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Original article

Are falls more common than road traffic accidents in pediatric trauma? Experience from a Level 1 trauma centre in New Delhi, India

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ABSTRACT

Purpose: The epidemiology of pediatric trauma is different in different parts of the world. Some researchers suggest falls as the most common mechanism, whereas others report road traffic accidents (RTAs) as the most common cause. The aim of this study is to find out the leading cause of pediatric admissions in Trauma Surgery in New Delhi, India.

Methods: Inpatient data from January 2012 to September 2014 was searched retrospectively in Jai Prakash Narayan Apex Trauma Centre Trauma Registry. All patients aged 18 years or less on index presentation admitted to surgical ward/ICU or later taken transfer by the Department of Trauma Surgery were included. Data were retrieved in predesigned proformas. Information thus compiled was coded in unique alphanumeric codes for each variable and subjected to statistical analysis using SPSS version 21.

Results: We had 300 patients over a 33 month period. Among them, 236 (78.6%) were males and 64 (21.3%) females. Overall the predominant cause was RTAs in 132 (43%) patients. On subgroup analysis of up to 12 years age group ($n = 147$), the most common cause was found to be RTAs again. However, falls showed an incremental upward trend (36.05% in up to 12 age group versus 27% overall), catching up with RTAs (44.89%). Pediatric Trauma Score (PTS) ranged from 0 to 12 with a mean of 8.12 ± 2.022 . 223 (74.33%) patients experienced trauma limited to one anatomic region only, whereas 77 (25.66%) patients suffered polytrauma. 288 patients were discharged to home care. Overall, 12 patients expired in the cohort. Median hospital stay was 6 days (range 1–182).

Conclusion: Pediatric trauma is becoming a cause of increasing concern, especially in the developing countries. The leading cause of admissions in Trauma Surgery is RTAs (43%) as compared to falls from height (27%); however, falls from height are showing an increasing trend as we move to younger age groups. Enhancing road safety alone may not be a lasting solution for prevention of pediatric trauma and local injury patterns must be taken into account when formulating policies to address this unique challenge.

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Introduction

Though the principles of pediatric trauma management are similar to adults, anatomical peculiarities and differences in physiological reserve confer additional responsibilities on the treating doctor for an optimal outcome.^{1,2} Pediatric survival is also one of the health performance indicators for a nation.³ The problem of pediatric trauma has been studied in different parts of the world,

and it is clear that epidemiology and hence effective prevention strategies differ geographically.^{1,2,4–6} Therefore, it is very important to delineate a problem statement for our own region when gearing up to tackle this menace. Whereas some researchers suggest falls as the most common mechanism, others report road traffic accidents (RTAs) as the most common cause. The aim of this study is to find out the leading cause of pediatric admissions in Trauma Surgery in New Delhi, India.

Materials and methods

JPN Apex Trauma Centre is the premier Level 1 trauma centre in the Indian subcontinent. Each year, more than 60,000 patients are

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evaluated catering to a population of around 10 million of New Delhi. All index admission records, investigations and follow-up records are traceable from a single Unique Identification Number, greatly facilitating research activities on a large prospectively maintained database.

We searched inpatient data from January 2012 to September 2014 retrospectively in our Trauma Registry. All patients aged 18 years or less on index presentation, admitted to surgical ward/ICU or later taken transfer by Department of Trauma Surgery were included. Patients who primarily received neurosurgical or orthopedic care and remained admitted in respective wards were not included. Pediatric trauma patients found stable on workup yet requiring admission for observation/treatment appropriate for a Level 2 trauma centre or Community Hospital, were transferred in accordance with pre-existing agreements in case of paucity of beds, and were not included in this study.

Applying above criteria, we had 300 patients over 33 months. Data were then retrieved from an electronic database into pre-designed proformas with emphasis on epidemiology (age, gender, mechanism of trauma), primary survey and abnormalities and pattern of injury-isolated or polytrauma. Each patient record was individually reviewed. Data obtained were coded with ICD codes of trauma. Follow-up information of patients was as much retrieved as available in records. Patients lost to follow-up were not contacted by telephone/by post due to logistic reasons. Information thus compiled was coded in unique alphanumeric codes for each variable and subjected to statistical analysis using SPSS version 21.

Results

We had 300 pediatric patients admitted in Trauma Surgery during January 2012 to September 2014. Of these, 236 (78.6%) were males and 64 (21.3%) females. Almost half (147; 49%) of the patients were up to 12 years age and rest (153; 51%) were in >12–18 years age group. We had no infant pediatric trauma patient admission in trauma surgery in the aforementioned period. In adolescent age group, the mean age was (16.27 ± 1.74) years.

Mechanism of trauma

Overall the predominant cause was RTAs in 132 (43%) patients; falls accounted for 81 (27%) patients (Table 1). On subgroup analysis of up to 12 years age group ($n = 147$), the most common cause was found to be RTAs again. However, falls showed an incremental trend (36.05% in up to 12 age group versus 27% overall), catching up with RTAs (44.89%, Table 2).

Pediatric trauma score

Pediatric trauma score ranged from 0 to 12 with a mean of 8.12 ± 2.022.

Pattern of injury

A total of 223 (74.33%) patients experienced trauma limited to one system only, whereas 77 (25.66%) patients suffered polytrauma, i.e. more than one anatomical region affected.

Hospital stay

The median hospital stay was 6 days (range 1–182 days).

Table 1
Mechanism of trauma ($n = 300$).

Mechanism	n (%)
RTA	132 (43)
Railway track injury	6 (2)
Fall from height	81 (27)
Fall of object	6 (2)
Blunt assault	20 (6.66)
Gunshot	4 (1.33)
Stab injury	14 (4.66)
Self inflicted	8 (2.66)
Accidental/sports	7 (2.33)
Animal injury	3 (1)
Foreign body ingestion	2 (0.66)
Machine injury	14 (4.66)
Blast injury	2 (0.66)
Electrocution	1 (0.33)

Table 2
Mechanism of trauma in >12 yrs age group ($n = 147$).

Mechanism	n (%)
RTA	66 (44.89)
Railway track injury	2 (1.36)
Fall from height	53 (36.05)
Fall of object	3 (2.04)
Blunt assault	6 (4.08)
Gunshot	1 (0.68)
Accidental/sports	7 (4.76)
Foreign body ingestion	1 (0.68)
Machine injury	6 (4.08)
Blast injury	1 (0.68)
Electrocution	1 (0.68)

Outcome

In this series, 288 patients were discharged to home care finally. Twelve patients expired in the cohort, in whom, 4 patients died from hemorrhagic shock, 4 from sepsis, 3 from multi organ dysfunction and 1 patient of electrocution died from arrhythmia.

Discussion

In contrast to the reductions in childhood mortality from trauma by up to 50% in high-income countries (HICs) between 1970 and 1995, the burden and pattern of childhood injuries are just now being studied in low and middle income countries (LMICs).⁴ Though malnutrition and infections are still the leading causes of mortality in LMICs,^{7,8} traumatic deaths are also five times higher than industrial nations.⁷ There are many studies reporting epidemiology of pediatric trauma in nations with dedicated trauma registries.^{9,10} However, countries with trauma systems in infancy of development are still not able to report and analyze pediatric trauma data in appropriate number.¹¹ Our study, involved trauma surgery data over 33 months from a Level 1 Trauma Center, hence, would help in addressing the mode of injury of pediatric trauma in the region.

Male to female ratio was 3.6:1 in our study. Almost half of the patients were up to 12 years age and the rest belonged to 12–18 years age group. No infant was seen in our study. A previous study from same institute addressing the issue of pediatric extremity vascular trauma has found the M/F of 1 in 0–5 years age group.¹² Infant proportion of just 2% has been reported in a large multinational study of 1600 pediatric trauma patients, supporting lack of any infant in our cohort of 300 patients.⁸

Prevalence of trauma in childhood admissions has been reported from 5.5% to 19.23%,¹³ in Indian studies¹⁴ as well as LMICs abroad.^{15–17} All reports confirm a majority affliction of boys than girls, M/F ratio of 1.5–3,¹⁸ the most common age group being 6–12

years^{14,18} and home being the most common place of injury nationally and internationally.^{18,19} Maximum mortality has been reported in 1–2 years age group²⁰ and RTAs as the most common cause.^{20,21} Studies from different geographic regions have shown falls as common mechanism of trauma in 0–9 years age groups or even overall.^{5,9,10,12} A previous study from this institution on 82 patients of pediatric extremity vascular trauma has also reported similar observations in this age group.¹² However in our current study we found that falls accounted for only 27% of injuries in the pediatric age group as opposed to RTAs (43%); the predominant cause of pediatric trauma in our study remained RTAs. A more plausible explanation is that up to 75% of children admitted to hospital due to fall from height have a head injury²² and are more likely to be admitted in neurosurgical department. RTAs were found to be the leading cause of mortality in another Indian study as well.

In many parts of the world, most childhood injuries treated in hospitals are due to falls that occur mainly at home.²³ Falls have been deemed the most common cause of injury in diverse studies in Ismailia, Uganda²⁴ and Saudi Arabia.²⁵ A mixed intervention consisting of safer play areas, safer construction, safer furniture for sleeping and playing and improved supervision has been recommended.⁸ In a south Asian study, pedestrians and motorcyclists accounted for the majority of unintentional injuries on the road and all caused mortality in children.²⁶ Over half of road traffic injuries in Colombia occur in pedestrians; this figure has been reported as high as 81% in other studies.⁸

In our study falls from height were found to be increased from 27% (in 0–18 years age group) to 36.05% (in up to 12 years age group) catching up with RTAs (44.89%), which is still the predominant injury mechanism in up to 12 years age group. Similar findings have been reported by other researchers.² The important implications of this observation lie in the focus for a thrust of preventive programs. It is interesting to note that the two leading causes of trauma, RTAs and falls from height, inflict more than 80% of injuries seen in up to 12 years age group. Improving road safety will always go a long way in reducing overall trauma burden; this may not be enough in pediatric trauma especially up to 12 years of age group, in our setting as well as some others.

Efforts should be directed at reducing childhood injuries in the home. In developing countries, provision of crèches, supervised nurseries at workplaces, increased awareness of risk factors in the peri-domestic environment, adequate parental supervision and child-friendly homes with safeguards on windows and covered balconies in multi-storey buildings have been suggested. Large impacts of simple accident prevention programs in the peri-domestic environment are exemplified by the 'Kid's Can't Fly' campaign of York, England.²⁷ Improving student-to-teacher ratios to enhance supervision, and legislation to discourage physical abuse by teachers have been recommended. Equipment functionality should be actively sought to decrease sport-related injuries. Play floors should be made of materials that cushion a fall effectively. Loose-fill surfacing materials of 12-inch depth made of sand, pea gravel, wood and shredded rubber products are recommended.

The mortality rate in our cohort was 4%, which is better than what has been reported by our western counterparts^{2,3} and elsewhere in India.¹ From our viewpoint, it conveys that attention to pediatric anatomic and physiologic peculiarities and giving the mechanism of trauma its due importance can achieve the same results as afforded by dedicated pediatric trauma centers in other parts of the world. It has been hypothesized that regional pediatric trauma centers or trauma centers with pediatric commitment provide superior survival advantages for injured children. Another reason for our low mortality may be less inclusion of head trauma as up to 70% of injury deaths have been reported due to head injuries.²⁸

Economic burden of pediatric trauma on the family is also underestimated. The social costs of pediatric trauma can easily tip a family into poverty.²⁹ Tailored injury prevention research in LMIC is urgently needed. Injury prevention strategies have to be made for the respective locales due to varied etiology and cultures. As is evident, emphasis on same preventive programs may not give same results everywhere.

Limitations

The scope of our study could have been wider if we had been able to report on pediatric abuse, burns, time of day and activity of the child when injured, selected cost of treatment and use of safety measures by families. Another limitation is the exclusion of patients with head trauma and those referred to Level 2 trauma centers, including which, epidemiological results could have been closer to the actual picture.

Conclusion

Pediatric trauma is increasingly becoming a cause of concern. The leading cause is RTAs (43%) as compared to falls from height (27%); however, falls show an increasing trend (36.05%) as we move to younger age groups. Enhancing road safety alone may not be a lasting solution for prevention of pediatric trauma and local injury patterns must be taken into account when formulating policies to address these unique challenges.

References

- Sharma M, Lahoti BK, Khandelwal G, et al. Epidemiological trends of pediatric trauma: a single-center study of 791 patients. *J Indian Assoc Pediatr Surg.* 2011;16:88–92.
- Hulka F. Pediatric trauma systems: critical distinctions. *J Trauma.* 1999;47: S85–S89.
- Chirdan LB, Uba AF, Yiltok SJ, et al. Paediatric blunt abdominal trauma: challenges of management in a developing country. *Eur J Pediatr Surg.* 2007;17: 90–95.
- Alterman DM, Daley BJ, Kennedy AP, et al. *Considerations in Pediatric Trauma.* Available at: <http://emedicine.medscape.com/article/435031-overview>; Accessed 11.01.15.
- Mukhida K, Sharma MR, Shilpakar SK. Pediatric neurotrauma in Kathmandu, Nepal: implications for injury management and control. *Childs Nerv Syst.* 2006;22:352–362.
- Kelishadi R, Qorbani M, Motlagh ME, et al. Frequency, causes, and places of unintentional injuries in a nationally representative sample of iranian children and adolescents: the CASPIAN-IV study. *Int J Prev Med.* 2014;5:1224–1230.
- Bartlett SN. The problem of children's injuries in low-income countries: a review. *Health Policy Plan.* 2002;17:1–13.
- Hyder AA, Sugerman DE, Puvanachandra P, et al. Global childhood unintentional injury surveillance in four cities in developing countries: a pilot study. *Bull World Health Organ.* 2009;87:345–352. G.
- Tracy ET, Englum BR, Barbas AS, et al. Pediatric injury patterns by year of age. *J Pediatr Surg.* 2013;48:1384–1388.
- Snyder CW, Muensterer OJ, Sacco F, et al. Paediatric trauma on the last Frontier: an 11-year review of injury mechanisms, high-risk injury patterns and outcomes in Alaskan children. *Int J Circumpolar Health.* 2014;73:25066.
- Simon R, Gilyoma JM, Dass RM, et al. Paediatric injuries at Bugando Medical Centre in Northwestern Tanzania: a prospective review of 150 cases. *J Trauma Manag Outcomes.* 2013;7:10.
- Jaipuria J, Sagar S, Singhal M, et al. Paediatric extremity vascular injuries-experience from a large urban trauma centre in India. *Injury.* 2014;45: 176–182.
- 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.
- Verma S, Lal N, Lodha R, et al. Childhood trauma profile at a tertiary care hospital in India. *Indian Pediatr.* 2009;46:168–171.
- Chowdhury SM, Rahman A, Mashreky SR, 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.
- Kozik CA, Suntayakorn S, Vaughn DW, Suntayakorn C, Snithan R, Innis BL. Causes of death and unintentional injury among school children in Thailand. *Southeast Asian J Trop Med Public Health.* 1999;30:129–135.
- Thein MM, Lee BW, Bun PY. Childhood injuries in Singapore: a community nationwide study. *Singapore Med J.* 2005;46:116–121.

18. Razzak JA, Luby SP, Laflamme L, et al. Injuries among children in Karachi, Pakistan — what, where and how. *Public Health*. 2004;118:114–120.
19. Mariam A, Sadik M, Gutema J. Patterns of accidents among children visiting Jimma University Hospital, Southwest of Ethiopia. *Ethiop Med J*. 2006;44:339–345.
20. Bener A, Al-Salman KM, Pugh RN. Injury mortality and morbidity among children in the United Arab Emirates. *Eur J Epidemiol*. 1998;14:175–178.
21. Vane DW, Shackford SR. Epidemiology of rural traumatic death in children: a population-based study. *J Trauma*. 1995;38:867–870.
22. Lam WH, Mackersie A. Paediatric head injury: incidence, aetiology and management. *Paediatr Anaesth*. 1999;9:377–385.
23. Bangdiwala SI, Anzola-Perez E, Romer CC, et al. The incidence of injuries in young people: I. Methodology and results of a collaborative study in Brazil, Chile, Cuba and Venezuela. *Int J Epidemiol*. 1990;19:115–124.
24. El-Sayed H, Hassan F, Gad S, et al. Pattern and burden of injuries among school children in Ismailia city, Egypt. *Egypt J Pediatr*. 2003;20:201–210.
25. Lawoyin TO, Lawoyin DO, Lawoyin JO. Factors associated with oro-facial injuries among children in Al-Baha, Saudi Arabia. *Afr J Med Med Sci*. 2002;31:37–40.
26. Luby S, Hassan I, Jahangir N, et al. Road traffic injuries in Karachi: the disproportionate role of buses and trucks. *Southeast Asian J Trop Med Public Health*. 1997;28:395–398.
27. Spiegel CN, Lindaman FC. Children can't fly: a program to prevent childhood morbidity and mortality from window falls. *Am J Public Health*. 1977;67:1143–1147.
28. Faillace WJ. Management of childhood neurotrauma. *Surg Clin N Am*. 2002;82:349–363.
29. Gurses D, Sarioglu-Buke A, Baskan M, et al. Cost factors in pediatric trauma. *Can J Surg*. 2003;46:441–445.