Nonfatal childhood injuries: a survey at the Children's Hospital of Eastern Ontario

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Objective: To examine the types and severity of injuries seen in the Emergency Department of the Children's Hospital of Eastern Ontario and the circumstances surrounding the events.
Design: Chart review.
Setting: A tertiary care hospital that serves a child population of 600 000 in eastern Ontario and western Quebec.
Participants: Every sixth day's charts of children up to 17 years of age who visited the Emergency Department because of injuries between Sept. 1, 1984, and Aug. 31, 1985, were examined retrospectively.
Results: A total of 2886 charts were reviewed. There were more boys than girls. Most (1354 [46.9%]) of the accidents had occurred at home. Falls and sports-related accidents were the leading causes of injury (in 1088 [37.7%] and 560 [19.4%] of the cases respectively). Most of the visits were for minor injuries (bumps, swellings, cuts, bruises and scrapes), and only 114 (4.0%) of the children were admitted to the hospital. Injuries from motor vehicle accidents accounted for the highest admission rate (17.4%). Important information regarding the circumstances surrounding the events (e.g., whether a seat belt or car seat was used) was frequently missing from the charts.
Conclusions: Nonfatal injuries are common, especially in or around the home, and remain a significant problem in our society in terms of radiographic and consulting fees, time off from school or work and pain. Given the difficulties in obtaining information on the circumstances surrounding the events prospective studies are needed. Factors related to the occurrence and severity of childhood injury and whether these factors can be altered remain a high priority for research.

Objectif : Examiner le type et la gravité des blessures observées au service d'urgence de l'Hôpital pour enfants de l'est de l'Ontario et les circonstances entourant ces événements.
Conception : Examen des dossiers.
Contexte : Un hôpital de soins tertiaires qui dessert une population de 600 000 enfants dans l'est de l'Ontario et l'ouest du Québec.
Participants : Examen rétrospectif de tous les dossiers, aux 6 jours, des enfants jusqu'à l'âge de 17 ans en consultation au service d'urgence en raison de blessures entre le 1er sept. 1984 et le 31 août 1985.

At the time the paper was written Dr. Shanon was a fellow in ambulatory care, Messrs. Bashaw and Lewis were research assistants in ambulatory care, Children's Hospital of Eastern Ontario, Ottawa, Ont., and Dr. Feldman was professor of pediatrics, University of Ottawa, and head of medical ambulatory care, Children's Hospital of Eastern Ontario, Ottawa, Ont.

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Résultats : Au total, on a examiné 2 886 dossiers. Les garçons étaient plus nombreux que les filles. La plupart des accidents (1 354 [46,9 %]) sont survenus au foyer. Les chutes et les accidents reliés au sport étaient les principales causes de blessure (dans 1 088 [37,7 %] et 560 [19,4 %] des cas respectivement). La plupart des consultations concernaient des blessures légères (bosses, enflure, coupures, contusions et éraflures), et seulement 114 enfants (4,0 %) ont été admis à l'hôpital. Les blessures attribuables à des accidents de la route représentaient le taux d'admission le plus élevé (17,4 %). Des informations importantes au sujet des circonstances entourant les événements (p. ex., si on a utilisé une ceinture ou un siège de sécurité) étaient souvent absentes des dossiers.
Conclusions : Les blessures non mortelles sont fréquentes, en particulier au foyer, et elles demeurent un problème important dans notre société par rapport aux frais de radiographie et de consultation, à l'absentéisme scolaire ou professionnel et à la douleur. Étant donné les difficultés d'obtenir des informations sur les circonstances entourant les accidents, il faudra mener des études prospectives. Les facteurs reliés à la fréquence et à la gravité des blessures au cours de l'enfance et les possibilités de modification de ces facteurs demeurent une priorité importante pour la recherche.

Injuries are the leading cause of death and a significant cause of disability in children.[1-4] Every year 32% of the 55 000 visits to the Emergency Department of the Children's Hospital of Eastern Ontario (CHEO) are because of injuries.

In 1974 the rate of accidental death among children aged 1 to 14 years was higher in Canada than in 19 other developed nations.[5] Despite that, little research on childhood injuries has been conducted in Canada. Most of the Canadian studies have focused on specific injuries, such as snowmobile-related injuries,[6] injuries at school[7] and clothing burns.[8] In 1964 Keddy[9] reported the causes of injury to children brought to an emergency department during 1 year. The leading causes were falls (in 33.0% of the cases), cuts or piercings (in 11.0%), poisonings (in 9.3%) and motor vehicle accidents (in 7.9%). To the best of our knowledge no information on the occurrence of nonfatal injuries in Canadian children has been published since.

The objective of this retrospective study was to examine the types and severity of injuries seen at CHEO and the circumstances surrounding the events. On the basis of the findings specific areas of nonfatal injuries can be studied and recommendations for prevention considered.

Methods

CHEO serves a combined urban and rural child population of about 600 000 in eastern Ontario and western Quebec. We reviewed the logbook of the Emergency Department for cases in which children up to 17 years of age had been treated because of injuries between Sept. 1, 1984, and Aug. 31, 1985. To achieve a sample of 15% of the annual injuries and an equal representation of each weekday and weekend day, all visits were recorded for every sixth day. The corresponding charts were reviewed, and information concerning the injury was collected.

A questionnaire was used to collect data and comprised four sections: (a) general information (sex, age, date and time of the injury, location of the child at the time of the injury, need for further consultation or radiographic examination and treatment), (b) information on motor vehicle injuries (Was the child riding a bicycle or motorcycle, driving a car, a passenger on a motorcycle, bus or car or a pedestrian?), (c) information on sports-related injuries (Did the injury occur during organized or nonorganized sports? Was it a community, school or private activity? What type of sport was it [e.g., team sport, water activity or winter activity]?) and (d) information on playground injuries (What type of equipment caused the injury?). When multiple injuries occurred, only the most severe was recorded.

Information from the charts was extracted by two research assistants. Data were entered into an SPSS-X program (SPSS Inc., Chicago) and analysed with the use of descriptive statistics (frequency distribution, odds ratio [OR] and confidence intervals [CIs]). CIs were determined with the use of the method described by Mehta, Patel and Gray.[10] Fatal injuries were not included.

Results

The charts of 2886 children were reviewed. More visits took place early in the week, between 10 am and 10 pm. Of the 1354 children injured at or around the home 619 (45.7%) were 4 years of age or less. There were more boys than girls (1773 [61.4%] v. 1113 [38.6%]). Boys were more likely than girls to be admitted to the hospital (82 [71.9%] v. 32 [28.1%]; $p = 0.00001$, OR = 6.58 [95% CI 5.56 to 7.81]).

The locations and the causes of injury are presented by age group in Table 1. Table 2 shows the type and frequency of injury by age group, and Table 3 presents the most common types of injury that led to hospital admission and the rate of admission.

Among the children 3 years of age or more the

extremities and the head were involved most often. Among those less than 3 years the elbow was most frequently injured.

Consultation with a subspecialist was required in 482 (16.7%) of the cases; the main reasons were fractures, eye injuries, burns and concussions. X-ray films were ordered in 1477 cases (51.2%).

Most of the injuries were not serious: in 602 cases (20.9%) no treatment was required, in 2155 (74.7%) the children were treated and released, and in 114 (4.0%) the children were admitted (data were missing in 0.4% of the cases).

Table 1: Location and cause of injuries among 2886 children seen in the Emergency Department of the Children's Hospital of Eastern Ontario between Sept. 1, 1984, and Aug. 31, 1985, by age group

	Age group, yr; no. (and %) of children				
Variable	0–4	5–10	11–17	Unspecified	All
Location					
Home	472	188	127	110	897 (31.1)
Outside home	147	161	134	15	457 (15.8)
School	18	203	240	5	466 (16.1)
Street	31	86	106	2	225 (7.8)
Arena	6	36	145	0	187 (6.5)
Playground	22	60	34	0	116 (4.0)
Public building	14	16	22	2	54 (1.9)
Car, bus or van	4	7	10	3	24 (0.8)
Missing data	–	–	–	–	460 (15.9)
Cause					
Fall	418	348	229	93	1088 (37.7)
Sports-related accident	9	150	399	2	560 (19.4)
Bicycle or tricycle accident	34	59	61	4	158 (5.5)
Fight	14	39	33	1	87 (3.0)
Playground equipment	18	53	5	7	83 (2.9)
Self-inflicted	21	21	25	4	71 (2.5)
Motor vehicle accident	8	23	35	3	69 (2.4)
Burn	28	7	11	18	64 (2.2)
Injestion of harmful substance	38	2	12	8	60 (2.1)
Missing data	–	–	–	–	97 (3.4)
Other	172	162	127	88	549 (19.0)

Table 2: Type and frequency of injury by age group

	Age group, yr; no. (and %) of children				
Type of injury	0–4	5–10	11–17	Unspecified	All
Minor					1698 (58.8)
Bump or swelling	141	175	271	49	636 (22.0)
Cut	233	215	130	33	611 (21.2)
Bruise	88	131	145	19	383 (13.3)
Scrape	19	25	22	2	68 (2.4)
Orthopedic					759 (26.3)
Fracture	67	149	182	14	412 (14.3)
Sprain	13	66	94	1	174 (6.0)
Muscle pull or strain	32	28	60	1	121 (4.2)
Dislocation	18	4	10	1	33 (1.1)
Ligament or cartilage injury	3	4	12	0	19 (0.7)
Other					429 (14.9)
Concussion or loss of consciousness	29	31	18	3	81 (2.8)
Burn	32	8	14	10	64 (2.2)
Poisoning	38	2	12	12	64 (2.2)
Eye injury	10	17	4	1	32 (1.1)
Internal injury	10	3	4	0	17 (0.6)
Nosebleed	3	0	3	0	6 (0.2)
Unspecified	–	–	–	–	165 (5.7)

Falls

Of the 1088 children who fell 704 (64.7%) did so at home. Both the head and the extremities were involved in 518 (47.6%) of the cases. Minor injuries occurred in 729 (67.0%) and orthopedic injuries in 283 (26.0%). Information about the age was available from 995 (91.5%) of the charts; 418 (42.0%) of the children were 4 years of age or less (279 [28.0%] were less than 2 years, and 139 [14.0%] were 2 to 4 years).

Sports-related accidents

These accidents accounted for 560 of the injuries. In 399 (71.2%) of the cases children 11 to 17 years old were involved. The injuries were minor in 294 (52.5%), orthopedic in 235 (42.0%) and concussions in 16 (2.9%).

The extremities were injured most frequently (in 405 [72.3%] of the cases); the head was involved in 101 (18.0%). Children were injured more often while playing team sports (hockey 99 [17.7%], football 76 [13.6%], and soccer and basketball 49 [8.8%] each) than while engaging in individual sports (skiing 50 [8.9%], gymnastics 26 [4.6%] and ice skating 25 [4.5%]). From the available information (in 407 cases) 122 (30.0%) of the injuries occurred during informal activities and 285 (70.0%) during organized activities (physical education 106 [37.2%], community-organized sports 97 [34.0%], school-organized sports 76 [26.7%] and private sports 6 [2.1%]).

Accidents involving playground equipment

Eighty-three (2.9%) of the injuries were caused by different types of playground equipment. Children were commonly injured while swinging (in 25 cases [30.1%]), climbing monkey bars (in 17 [20.5%]) or playing with creative equipment (tires, slides, tunnels and climbing platforms) (in 16 [19.3%]). The extremities and the head were involved in 41 (49.4%) and 36 (43.4%) of the cases respectively. Forty-five (54.2%) of the injuries were minor, 26 (31.3%) orthopedic and 5 (6.0%) concussions.

Motor vehicle accidents

In 22 (31.9%) of the 69 motor vehicle accidents the children were pedestrians, in 23 (33.3%) they were passengers, and in 7 (10.1%) they were driving motorbikes. The extremities and the head were involved in 28 (40.6%) and 25 (36.2%) of the cases respectively. Of the injuries 46 (66.7%) were minor, 11 (15.9%) orthopedic and 2 (2.9%) concussions. Compared with the other types of injury those caused by motor vehicle accidents had the highest rate of admission (17.4%) (Table 3), even though they accounted for only 2.3% of the injuries.

Burns

Of the 64 children who were seen because of burns 53 (82.8%) were at home at the time of the accident, and 24 (37.5%) were less than 1 year of age. The mechanism of the burn injury was not recorded in 11 (17.2%) of the cases; of the remaining 53 cases 2 (3.8%) were electrically induced and 51 (96.2%) heat induced. The extremities were involved most frequently (in 40 [62.5%] of the cases); the head and neck and the chest were the next most common areas (in 10 [15.6%] and 4 [6.2%] respectively). Consultation was required in 14 (21.9%) of the cases.

Discussion

Accidents are the main single cause of injury and death among young people worldwide. In Göteborg, Sweden,[1] and in Wales[2] injury rates of 14.4% and 20% respectively were found among children.

Table 3: Most common causes of injury that led to hospital admission

Cause	No. (and %) of children	No. (and %) of admissions	Admission rate, %
Fall	1088 (37.7)	42 (36.8)	3.9
Sports-related accident	560 (19.4)	14 (12.3)	2.5
Bicycle or tricycle accident	158 (5.5)	13 (11.4)	8.2
Fight	87 (3.0)	0	0
Playground equipment	83 (2.9)	4 (3.5)	4.8
Motor vehicle accident	69 (2.4)	12 (10.5)	17.4
Burn	64 (2.2)	4 (3.5)	6.2
Ingestion of harmful substance	60 (2.1)	5 (4.4)	8.3
Other*	620 (21.5)	17 (14.9)	2.7
Missing data	97 (3.4)	3 (2.6)	3.1

*Other causes were self-inflicted, machinery, smoke and fumes.

Falls, burns and poisonings were the main causes in India,[3] and an overall injury rate of 2239 per 10 000 was found among children aged 15 years or less in Massachusetts.[4]

Of the injuries reviewed in our study 619 (21.4%) occurred in or around the home among children 4 years of age or less. This is not surprising given the amount of time young children spend in their home environment. At all ages falls were the leading cause of injury. At home injuries caused by falls and burns were the most common.

The chances of being admitted to the hospital were six times higher among the boys than among the girls. The male:female ratio for injuries from accidents involving bicycles and machinery was higher than expected. However, this was not true for other types of injury, which suggests that girls and boys participated in similar activities.

The fact that children were injured more often while playing team sports than while engaging in individual sports might merely represent the larger number participating in team sports and not the hazards of a specific activity. The same might apply to the difference in the number of children injured while participating in organized and nonorganized sports.

Like others[2-4] we found that most of the injuries were not serious. Treatment was either not required or given on an ambulatory basis. It could be speculated that many injured children were not brought to the department.

Admission was warranted in only 4.0% of the cases. Nevertheless, in terms of radiographic and consulting fees, time off from school or work and the pain and temporary limitation of activity, childhood nonfatal injuries remain a significant problem in our society.

Information was lacking in the following areas: accidents around the home (a detailed description of the injury, specifically if it was a fall), motor vehicle accidents (the location of the passenger in the car and whether seat belts, car seats or bicycle or motorcycle helmets were used), sport injuries (whether first aid was given before the patient was brought to the hospital) and accidents involving playground equipment (the ownership of the equipment [school, community or private], the type of ground cover underneath the equipment and whether an adult was present at the time of the accident).

It is hoped that prospective multicentre studies of childhood injuries will be able to answer questions about whether the circumstances surrounding such injuries can be modified. Although not all accidents can be prevented, a few important preventive measures have been implemented in the last decade, such as standards for children's sleepwear,[11] child safety seats in cars[12] and childproof medicine containers.[13]

Because almost half of the injuries in our study occurred at home priority should be given to research into and educational programs for the prevention of such injuries as falls, burns and poisonings among younger children at home. There is evidence that educational programs for parents reduce the number of home hazards.[14,15]

Similarly, since motor vehicle injuries accounted for the highest admission rate future prospective studies should investigate new motor vehicle safety measures and find better ways of implementing preventive measures already proved to be efficient (e.g., seat belts and bicycle helmets). In addition, the degree to which laws regarding seat belts and fire safety standards are being enforced should be assessed.

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