Community-acquired needle stick injuries in Canadian children: Review of Canadian Hospitals Injury Reporting and Prevention Program data from 1991 to 1996

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OBJECTIVE: To review community-acquired needle stick injuries (CANSIs) in children reported to a Canadian emergency room-based injury surveillance program.
DESIGN: Analysis of 1991 to 1996 CANSI records followed by chart review to determine use of prophylactic interventions and outcome information.
SETTING: The Canadian Hospitals Injury Reporting and Prevention Program network of 10 paediatric and six general hospitals.
PATIENTS: Nonoccupational injuries to patients younger than age 20 years involving used needles were reviewed.
MAIN RESULTS: Of 116 children injured, most were male (74%); the median age was 6.6 years. Needles were picked up before injury in 77% of the cases. Most injuries (78%) were from needles presumed to have been discarded by an injection drug user. Parks were the most common site of injury (21%). Six per cent of injuries occurred in medical settings. Treatment information was obtained for 71 (61%) patients. Only 1.7% had been immunized against hepatitis B virus before injury. Hepatitis B immune globulin and hepatitis B virus vaccine were given to 78% and 76% of children, respectively. None received human immunodeficiency virus prophylaxis.
CONCLUSIONS: Programs teaching needle avoidance may help prevent many CANSIs. The safety of outdoor, home and medical environments also needs to be ensured. Treatment guidelines for CANSIs will help ensure appropriate postinjury management.

Key Words: *Children; Community-acquired needle stick injury; Needle stick injury*

Des blessures d'aiguille dans la collectivité à des enfants canadiens : Examen des déclarations de blessures dans des hôpitaux canadiens et données des programmes de prévention entre 1991 et 1996

OBJECTIF : Examiner les blessures d'aiguille dans la collectivité (BAC) à des enfants canadiens, déclarées à un programme de surveillance canadien établi dans les salles d'urgence.
MÉTHODOLOGIE : Analyse des dossiers de BAC entre 1991 et 1996, suivie d'un examen des dossiers pour colliger les interventions prophylactiques privilégiées et l'information sur l'état définitif de l'enfant.
EMPLACEMENT : Le réseau du programme de prévention et de déclaration des blessures dans les hôpitaux canadiens, composé de dix hôpitaux pédiatriques et de six hôpitaux généraux.
PATIENTS : Les blessures non professionnelles de patients de moins de 20 ans causées par des aiguilles usagées ont été passées en revue.
PRINCIPAUX RÉSULTATS : Des 116 enfants blessés, la plupart étaient de sexe masculin (74 %), et leur âge moyen était de 6,6 ans. Dans 77 % des cas, les aiguilles ont été ramassées avant la blessure. La plupart des blessures (78 %) provenaient d'aiguilles présumément jetées par un utilisateur de drogues injectables. Les parcs représentaient le principal lieu de blessure (21 %). Six pour cent des blessures ont eu lieu en milieu médical. On a obtenu l'information relative au traitement pour 71 (61 %) patients. Seulement 1,7 % des enfants avait été vacciné contre l'hépatite B avant la blessure. De l'immunoglobuline anti-hépatitique B et le vaccin anti-hépatitique B ont été administrés à 78 % et 76 % des enfants, respectivement. Aucun n'a reçu de traitement prophylactique contre le virus d'immunodéficience humaine.
CONCLUSIONS : Des programmes apprenant à éviter les aiguilles pourraient contribuer à prévenir bien des BAC. Il faut également garantir la sécurité des milieux extérieurs, domiciliaires et médicaux. Les directives de traitement des BAC contribueront à garantir une meilleure prise en charge après une piqûre d'aiguille.

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Needle stick injuries have received much attention in recent years due to the risk of transmission of hepatitis B virus (HBV), hepatitis C virus (HCV) and human immunodeficiency virus (HIV) by this route (1,2). The epidemiology and management of these injuries in the occupational setting have been well described (3,4), but much less is known about community-acquired needle stick injuries (CANSIs). These injuries lead to a great deal of anxiety for those injured and their families (5,6).

The Canadian Paediatric Society has recently prepared a position statement to aid management of the injured child (7), but the circumstances surrounding CANSIs in Canadian children have not been described. We therefore reviewed needle stick injuries reported to the Canadian Hospitals Injury Reporting and Prevention Program (CHIRPP) surveillance network (8).

PATIENTS AND METHODS

CHIRPP database review: Needle stick injury data were extracted from the CHIRPP database for a six-year period from 1991 to 1996, using both the numerical code for these injuries and a text word search. Information in the database had been entered from standard questionnaires completed at the time of injury by caregivers or the child, if old enough, and physicians in the emergency rooms of participating hospitals. The CHIRPP network comprises the 10 paediatric hospitals in Canada and five general hospitals; these are located in seven Canadian provinces and in one territory, and include most major Canadian urban centres.

Injuries were included in the analysis if the injured person was younger than age 20 years, the injury was not work-related and the needle had been used by someone other than the injured person. Variables in the CHIRPP database included age, five-year age groups, sex, environmental location where injury occurred, body part injured and a short free text description of how the injury occurred.

Two new variables, mechanism of injury and risk group, were created using the text descriptions. The mechanism of injury groups used were child picked up a needle; child was injured by another person who had picked up a needle; needle present in the environment and not seen before injury; and mechanism not stated or unclear. The risk groups were high risk, when the needle was presumed or stated to have been used by either an intravenous drug user (IDU) or person infected with HBV, HCV or HIV; intermediate risk, when the injury occurred in medical settings such as doctors' offices; low risk, when the needle had been used for insulin injection and the previous user of the needle was known; and unknown risk. The information available did not allow the assessment of risk to incorporate some previously described risk factors, such as visible blood on the needle or the depth of penetration of the needle into the child (4).

Chart review: Information regarding prophylactic interventions for HBV and HIV, and outcome information regarding whether infection with these viruses or HCV occurred as a result of injury was sought by chart review and was recorded on standard forms. CHIRPP sites were asked to review the available hospital and clinic records of those injured to determine HBV immunization status before injury; use of postexposure prophylaxis for HBV with hepatitis B immune globulin (HBIG) and/or HBV vaccine,

TABLE 1: Age group and sex distribution of patients with needle stick injuries and patients seen for injuries of all kinds, CHIRPP data from 1991 to 1996

Age group (years)	Number of needle stick injuries	Needle stick injuries/100,000 injuries of all kinds	Percentage of males among patients with needle stick injuries	Percentage of males among patients with injuries of all kinds
0 to 4	28	16	68	57
5 to 9	66	52	82	59
10 to 14	19	13	58	61
15 to 19	3	5	50*	63
Total	116	23	73	59

**Sex was unknown for one patient in this age group. CHIRPP Canadian Hospitals Injury Reporting and Prevention Program*

TABLE 2: Mechanisms of needle stick injury by age group, CHIRPP data from 1991 to 1996 (expressed as percentage of all injuries in age group)

	Age group (years)			
Mechanism	0 to 4 (n=28)	5 to 9 (n=66)	10 to 19 (n=22)	Total (n=116)
Picked up needle	68	71	54	67
Stuck by other person	4	8	23	10
Needle not seen before injury	25	9	14	14
Not stated	4	12	9	10

Column totals may exceed 100% due to rounding. CHIRPP Canadian Hospitals Injury Reporting and Prevention Program

TABLE 3: Needle stick injury locations by age group, CHIRPP data from 1991 to 1996 (expressed as percentage of all injuries in age group)

	Age group			
Location	**0 to 4 (n=28)**	**5 to 9 (n=66)**	**10 to 19 (n=22)**	**Total (n=116)**
Outdoors	46	80	64	69
Park	18	27	9	22
Street or parking lot	11	24	23	21
Home (own or other's)	7	15	9	12
School playground	0	6	9	5
Beach	4	3	0	3
Other or not specified	7	5	14	7
Indoors	39	9	18	18
Home (own or other's)	21	3	9	9
Doctor's office or other medical setting	18	3	0	6
Other or not specified	0	3	9	3
Not specified out or indoors	14	11	18	13
Own home	11	0	5	3
Daycare or school	0	5	5	3
Unknown	4	6	9	6

Column totals may exceed 100% due to rounding. CHIRPP Canadian Hospitals Injury Reporting and Prevention Program

and for HIV with anti-HIV medications; the place where any subsequent HBV vaccine doses were provided; reasons for not using prophylactic measures; and any occurrence of HBV, HCV or HIV infection following injury.

For statistical analysis, χ^2 or Fisher's exact tests were used to compare proportions, with $P<0.05$ chosen as the level of significance.

RESULTS

CHIRPP database review: One hundred and eighteen cases from 14 of the 16 hospitals met the inclusion criteria. Subsequently, two injuries due to sterile needles were excluded based on additional information obtained from the chart review, and thus 116 records were analyzed. On average, 19.3 needle stick injuries/year were reported during the six years. CANSIs accounted for 0.02% of all injuries to patients younger than age 20 years reported to CHIRPP during the study period.

The age range of the injured children was 0.8 to 16.9 years, with a median age of 6.6 years. Due to the small number of injuries in the 15- to 19-year-old age group (3), this group was combined with the 10- to 14-year-old group in subsequent analyses. Males accounted for 73% of cases. The excess of males in the group of patients with needle stick injuries was greater than that usually seen in CHIRPP data and was particularly marked among five- to nine-year olds, where 82% of the patients were male (Table 1).

Five- to nine-year olds had the highest frequency of needle stick injuries relative to all injuries in the age group (Table 1). The relative frequency for this age group was four times greater than the combined relative frequency of the other age groups.

The majority of injuries (78%) were classified as high risk. Nearly all of the injuries involved discarded needles presumed to have been used by an IDU. Two cases involved a needle belonging to a known IDU, and one case involved a source said to be HIV positive. Six per cent of the injuries were classified as intermediate risk; these occurred in settings such as doctors' offices when used needles were not disposed of properly (eg, a needle was left out in the room or the sharps box was accessible to the child). Twelve per cent were felt to be low risk injuries, and 3% were of unknown risk.

High risk injuries were less common in younger children: 50% of the injuries in those younger than five years of age and 88% of all injuries among those five years of age or older were high risk ($P<0.0001$). Conversely, intermediate risk injuries were relatively more important for younger children. Eighteen per cent of injuries in children younger than five years of age, compared with only 2% in those five years of age or older, occurred in medical settings ($P<0.01$).

Seventy-seven per cent of the injuries involved the needle being picked up, with the needle being handled by the injured child in 67% and by another person in 10% of the cases (Table 2). The importance of picking up needles as a mechanism of injury appeared to decline with increasing age (70% of injuries were of this type in children younger than 10 years of age versus 55% in those 10 years of age or older), but this difference was not statistically significant.

The environmental location of injuries by age group is shown in Table 3. The majority of injuries occurred outdoors (69%). Outdoor injuries were significantly more common in children five years of age or older (76% versus 46%, $P<0.01$). Parks were the most frequent site, followed closely by streets and parking lots, and outdoor sites adjacent to the child's home or another home, such as yards.

Hand injuries accounted for 71% of all needle stick in-

juries. Two children who put needles in their mouths had mucosal injuries, and all other injuries were percutaneous.

Chart review: Chart review forms were returned for 71 children (61% response rate) from nine of 15 sites (60%). Children whose charts were and were not reviewed did not differ in terms of age, sex, risk or mechanism of injury distribution.

***Initial management*:** Regarding HBV vaccine status, only two children (1.7%) of those injured had been fully immunized with three doses of HBV vaccine before injury. Another two children had each received two doses of vaccine.

HBIG was known to have been given to 78% of children postinjury and HBV vaccine to 76% of children postinjury. Seventy-three per cent received both HBIG and HBV vaccine.

HBIG was given more often for high risk injuries (81%) than for low risk injuries (33%) ($P<0.05$), as was HBV (80% versus 33%, $P<0.05$). All three intermediate risk children for whom information was available received both HBIG and HBV vaccine. The most commonly cited reasons for not giving either HBIG or HBV vaccine were that the child was felt to be at no or extremely low risk of infection from the injury based on evaluation in the emergency room.

A complete HBV vaccine series was recommended in the emergency room for 56% of the unimmunized children. The planned sites for subsequent immunizations were hospital clinics (57%), family physicians' offices (25%) and paediatricians' offices (18%).

None of the children received antiretroviral medications for HIV prophylaxis.

***Patient follow-up*:** Because charts were reviewed at the hospital and follow-up often occurred in other settings, such as physicians' offices or public health clinics, the information obtained was limited. The hepatitis B vaccine series was known to have been completed in 59% of cases and not completed in 4%; however, it was not known whether the series was completed for 37% of the children.

Similarly, serological tests to determine whether infection occurred were available from the chart in less than 50% of cases (42% had follow-up test results available for HIV, 38% for HBV and 18% for HCV). None of these tests were positive. Again, serological follow-up may have been performed elsewhere in many instances.

DISCUSSION

Several findings of the present review were similar to those from other sites (9-11), including the predominance of young school-aged males among those injured. Reasons for this may include disproportionate exposure to discarded IDU needles through play in outdoor sites and a lack of understanding regarding the risks of handling these needles, relative to females and to other age groups.

Regarding injury mechanism, the large proportion of injuries (77%) involving the child either picking up a needle or being stuck by another child was also noted in a review from Dublin, Ireland (10), where the two mechanisms led to 87% of injuries. This suggests that the majority of injuries might be preventable if children could be taught not to handle needles.

The specific environmental locations where injuries occurred were also similar to those reported by others. Parks, followed by streets, were the most frequent sites noted Dublin, Ireland (10) and Edinburgh, Scotland (11). In a review of 958 adult patients given HBIG in England and Wales for out of hospital needle sticks (12), the most common injury site was "in the street", followed in order by "from contact with rubbish", "in the park" and "on the beach".

Although few in number, the occurrence of injuries in young children at physicians' offices was nevertheless an unexpected and disturbing finding. Attention clearly needs to be paid to "kiddie proofing" in these settings, with used needles being safely disposed of as recommended (1). Puncture-resistant sharps containers should be emptied frequently and kept well out of reach of young patients. Container lids should be tightly sealed, and openings should be checked to make sure small fingers and hands cannot enter.

Regarding HBV prophylactic measures, use in the Canadian hospitals was similar to that in Edinburgh (11), where 84% received HBIG and 73% received vaccine. In Dublin (10), HBV vaccine was used more often (92%) and HBIG less often (56%) than in Canada.

The fact that the great majority of injured children were not immunized against HBV before injury was not surprising. Universal HBV immunization began in most Canadian provinces and territories in the mid-1990s, but it is most often given to children in grade 4 or higher. Current immunization programs leave the prime CANSI age groups unprotected against HBV.

The observation that no children whose charts were reviewed received HIV prophylaxis is of interest. This may be due in part to the fact that most injuries in this review occurred before the 1995 publication of the case-control study of HIV infection in health care workers (2), which established the efficacy of zidovudine prophylaxis.

Several limitations of this study should be noted. First, CHIRPP data are not population based, and cannot be used to estimate how many needle stick injuries actually occurred in regions with CHIRPP sites or on a national basis. As well, the actual number of injuries reported to CHIRPP may be an underestimate because physician reporting is voluntary. Population-based surveillance incorporating physicians' offices, public health clinics and hospitals is needed to determine the CANSIs frequency in a community. (Even then, as with occupational injuries, some injured children might not seek medical attention.) The risk group stratification used was linked closely to location of injury, ie, most outdoor injuries were classified as high risk. However, text descriptions did reveal some

indoor injuries that were due to IDU needles and some outdoor injuries that clearly fell in the low risk category. We thus feel more specific information was obtained using this variable than by using location alone. Finally, follow-up data from the present review are limited to small numbers of children. Conclusions about successful completion of HBV vaccine series or estimates of the risk of viral infection following injury cannot be made.

CONCLUSIONS

Although uncommon, CANSIs are anxiety-provoking and may lead to the transmission of serious viral infections. While the effectiveness of prevention efforts to reduce these injuries has not been studied, primary prevention programs to teach children needle avoidance seem reasonable, as are close supervision, and maintenance of home and outdoor environments. Programs aimed at reducing environmental contamination by persons who use injection drugs, such as needle-exchange programs, may also be beneficial.

Secondary prevention to lower the risk of HBV and HIV transmission is also important. Because prophylactic management is based on extrapolation from occupational injuries studies, there is uncertainty about some aspects of care, such as the need for HBIG in addition to HBV vaccine in the nonimmune child and the use of HIV prophylaxis in this setting (5,6). Despite this, treatment guidelines such as the recent Canadian Paediatric Society statement (7) will help ensure that children with CANSIs receive the best possible counselling, treatment and follow-up.

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