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The risk of child abuse in infants and toddlers with lower extremity injuries

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Abstract:
Purpose: The aim of this study was to assess the risk of child abuse in children younger than 18 months admitted to a pediatric trauma service with lower extremity injuries.
Methods: An Institutional Review Board–approved retrospective case series of children admitted to a regional pediatric trauma center with lower extremity injuries from 1998 to 2002 (n = 5497) was performed. Factors analyzed included age, injuries, and injury mechanism.
Results: Among 5497 trauma patients, the incidence of abuse was 104 (2%) of 4942 children 18 months or older and 175(32%) of 555 children younger than 18 months (odds ratio [OR], 21.4 ± 2.9, $P < .001$). There were 1252 (23%) patients with lower extremity injuries in the entire sample, and 66 of these were younger than 18 months. In the extremity trauma group, for patients 18 months or older, 16 (1%) of 1186 were abused compared with 44 (67%) of 66 patients younger than 18 months (OR, 146 ± 53, $P < .001$). Among all trauma patients younger than 18 months, 41 of 55 lower extremity fractures were linked to abuse, whereas 134 of 500 other injuries were caused by abuse (OR, 8.0 ± 2.6, $P < .001$). Among the 41 abuse-related fractures, femur fracture was the most common (22), followed by tibia fracture (14).
Conclusions: Among children 18 months or older, abuse is an uncommon cause of lower extremity trauma. In children younger than 18 months, lower extremity injuries, particularly fractures, are highly associated with child abuse. Clinicians must thoroughly investigate lower extremity injuries in this age group.

According to 2001 data from the Centers for Disease Control, more children were killed by homicide before their first birthday than children aged 1 and 2 combined. In fact, these data illustrate that the homicide rate declines every year from age 0 to age 5 [1]. Furthermore, other research indicates that most of homicides before age 5 are because of child abuse, meaning that the fatal injury was inflicted by a parent or guardian [2].

It is well known that head trauma is often a presenting sign of child abuse [3], but few studies have examined lower

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Table 1 Frequency of trauma cases as a function of child abuse, age, and other variables

Age group	No abuse	Abuse rule out abuse	Total	OR 95% CI	χ^2 (P)
≥18 months					
No leg (%)	97.7	2.2	3765	1.01-2.92	4.16,
Leg (%)	98.6	1.4	1177		$P = .041$
n	4838	104	4942		
<18 months					
No leg (%)	73.2	26.8	489	1.56-3.10	42.8,
Leg (%)	33.3	66.7	66		$P < .001$
n	380	175	555		
≥18 months					
Girls (%)	97.2	2.8	1756	1.15-2.46	7.3,
Boys (%)	98.4	1.7	3186		$P = .007$
Total	4838	104	4942		
<18 months					
Girls (%)	69.7	30.3	238	0.2-1.16	0.32,
Boys (%)	67.5	32.5	317		$P = .57$
Total	380	175	555		
≥18 months					
Asian (%)	100.0	0.0	24		32.5,
Black (%)	95.3	4.7	766		$P < .001$
Hispanic (%)	100.0	0.0	12		
Other (%)	97.3	2.7	224		
Unknown (%)	97.6	2.4	335		
White (%)	98.5	1.5	3581		
Total	4838	104	4942		
<18 months					
Asian (%)	0.0	100.0	1		6.1,
Black (%)	66.4	33.6	113		$P = .30$
Hispanic (%)	33.3	66.7	3		
Other (%)	61.5	38.5	39		
Unknown (%)	64.9	35.1	37		
White (%)	70.7	28.3	362		
Total	380	175	555		

extremity injuries in this context. Therefore, the purpose of this study was to characterize the incidence of child abuse–related injuries in infants and children with lower extremity trauma.

1. Methods

An Institutional Review Board–approved retrospective review of hospital-based trauma registry data was conducted to identify children with lower extremity injuries admitted to an American College of Surgeons–verified level I pediatric trauma center for 5 years (from 1998 through 2002 inclusive). After preliminary review of the population for age, cause of injury, and diagnoses, the group was further divided into 2 age groups for comparison: children younger than 18 months and children 18 months or older. Case records were also reviewed for patient ethnicity, injury location and description, injury severity score, and revised trauma score (RTS). A child was assigned the diagnosis of "lower extremity injury" if any lower extremity injury was recorded in the trauma registry, and "lower extremity fracture" if appropriate radiographic findings were documented by an attending radiologist. If the trauma registry record for a patient indicated a diagnosis of "child abuse" or "child abuse suspected," the case was placed in the "abuse" category for further analysis. In our clinical experience, most of patients with an admission diagnosis of "child abuse suspected" are confirmed as abuse cases when the full clinical evaluation is completed. Furthermore, if, during the hospitalization, child abuse is definitely ruled out in a suspected abuse case, the "suspected abuse" diagnosis is deleted from the registry.

χ^2 was used to determine P values associated with odds ratios (OR). Kaplan-Meier survival curves describe the relationship between injury and abuse categories as a function of age. Differences between the groups were assessed with a log rank statistic. Log regression was used to develop an abuse model.

2. Results

The study group consisted of 5497 patients admitted for treatment of injury during the time frame of the study. In the study group, 4942 (90%) children were 18 months or older and 555 (10%) were younger than 18 months old. The incidence of child abuse was 104 (2%) of 4942 children 18 months or older and 175 (32%) of 555 children younger than 18 months (OR, 21.4 ± 2.9, $P < .001$).

There were 1252 patients with lower extremity injuries in the entire study group. Sixty-six of these patients were younger than 18 months old and 1186 were 18 months or older. Among patients with lower extremity injuries, there were 16 (1%) abuse cases of the 1186 children 18 months or older compared with 44 (67%) abuse cases of the 66 patients younger than 18 months (OR, 146 ± 53, $P < .001$). These 44 lower extremity injury cases included 41 patients with fractures and 3 patients with soft tissue injuries alone.

Table 2 Abuse as a function of lower extremity injury, age, race, and the interaction between age and lower extremity injury

	B	SE	Wald	df	Significance	OR
Leg	−0.53	0.33	2.99	1	.094	0.59
Infant	2.77	0.18	228.21	1	.000	15.9
Infant by leg interaction	2.08	0.46	21.23	1	.000	8.0
Race[a]			21.99	5	.001	
RTS	−0.28	0.04	37.37	1	.000	0.75
Constant	−0.02	1.02	0.01	1	.985	0.98

Gender and sex by age interaction were not significantly associated with abuse after controlling for the other variables.

Leg indicates lower extremity injury; infant, patient younger than 18 months old; RTS, Revised Trauma Score.

[a] Race was dummy coded and the individual categories are not listed. See Table 1 for a summary of results by race.