerable anxiety in parents and children regarding the possibility of contracting bloodborne pathogens, our study confirms that the risk is low.

Most guidelines concerning CA-NSI\(^27–30\) suggest management plans that are mainly extrapolated from data on the risks of seroconversion after occupational needlestick injuries in health care workers. However, needlestick injuries that occur in the community are a separate entity and likely carry a considerably smaller risk of transmission of HIV, HBV, and HCV. Needles found in the community have been exposed to environmental temperatures and drying for an indeterminate period of time. Moreover, as seen in our study, most of these injuries are superficial (only 26% of patients reported any bleeding on their part) and rarely involve a device with blood visible on the needle or syringe (13%). Although the risk of seroconversion may be small, it remains a possibility. We observed no seroconversions; yet, this 0 numerator does not mean zero risk. In the event of a 0 numerator, one can estimate the upper 95% confidence limit of risk by using Hanley and Lippman-Hand’s “rule of three,”\(^31\) where the approximation of risk is \(3/n\). If \(n\) is the number of serologic results collected at 6 months for HIV, HBV, and HCV, then the respective estimated maximal risks of transmission of these viruses would be 1.6%, 1.8%, and 1.9%, respectively.

It is also noteworthy that hepatitis B surface antigen and HCV RNA have been detected in syringes discarded
in parks and playgrounds.\textsuperscript{23,32} Despite the fact that HIV is a more fragile virus and is particularly susceptible to drying and higher temperatures,\textsuperscript{33} HIV DNA and RNA have been detected in discarded needles and syringes at shooting galleries.\textsuperscript{34,35} Whether the recovery of viral nucleic acid sequences or proteins equates the potential for transmission remains unclear.

There are currently 2 reported incidents of blood-borne viral infections thought to be secondary to a CA-NSI, both from Barcelona, Spain. One, a case of presumed acute HBV infection in a 4-year-old boy,\textsuperscript{36} and the other, a case of HCV seroconversion, viremia, and hepatitis in a 64-year-old woman.\textsuperscript{37} At this time, no HIV infections have been reported after a CA-NSI.

Theoretical benefit in risk reduction that is achieved by adding a PI to the basic regimen of 2 nucleoside analogues must be balanced against the potential for increased toxicity and decreased adherence.\textsuperscript{38,39} We did not observe a significantly higher rate of adverse effects or early discontinuation of medications in our patients who were prescribed antiretroviral prophylaxis with zidovudine, lamivudine, and a PI compared with those who were prescribed only zidovudine and lamivudine. However, the number of patients who were prescribed a PI was small.

Eighty-four percent of our patients were not previously immune to HBV. This is in keeping with the fact that our patients tended to be quite young, with a mean age (7.9 years) that is lower than the age at which the HBV vaccine is administered (9–10 years) as part of the routine vaccination schedule in the province of Quebec. Among these seronegative patients, 7% did not receive ≥1 dose of HBV vaccine, and 18% did not receive HBIG. Suboptimal prophylaxis was because of physician failure, patient dropout, or late presentation.

Two thirds of our CA-NSI injuries occurred in children who purposely handled needles rather than from accidental contact. This clearly shows that the majority of pediatric CA-NSIs can be prevented. It is also important to note that 27% of our events occurred in areas that should be considered safe: in and around the home, day care, or school. Educating young children and their parents about the risks of handling discarded needles can, therefore, be an important preventive intervention.

To minimize CA-NSI in children, the number of discarded needles must also be reduced through the prevention and treatment of intravenous drug addiction, public health programs offering safe needle disposal and needle exchange, the availability of appropriate disposal containers in parks and public places, and community projects to clean up parks and playgrounds. From 2003, we observed an apparent decrease in the number of CA-NSIs per year. This coincided with the implementation of a park clean-up and needle retrieval program in Montreal.\textsuperscript{1}
CONCLUSIONS
We observed no seroconversions for HIV, HBV, and HCV in 274 pediatric CA-NSIs, thereby confirming that the risk of transmission of bloodborne viruses in these events is very low.

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