Research Article

DOI: http://dx.doi.org/10.18203/2349-2902.isj20161163

Patterns of extremities trauma in children and their management in emergency department in Suez Canal University Hospital, Ismailia, Egypt

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Received: 05 March 2016 Revised: 08 March 2016 Accepted: 12 April 2016

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ABSTRACT

Background: Extremities trauma is extremely common in the pediatrics age group and many risk factors have been analysed for their role in this type of trauma. The aim of this study was to describe patterns of extremities injuries in children with different types of musculoskeletal injuries.

Methods: A descriptive cross-sectional study was conducted on 270 children attending to Suez Canal University Hospital, Ismailia, Egypt. With different types of musculoskeletal injuries. Differences in gender, anatomic site, circumstances, location of trauma occurrence and trauma level were investigated among three different age groups (pre-school, school and adolescents).

Results: The results showed that males were at a higher risk of extremities trauma than females and the male to female ratio increased with increasing age. The highest incidence of extremities injuries in children occurred in school age group. (66.3%) of injuries occurred after low energy trauma mostly due to falls. Home was the main location of injury occurrence (44.07%), followed by roads (29.63%), playgrounds (17.41%) and school (8.89%). Injuries of upper limbs represented (79.63%) of all injuries. Distal forearm injuries accounted for (30%) of all injured sites and were more frequent in adolescents. (30.37%) of the studied patients were shared in sport behaviour.

Conclusions: The differences which existed in the prevalence of injuries, characteristics and circumstances across the three age groups may be explained by age-related changes in behaviours, together with attending different places.

Keywords: Pediatric musculoskeletal injuries, Age groups injuries, Risk factors

INTRODUCTION

Trauma is the leading cause of death and disability in childhood. It account for approximately 50% of all deaths in children, and almost 1 in every 6 requires treatment in the emergency department each year for injuries.¹

In Egypt, injuries are a significant source of mortality and morbidity; they are the fifth leading cause of death .In one rural health unit in Egypt, injuries constituted 23.1% of all visits mostly of children.²

Because periods of pediatric ages are characterized by different stages of physical, cognitive and social development, this may obviously explain the varying patterns of injuries across age groups.³

In addition to the financial burden, injuries lead to emotional trauma for children, parents, and society.⁴

Consideration of growth potential is the major difference in treating injuries in children as compared with adults because pediatric Extremities trauma can result in enhanced or diminished growth. Adult bone is dynamic; it is constantly involved in bone turnover and remodeling

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in response to aging and changes in stress on the skeleton. Pediatric skeleton not only remodels in response to alterations in stress, but also grows in length and width and changes shape, alignment, and rotation as it mature.⁵

Extremities trauma is extremely common in the pediatric age group. If all musculoskeletal tissues are considered, they would constitute 40% of all childhood injuries. Such injuries include, bone fractures, dislocations, strains, sprains, tendon disruption, muscle tears, and joint pain from injuries such as bone bruises.⁶

It has been reported that fractures are a common event in childhood with considerable variations in the incidence rate from 1.2% to 5% among different studies. This variability may depend on the child's condition, age, and social and environmental factors.⁷

The majority of fractures in children involve the upper limb. Lower limb fractures are mainly caused by twisting injuries and road traffic accidents.⁸

Several factors have been analyzed for their role in determining fracture risk. Bone mass and bone mineral density, low calcium intake, high body mass index (BMI), inactivity, behavioral difficulties, consumption of carbonated beverages, use of drugs (corticosteroids) have been variably associated with this kind of injury in children.⁹

It has also been demonstrated that a first fracture at a young age is associated with an increasing risk of sustaining subsequent fractures. 10

Extremities trauma in children should be treated as early as possible because they heal more rapidly than adult injuries do and Pediatric bony injuries are more often treated by closed reduction than by open reduction because of short time to union and the ease of obtaining and maintaining near-anatomic reductions, as well as the potential for remodeling.¹¹

The aim of this work was to study the patterns of the extremities injuries in children in order to support the preventive measures to decrease their complications and decrease emergency department visits.

METHODS

This study was carried out as a descriptive cross-sectional study and conducted on 270 patients in emergency department in Suez Canal University Hospital, Ismailia, Egypt. Up to 18 years old of both sexes with trauma in their extremities. Populations in the study were divided into 3 age groups (pre-school children (0-5.9 years), school children (6.0-10.9 years), and adolescents (11-18 years)).

Exclusion criteria

Trauma

- History of any specific pathologic process known to affect bone and mineral metabolism
- Presence of any specific treatment known to affect bone and mineral metabolism
- Children with poly-trauma and injuries other than musculoskeletal injuries

Table 1: Descriptive categories of Landin's modified trauma levels. 12

A. Minor trauma Falling to the ground from <0.5 m (standing height) Falling to a resilient surface (rubber or sand from 0.5-3 m) Falling from a bed or cot Low - energy sporting injuries, such as ball sports, judo, karate and wrestling Playing injuries including playground scuffles B. Moderate trauma Falling to a concrete or other non-resilient surface from 0.5-3 m Falling from a bunked Baby being dropped to the floor by an adult Falling downstairs Falling from a bicycle

C. Severe traumaFalling from a height exceeding 3 m

All traffic accidents not already mentioned

Falls while moving on skateboards or skates

Being hit by a moving object

In each patient the following was studied

- Sociodemographic data it include data regarding; age, sex, residence, special habits, social class and parent education level
- Clinical evaluation Clinical evaluation of the patients
 was carried out on arrival to emergency department
 regarding initial assessment of the patient whether
 stable or not, through ABCDE, general examination
 which include vital signs (BP-temperature-pulserespiratory rate) and Head and neck, chest, heart and
 abdomen examination, local examination of the
 injured limb and calculation of body mass index.
- *Investigations* they included X-ray to the affected parts and other investigations when needed.
- Trauma data it included anatomic site of trauma, type of injury, location of injury occurrence, mechanism of trauma associated injury and Trauma level category based on a modified Landin's description that considers the height of the fall and the Landin's surface, the physical activity engaged in, and whether or not any equipment was being used (Table1).
- Medical history it was include history of history of similar trauma, history of bone disease and drug history.

Fate at emergency room Fate was recorded either.
 (A) Full treatment and discharge.
 (B) Admitted to inpatient ward for observation and for further intervention.
 A clear consent was taken from the parent or the relative of the patient before examination.

Data collected throughout history, clinical examination and laboratory investigations were coded, entered and analyzed using Microsoft excels software. Data were imported into SPSS (Statistical Package for Social Sciences) software program version 20.0 for analysis. According to the type of data, the following tests were used to test differences for significance; Chi square, t test, and one-way ANOVA with least significance difference. Chi square test and non-parametric tests were used to compare categorical variables. P value set at ≤0.05 for significant results.

RESULTS

The total number of patients who participated in this study was 270.

Table 2 showed the demographic data of the studied patients which revealed that males (66.67%)

outnumbered females (33.33%) with a sex ratios 1.2, 1.8 and 4 in preschool children, school children and adolescents respectively. A statistically significant difference was found between sex and age of patients (p<0.001) as males were at a higher risk of injuries than females in every age group, with progressively increasing incidence with age.

Table 3 showed that falling down was the most common mechanism of injuries and constituted about 64% of all cases followed by road traffic accidents which accounted for 18.89% of all cases. Among falls, falling at same level predominated and accounted for 37.78% of all cases followed by sport related injuries and falling from a bicycle (10% and 7.41% respectively). Falling at same level was frequent in preschool children and represented 60% of all preschool patients.

Table 4 revealed that, low energy trauma (mild trauma) predominated and accounted for 66.3% of all causes of trauma according to Landin's classification mostly due to falls. A statistically significant association was found between low energy trauma and sex in school children and adolescents (p=0.007 and p=0.016, respectively) in whom mild trauma was more frequent in males, while no difference existed in pre-school children.

Table 2: Demographic data of the studied patients.

	Pre-school children (n=53)		School ch	ildren (n=141)	Adolescents (n=76)		Total (n=270)	
	No.	%	No.	%	No.	%	No.	%
Sex								
Male	29	54.72	90	63.83	61	80.26	180	66.67
Female	24	45.28	51	36.17	15	19.74	90	33.33
Males/females ratio	29/24 (1.2)		90/51 (1	.8)	61/15 (4)	P < 0.0	001*
Mean age±SD	4.38±1.1		8.62±1.4		13.29±	2.8		
Range	6 months-18	8 years						

^{*;} Statistically significant at $p \le 0.05$

Table 3: Distribution of the studied patients by mechanism of trauma and age.

	Pre-school children (n=53)			chool children n=141)	Adoles (n=76)		Total (n=27	Total (n=270)	
	No.	%	No.	%	No.	%	No.	%	
Mechanisms of injury									
Falling from same level	32	60.4	35	24.82	35	46.05	102	37.78	
RTA	3	5.66	31	7.8	17	22.37	51	18.89	
Other mechanisms	0	0	35	10.64	10	13.16	45	16.67	
Sport and playing related falling	4	7.57	17	12.06	6	7.89	27	10.00	
Falling from a bicycle	3	5.66	15	10.64	2	2.63	20	7.41	
Falling from a height	4	7.54	8	4.96	5	6.58	17	6.29	
Falling on stairs	7	13.2	0	0	1	1.32	8	2.96	

Table 4: Distribution of mechanisms of injuries according to Landin's classification.

	Mild (n=179)	Moderate (n=34)	Severe (n=57)
Mechanisms of injury			
Falling from same level	102	0	0
Falling from a height	9	6	2
Falling from a bicycle	0	20	0
Falling on stairs	0	8	0
Sport and playing related falling	27	0	0
RTA	0	0	51
Other mechanisms	41	0	4
Total percentage	66.30	12.59	21.11

Table 5 showed that, home was the commonest place where the children sustained their injuries, it accounted for 44.07% of all locations, compared to 29.63% were injured in the street, 17.41% were injured in the playground and only 8.89% were injured in the educational facilities.

Table 6 showed that forearms and wrist accounted for 56.3% of an all injured sites and it was observed that forearms and wrists injuries predominated in females (66.6%) in pre-school age rather than males (41.4) but those injuries were nearly equal in both sex in school children and adolescents age group.

Table 5: Distribution of the studied patients by location of injury and age group.

	Pre-school children (n=53)		School chi	School children (n=141)		Adolescents (n=76)		=270)
	No.	%	No.	%	No.	%	No.	%
Location								
Home	36	67.92	63	44.68	20	26.32	119	44.07
Road	7	13.2	43	30.5	30	39.47	80	29.63
Playground	6	11.32	25	17.73	16	21.05	47	17.41
Educational facilities	es 4	7.5	10	7.09	10	13.16	24	8.89

Table 6: Distribution of the studied patients by anatomic site of injury and sex in every age group.

	Pre-school children(n=53)		School children (n=141)		Adolescents (n=76)		Total (n=270)	
	Male	Female	Male	Female	Male	Female	No.	%
Anatomic site of injury	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)		
Forearms and wrists	12 (41.4	16 (66.7)	48 (53.3	26 (51)	40 (65.6)	10 (66.7)	152	56.3
Hands	7 (24.1)	5 (20.8)	20 (22.2	9 (17.6)	8 (13.1)	1 (6.7)	50	18.52
Foots	2 (6.9)	2 (8.3)	6 (6.67)	12 (23.5	5 (8.2)	1 (6.7)	28	10.37
Legs and ankles	5 (17.2)	1 (4.2)	9 (10)	4 (7.8)	4 (6.6)	2 (13.3)	25	9.3
Upper arms	3 (10.3)	0 (0)	6 (6.67)	0 (0)	3 (4.9)	1 (6.7)	13	4.81
Thighs	0 (0)	0 (0)	1 (1.11)	0 (0)	0 (0)	0 (0)	1	0.37
Others	0 (0)	0 (0)	0 (0)	0 (0)	1 (16.4)	0 (0)	1	0.37

DISCUSSION

As skeletal injuries are common in childhood and in order to plan preventive programs for safer environments to be possible, those injuries epidemiology of specific geographical areas must be known.¹³

The aim of the present work was to study patterns of extremities injuries in children in trauma patients with different types of musculoskeletal injuries, focusing on mechanisms, risk factors and locations of injuries.

The overall injury incidence was higher in males (66.67%) than females (33.33%). This agreed with Morrongeillo et al who attributed increased boys injuries

than females to increased exposure to injury risk in their daily activities. 14

In the present study a statistically significant difference was found between sex and age of patients and male to female ratio significantly increased from preschool children (1.2) to adolescents (4) in agreement with previous reports. ^{15,16}

As regard mechanism of trauma, the present study showed that, low energy trauma predominated and accounted for 66.3% of all causes of injuries mostly due to falls. A statistically significant difference was found between low energy trauma and sex in school children and adolescents in whom mild trauma was more frequent

in males. Similarly, Rennie et al who analyzed the basic epidemiology of different mechanisms of fracture in British children, reported that falls accounted for 57% of all fractures, occurred at a younger age and prevailed in males.¹⁷

Regarding the location where injuries commonly occurred, it has been reported by Rochwood that the home accounts for 37% of all fractures in children, while school represents 20%. ¹⁸ In this study as well, the home was the place where extremities injuries most frequently occurred (44%), followed by roads (29.36%), playgrounds (17.41%) and school (8.89%), and locations changed among age groups and gender. Home injuries were decreased as age increased, while playground, educational facilities and road injuries were increased as age increased. These findings are not surprising and reflect the amount of time that pre-school children spend at home in comparison with older children and adolescents who gradually spend a greater amount of their active time outside the home. ¹⁹

This study confirmed that the upper limb was more frequently involved at any age, in agreement with a previous epidemiologic study performed in various age groups by Rennie et al.¹⁷

The current work showed that forearms and wrist accounted for 56.3% of an all injured sites and it was observed that forearms and wrists injuries were more in females (66.6%) in pre-school age rather than males (41.4%) but those injuries were nearly equal in both sex in school children and adolescents age groups, also the upper arm injuries were more frequent in male in preschool children and school children rather than females. Legs and ankles injuries were more common in preschool boys (17.2%) rather than girls (4.2%) and in adolescent females (13.3%) rather than males (6.6%). This discrepancies can probably be explained by different specific causes related to trauma mechanisms especially fall characteristics. Rennie et al reported that, the most commonly fractured site in children is the forearm, compromising at least one third of all fractures.¹

Regarding sport participation, the current study revealed that nearly one third of the studied patients (30.37%) was shared in sport behavior while approximately two third (69.63%) were not participated in any sport behavior and sport participation was increased while age was increased. Increased participation in both organized and informal sports, as well as the overall high levels physical activity during adolescents, has been previously advocated to explain the increased incidence of fractures in adolescents. ¹⁸

CONCLUSION

The differences which existed in the prevalence of injuries, characteristics and circumstances across the three age groups may be explained by age-related

changes in behaviors, together with attending different places.

The followings are the recommendations of this study

- Prevention is the only positive attitude towards reduction of extremities injuries in children through public education, implementation of safety strategies and government legislation.
- Educating children at school, through audiovisual programs, on traffic rules and safety measures when using the road or playing sport.
- Educating child bicyclists to increase use of safety helmets and other protectors to their extremities.
- Identification of the risk factors through the epidemiological studies is vital to develop safety measures.

Funding: No funding sources Conflict of interest: None declared

Ethical approval: The study was approved by the

institutional ethics committee

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Cite this article as: Elbaih AH, Taha M, Saker A, Aziz S, Shahate A. Patterns of extremities trauma in children and their management in emergency department in Suez Canal University Hospital, Ismailia, Egypt. Int Surg J 2016;3:887-92.