



Pattern and Outcome of Unintentional Pediatric Trauma in the Emergency Department of a Tertiary Care Hospital in South India

Kundavaram Paul Prabhakar Abhilash¹, David Vincent¹, Anjali Sarah George¹, Kimmin Kalyaniwala¹, Anand Prajapathi¹, Sheba Meriam Thomas¹

¹Department of Emergency Medicine, Christian Medical College, Vellore, Tamil Nadu, India

Background: Pediatric trauma is a significant cause of morbidity, and few studies on profile and outcome have been done in the emergency departments (EDs) of India. **Methodology:** This prospective observational study was conducted between October 2014 and December 2014 in the adult and pediatric ED's of Christian Medical College, Vellore. All patients younger than 18 years, who presented with unintentional injury, were enrolled in this study. **Results:** The adult and pediatric ED's attended to a combined 24,482 patients (16,169 adults and 8313 children and adolescents) during the 3-month study with 8.2% (2022/24,482) being trauma incidents. Pediatric and adolescent (<18 years) trauma patients comprised 20% (397) of trauma cases, and adult (>18 years) trauma patients made up the remainder 80% (1624). Falls are the most common mechanism of injury among infants and toddlers with decreasing frequency with age. With increasing age, the place of injury changes from the surroundings of home to playgrounds, schools, and the roads. About 80% of injuries among infants occur at home while only 12% of adolescent injuries occur at home. Road traffic injuries account for 46% of injuries sustained by adolescents. Most of the children and adolescents (63%) were managed conservatively. Minor surgical intervention was required in 20% whereas 11% required major surgical intervention. Majority (77%) was discharged stable from the ED, and 21% were admitted. The in-hospital mortality of pediatric trauma was 1.2% (5/397). **Conclusions:** Pediatric and adolescent trauma is a significant cause of morbidity and mortality in India, accounting for almost one-fifth of injured patients. There exists a need for injury prevention programs focusing on peridomestic safety among children <12 years and school and road safety among children >12 years and adolescents.

Key words: Pediatrics, trauma, emergency department, unintentional injuries

INTRODUCTION

Children all, worldwide, are very prone to injuries of various kinds. Children's physical and cognitive abilities, degrees of dependence, activities, and risk behaviors all change substantially as they grow older, leading to major injuries. Injuries are not inevitable; however, they can be prevented or controlled. The WHO and United Nations Children's Fund recognize pediatric trauma as a major public health problem requiring immediate attention.^{1,2} Pediatric trauma is considered to differ from adult trauma in the patterns of injury sustained, and requirement of surgical intervention. Child injuries can be divided into intentional and unintentional injuries based on intent. Unintentional injuries include road traffic

injuries (RTIs), falls, burns, poisoning, drowning, occupational injuries, sports injuries, fall of objects, and injuries in disaster situations whereas intentional ones include suicide, assault, child maltreatment, and homicides. Unintentional injuries are one of the leading causes of death, hospitalization, and disability worldwide.³⁻⁵ However, the pattern and etiology of injuries and their outcome vary substantially within populations and across countries. A proper trauma database is lacking in India, and most of the studies on pediatric trauma have been done among pediatric surgery in patients or neurosurgical in patients. Very few studies have been reported

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

Received: June 20, 2018; Revised: June 24, 2018; Accepted: July 23, 2018

Corresponding Author: Dr. Kundavaram Paul Prabhakar Abhilash, Department of Emergency Medicine, Christian Medical College, Vellore - 632 004, Tamil Nadu, India. Tel: 9994924743. E-mail: kppabhilash@gmail.com

How to cite this article: Prabhakar Abhilash KP, Vincent D, George AS, Kalyaniwala K, Prajapathi A, Thomas SM. Pattern and outcome of unintentional pediatric trauma in the emergency department of a tertiary care hospital in South India. J Med Sci 2018;38:269-74.

from the emergency departments (EDs) of India, and data on trauma among adolescents are even rare. Hence, this study was done to study the profile and outcome of unintentional injuries among children and adolescents presenting to our ED.

METHODOLOGY

This prospective observational study was conducted between October 2014 and December 2014 in the adult and pediatric ED's of Christian Medical College, Vellore, which is a 75-bed department; one of the largest in South India with an average of 310 admissions per day. We handle 1100–1200 cases of pediatric trauma annually. All patients younger than 18 years, who presented with unintentional injury to the ED of our hospital during the study, were recruited. Patients presenting with intentional injury, burns, poisoning, hanging, and drowning were excluded from the study. A written informed assent was taken from the parent or guardian of children <12 years of age and informed consent was taken from children more than 12 years of age.

A study form was completed which included a detailed history of the mechanism of injury, physical examination of site, and nature of injury along with demographic details of the patients. The time of incident, triage time, priority assigned, relevant tests done, including radiological investigations, and details of management were documented. The severity of the injury was assessed by using the revised trauma score (RTS). Disposition from the ED with regard to admission, discharge, left against medical advice, or death was also documented. The patients enrolled were followed up until hospital discharge to assess the outcome regarding mortality.

The children were classified according to age as follows: infants (up to 1 year), toddlers (1–3 years), preschool (3–6 years), school-aged children (6–12 years), and adolescents (12–17 years). Triage priority level was defined as follows:

- i. Triage Priority 1: Patient with airway, breathing, or circulation compromise or head injury with Glasgow Coma Scale (GCS) <8
- ii. Triage Priority 2: Patient with stable airway, breathing, and circulation with long-bone injuries, dislocations, stable abdominothoracic injuries, and head injury with GCS 9 or more
- iii. Triage Priority 3: Hemodynamically stable patients with minor trauma.

Minor surgical intervention was defined as those procedures that were done in the ED (e.g., suturing and debridement). All procedures were done in the operation theater under regional

or general anesthesia were classified as major surgical intervention.

Statistical analysis

Data were entered into the Microsoft Excel (version 16) and analyzed using Statistical Package for Social Sciences for Windows (SPSS Inc. Released 2007, version 16.0. Chicago, IL, USA). Continuous variables are presented as mean (standard deviation). Categorical and nominal variables are presented as percentages.

This study was approved by the Institutional Review Board (IRB Min. No. 9105 October 6, 2014), and the patient confidentiality was maintained using unique identifiers and by password protected data entry software with restricted users.

RESULTS

The adult and pediatric ED's attended to a combined 24,482 patients (16,169 adults and 8313 children and adolescents) during the 3-month study with 8.2% (2022/24,482) being trauma incidents. Pediatric and adolescent (<18 years) trauma patients comprised 20% (397) of trauma cases, and adult (>18 years) trauma patients made up the remainder 80% (1624). Among these children, 4% were infants (up to 1 year), 34% were toddlers (1–3 years), 20% were in preschool (4–6 years), 23% were school-age children (7–12 years), and 19% were adolescents (13–18 years). About 60% of the patients received first aid at a primary or secondary level hospital and then referred to our institute. Boys-to-girls ratio was 1.9:1. The baseline characteristics are shown in Table 1.

The mean RTS was 7.72. Majority (72%) of children sustained injuries during the most active part of the day (6 am–5 pm). Half the patients (51%) presented to the ED during the afternoon shift (3 pm–10 pm). Falls are the most common mechanism of injury among infants and toddlers with decreasing frequency with age. As expected, RTIs and sports-related injuries show an increasing frequency with age [Figure 1].

The frequency of place of injury according to age is shown in Figure 2. With increasing age, the place of injury changes from the surroundings of home to playgrounds, schools, and the roads. About 80% of injuries among infants occur at home whereas only 12% of adolescent injuries occur at home. RTIs account for 46% of injuries sustained by adolescents. The area of the body injured according to age is shown in Table 2. The frequency of extremity injuries shows an increasing trend with age with the highest rate among school children (66.3%) and adolescents (44.6%). Fractures and dislocations are more common among school going children (33%) and adolescents (32%).

Only 6% (25/397) of patients had a suspected intra-abdominal injury, and a focused assessment with sonography in trauma (FAST) was performed. FAST was positive in four of them (16%). Traumatic brain injury was suspected in 45.3% of patients, and computed tomography (CT) of the brain was performed. Two-thirds (67%) had a normal CT scan, 11% had contusions, 9% had subdural hemorrhage,

Table 1: Baseline characteristics ($n=397$)

Variable	n (%)
Mean age in years (SD)	6.6 (5.14)
Males	263 (66)
Females	134 (34)
Referred from other hospitals	237 (60)
Triage priority	
Priority 1	23 (6)
Priority 2	181 (45)
Priority 3	193 (49)
Mean revised trauma score (SD)	7.72 (0.16)
Time of incidence	
8 am-3 pm	173 (44)
3 pm-10 pm	186 (47)
10 pm-8 am	38 (9)
Time of presentation to the ED	
8 am-3 pm	120 (30)
3 pm-10 pm	210 (53)
10 pm-8 am	67 (17)

ED=Emergency departments; SD=Standard deviation

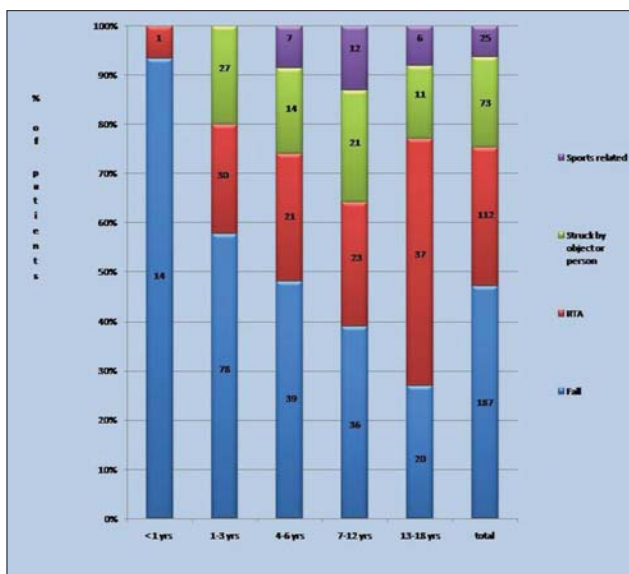


Figure 1: Frequency of mechanism of injury by age

5% had pneumocephalus, 5% had cranial bone fractures, 2% had an extradural hemorrhage, and 1% had a subarachnoid hemorrhage.

Most of the children and adolescents (63%) were managed conservatively. Minor surgical intervention was required in 20% whereas 17% required major surgical intervention [Figure 3]. Majority (77%) was discharged stable from the ED, 21% were admitted, 1% (4/397) died in ED, and 1% left against medical advice. One child died intraoperatively. Overall, the in-hospital mortality of pediatric trauma was 1.2% (5/397).

DISCUSSION

Injuries are an increasingly common cause of mortality, morbidity, and disability in children worldwide. Their curiosity, limited knowledge about dangers around them, and anatomical disadvantages increase childhood injury rates. This study offers a comprehensive description of pediatric trauma cases in the ED. The prevalence of pediatric and adolescent trauma in our ED was 4.8%. The prevalence rates vary from 5.5% to 19.2% in various parts of India.⁴⁻⁸ This difference is probably due to the difference in referral pattern, with higher prevalence seen in secondary and community hospitals. More than half (60%) of our patients were referred cases as is the case with most tertiary level hospitals. The different cutoff for age (<12, <15, <18, and <20 years) has been used in different studies and hence the wide range in prevalence. Since our hospital is a tertiary care referral center, the prevalence of pediatric trauma may not accurately reflect the prevalence of trauma in the community. Pediatric and adolescent trauma

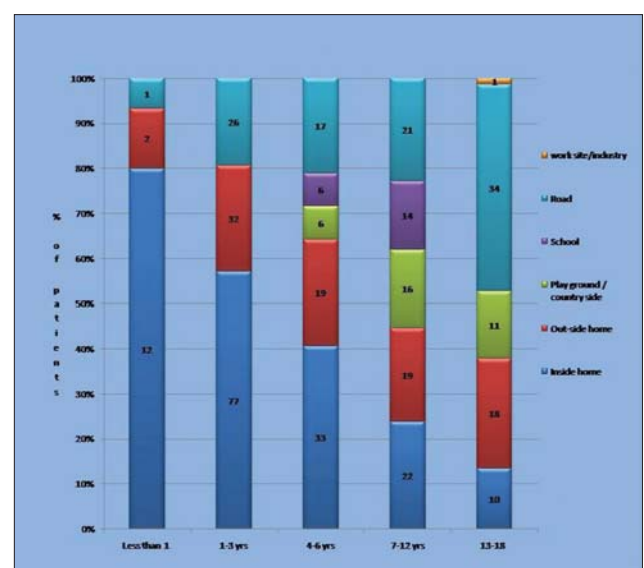


Figure 2: Frequency of place of injury by age

Table 2: Profile of injury pattern and management across age groups

	<1 year (<i>n</i> =15), <i>n</i> (%)	1-3 years (<i>n</i> =135), <i>n</i> (%)	4-6 years (<i>n</i> =81), <i>n</i> (%)	7-12 years (<i>n</i> =92), <i>n</i> (%)	13-18 years (<i>n</i> =74), <i>n</i> (%)
Site of injury					
Head and neck	12 (80)	105 (78)	52 (64.2)	31 (33.7)	43 (58.1)
Thorax	1 (6.6)	3 (2.3)	7 (8.6)	3 (3.3)	6 (8.1)
Abdomen		9 (6.7)	13 (16)	6 (6.6)	12 (16.2)
Upper limb	2 (13.2)	58 (43)	15 (18.5)	44 (47.8)	22 (29.7)
Lower limb	1 (6.6)	23 (17)	29 (26)	65 (70.7)	32 (43.2)
Nature of injury					
Fracture/dislocation	2 (13.2)	40 (29.6)	20 (24.7)	40 (43.5)	34 (45.9)
Sprain		13 (9.7)	8 (9.9)	12 (13)	5 (6.7)
Open wound		41 (30)	34 (42)	19 (20.7)	14 (18.9)
Amputation		4 (3)	1 (1.2)	33 (3.3)	2 (2.7)
Internal organ injuries	3 (20)	18 (13.3)	8 (9.9)	11 (12)	15 (20.3)
Superficial wounds/contusions	15 (100)	82 (60.7)	55 (68)	64 (69.6)	45 (60.8)
Management details					
Conservative management	15 (100)	90 (67)	45 (55)	52 (56.5)	49 (66.2)
Minor surgical intervention		36 (26.7)	19 (23.5)	13 (14.1)	9 (12.2)
Major surgical intervention		9 (6.7)	17 (21)	27 (29.3)	16 (21.6)
Outcome from ED					
Discharged stable	13 (86.8)	122 (90.4)	63 (77.8)	58 (63)	49 (66.2)
Admitted	2 (13.2)	11 (8.1)	16 (19.8)	33 (35.8)	22 (29.7)
Died in ED		2 (1.5)			1 (1.3)
Left against medical advice			2 (2.4)	1 (1.1)	2 (2.7)
In-hospital mortality					
					1 (1.3)

ED=Emergency departments

accounted for 20% of all trauma cases in our hospital. However, in a study from Trinidad and Tobago, pediatric trauma (<20 years) accounted for 41.5% of all trauma cases.⁹

The mean age of 6.6 years seen in our study is similar to the mean age reported in other Indian and Southeast Asian studies.¹⁰⁻¹² Studies from Bangladesh, Iran, Nigeria, Singapore, Trinidad and Tobago and from many Indian cities have consistently shown boys to be more commonly injured than girls.^{5,9,10,13,14} In most developing countries, boys indulge in more outdoor physical activities and start riding vehicles during their school age and adolescent period and hence more prone to injuries. The finding that the majority of injuries occurred in the peridomestic area in children below the age of 12 years is consistent with many other studies. The change in the place of injury from the surroundings of home during early years to the surroundings of school and the road during later years is related to the amount of time spent and physical activities indulged in those areas.

Falls were the leading cause of trauma in all age groups, followed by RTIs, except in the 13–18 years' age group in

which falls were the second most common mechanism after RTIs. This finding correlates well with Indian studies and with studies from the West.^{4,5,15} Injuries are not inevitable; they can be prevented or controlled. School-aged children and adolescents had a higher percentage of fractures and dislocations compared to younger children.¹⁶ This can be attributed to the more risk-taking behavior and complicated activities among the former group compared to the latter. Our study is one of the few studies describing the pattern of injury among adolescents.

In this study, half of the patients were classified as Priority 3, and only 6% had a life-threatening or organ-threatening emergency and classified as Priority 1. More than 3/4th of the patients were managed in the ED and were discharged stable. Major surgical intervention was required in only 17% of the patients. Blunt trauma to the abdomen was the immediate cause of death in 3 children and one child died due to severe head injury and a hemopneumothorax. This significant finding puts into perspective the impact of poor road safety measures prevalent in our country. Considering that all four deaths

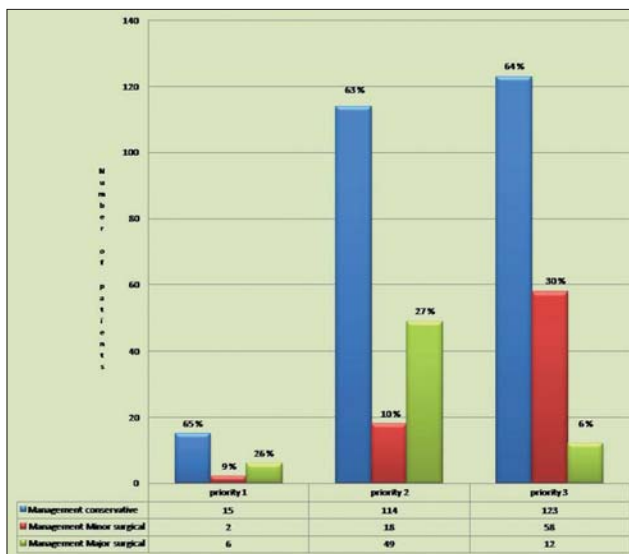


Figure 3: Management in the emergency department and priority

resulted from road traffic accidents, the urgent need to improve road safety in our country cannot be overemphasized.

There is a need for educational and interventional programs to help parents and teachers understand the need to make the home and school environments safe for children. A proactive attitude coupled with intensive research on the prevention, education, legislative enforcement, and prehospital management would positively impact the health status of children.

CONCLUSIONS

Pediatric and adolescent trauma is a significant cause of morbidity and mortality in India, accounting for almost one-fifth of the injured patients. The injury profile changes through increasing age groups, with the older children adopting adult trauma characteristics. The epidemiological profile of trauma patients from our ED may be used to develop injury prevention programs focusing on peridomestic safety among children <12 years and school and road safety among children >12 years and adolescents.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Child and Adolescent Injury Prevention: A Global Call for Action. World Health Organization; March, 2005. Available from: http://www.who.int/violence_injury_prevention/other_injury/childhood/en/index.html. [Last accessed on 2016 Jul 28].
2. A League Table of Child Deaths by Injury in Rich Countries. Innocenti Report Card No. 2. Florence, UNICEF Innocenti Research Centre; 2001. Available from: <http://www.unicef-icdc.org/publications/pdf/repcard2e.pdf>. [Last accessed on 2016 Jul 28].
3. Pal R, Agarwal A, Galwankar S, Swaroop M, Stawicki SP, Rajaram L, *et al.* The 2014 academic college of emergency experts in India. *Indian J Crit Illn Inj Sci* 2014;4:114-30.
4. Sharma M, Lahoti BK, Khandelwal G, Mathur RK, Sharma SS, Laddha A, *et al.* Epidemiological trends of pediatric trauma: A single-center study of 791 patients. *J Indian Assoc Pediatr Surg* 2011;16:88-92.
5. Chowdhury SM, Rahman A, Mashreky SR, Giashuddin SM, Svanström S, *et al.* The horizon of unintentional injuries among children in low-income setting: An overview from Bangladesh health and injury survey. *J Environ Public Health* 2009;2009:435403.
6. Tandon JN, Kalra A, Kalra K, Sahu SC, Nigam CB, Qureshi GU, *et al.* Profile of accidents in children. *Indian Pediatr* 1993;30:765-9.
7. Singhi S, Singhi S, Gupta G. Comparison of pediatric emergency patients in a tertiary care hospital vs. a community hospital. *Indian Pediatr* 2004;41:67-72.
8. Verma S, Lal N, Lodha R, Murmu L. Childhood trauma profile at a tertiary care hospital in India. *Indian Pediatr* 2009;46:168-71.
9. Kirsch TD, Beaudreau RW, Holder YA, Smith GS. Pediatric injuries presenting to an emergency department in a developing country. *Pediatr Emerg Care* 1996;12:411-5.
10. Ong ME, Ooi SB, Manning PG. A review of 2,517 childhood injuries seen in a Singapore emergency department in 1999: mechanisms and injury prevention suggestions. *Singapore Med J* 2003;44:12-9.
11. Thein MM, Lee BW, Bun PY. Childhood injuries in Singapore: A community nationwide study. *Singapore Med J* 2005;46:116-21.
12. Kozik CA, Suntayakorn S, Vaughn DW, Suntayakorn C, Snitbhan R, Innis BL. Causes of death and unintentional injury among school children in Thailand. *Southeast Asian J Trop Med Public Health* 1999;30:129-35.
13. Karbakhsh M, Zargar M, Zarei MR, Khaji A. Childhood injuries in Tehran: A review of 1281 cases. *Turk J Pediatr* 2008;50:317-25.
14. Adesunkanmi AR, Oginni LM, Oyelami AO,

- Badru OS. Epidemiology of childhood injury. *J Trauma* 1998;44:506-12.
15. Agran PF, Winn DG, Anderson CL. Surveillance of pediatric injury hospitalizations in Southern California. *Inj Prev* 1995;1:234-7.
16. Deasy C, Gabbe B, Palmer C, Babl FE, Bevan C, Crameri J, *et al.* Paediatric and adolescent trauma care within an integrated trauma system. *Injury* 2012;43:2006-11.