Original article

Seasonal variation in orthopedic trauma patients—An experience from central India

Rajeev Shukla, Nikhil Jain*, Utkarsh Agarwal, Tanveer Sheikh, Ravikant Jain

Department of Orthopedics, SAMC & PGI, Indore, India

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ABSTRACT

Objectives: This study aims to determine the various epidemiological factors responsible for orthopedic trauma cases: how do weather patterns, month, season and public working schedule influence the daily frequency of orthopedic trauma.

Material and methods: This was a descriptive study performed in the Department of Orthopedics at a tertiary care centre in central India. Participants: 7980 trauma cases reported in our study period. Study variables: Demographic characteristics of the cases, time, day, the month of injury and type of trauma and cause of trauma. etc. Statistical analysis: Proportions.

Results: In our study period from 2005 to 2016, there were total 7980 admissions, the annual incidence of trauma was 22.78%. RTA was the commonest cause of injury (46.85%). Most common age group affected was 11–40 year age group (64.06%), with the predominance of Male (67.40%) and rural population (72%). The commonest victims of trauma were labourer (37.66%). Maximum cases of trauma occurred during summer (58.9%). Fracture of upper extremity especially around Elbow was common which were 987 (26.41%) amongst which the fracture supracondylar humerus in pediatric age group was most common around 456. And in rainy season and winter season, there was the dominance of lower extremity fracture which was fracture around Ankle and Foot (i.e. 557; 23.59%) and fracture of tibia bone (i.e. 516; 27.4%) respectively.

Conclusion: Orthopedic trauma at a tertiary health care trauma center do vary significantly with the weather and are highest in the Summer season.

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1. Introduction

Trauma represents a major epidemic of non-communicable disease in the present century. They are no longer considered accidental but are part of the price we pay for the technological progress. Orthopedic surgeons usually hypothesize how environment variables and public working schedule may influence orthopedic injury or trauma quantity, but only certain studies have formulated this.¹ Trauma has its own natural history and follows the same epidemic pattern as any other disease that is an agent, the host and the environment interacting together to produce injury or damage. They occur more frequently in certain age group, at certain times of day and the week and at certain localities, for example, a warm and sunny summer weekend may keep orthopedic trauma surgeons busy, while a cold winter day

may yield a lighter workload. Several studies in the general surgery and orthopedic literature show adult trauma to be positively correlated with temperature.² While others have shown that rainfall can increase consults in the rainy season due to sledding accidents and slip on water.³ Among the total disability-adjusted-life-years (DALYs), 13% were due to injuries. Among both children aged 5–14 years and young people aged 15–29 years, road traffic injuries are the second leading cause of trauma and death worldwide.⁴ The mortality and economic losses imposed by morbidity resulting from injuries are largely preventable. However, the development of effective injury prevention efforts depends on reliable and detailed information on the incidence and pattern of injury. In developed countries, such data are available from vital statistics registers and health care records. However, such records are of limited value in developing countries. Many ill or injured persons in these countries never receive medical care from orthodox health facilities, and many deaths are not reported; making health records an incomplete source of data. Injury as a research problem has also been largely ignored in developing

* Corresponding author.

E-mail address: nikrockin23@gmail.com (N. Jain).

countries.^{5–7} The Injury is thus a long-overlooked health problem that deserves study. The purpose of this prospective analysis is to determine how weather patterns, season and public activity schedule influence the daily frequency of orthopedic trauma at a level 3 trauma center.

2. Materials and methods

The present study was conducted in Department of Orthopedics, at a tertiary health care centre, SAMC & PGI, Indore, M.P, India. with the approval from our institutional review board. Orthopedic trauma data were collected from our institutional database of the period 2005–2016. Inclusion criteria were injured patients of any age presenting to the casualty department, including mass casualties if any. A pretested trauma registry form was completed for all trauma patients with informed consent. However, if the patient was brought unconscious or disoriented, an attempt was made to collect the information from the patient's attendant. If there was no attendant or if consent was not given, the victim was excluded from the study. Basic demographic characteristics, time and date, nature and cause of injury, vital signs and outcome data were recorded. The collected data was entered into Microsoft Excel and analyzed.

3. Results

During the study period 2005–2016, there were 20600 orthopedic trauma consults in emergency room out of which 7980 trauma patients get admitted in Orthopedic ward. Most of the injuries were seen in 11–40 year age group (64.06%) of which 21–30 year age group suffered the maximum injuries (26.53%), cases >50 yrs contributed only 10.05% of total admission (Fig. 1). Most common mode of injury was road traffic accident in patients less than 75 years of age. Sex wise distribution was Male (67.4%) far outnumbered female (22.6%), the male to female ratio being 2.06:1 (Fig. 2). Victims from rural population were affected more than the urban population (72% Vs 28%). Laborers (37.66%) were the commonest victim of trauma followed by farmers (31.8%). Maximum cases of trauma occurred during summer (46.81%) followed by rainy and winter season (23.59% and 24.58% respectively) (Table 1). In summer season there were maximum trauma patients in emergency room and orthopedic ward amongst which Fracture of upper extremity especially Elbow were common which were 987 (26.41%) and the fracture supra-condylar humerus in pediatric age group were most common around 456. The reason being the school holidays and summer vacations of children. And in rainy season and winter season there was dominance of lower

Fig. 2. Distribution according to age.

extremity fracture which were fracture around Ankle and Foot (i.e 557; 23.59%) and fracture of tibia bone (i.e 516; 27.4%) respectively (Table 2).

4. Discussion

To reduce the load of trauma is among the main dare for public health in the next century as injuries can be avoided and many effective master plans are available and can be used.⁷ In the present study we found that annual incidence of trauma was 22.78% and there is increase in incidence of trauma in the same institute from 8.9% to 22.78% from 1981 to 2001, supports the WHO prediction that trauma will rise from 9th leading burden of disease in 1990 to third leading cause in 2020 worldwide.⁸ Most of the injuries were seen in 11–40 year age group (64.06%) of which 21–30 year age group suffers the maximum injuries (26.53%), cases >50 yrs contribute only 10.05% of total admission. Similar findings were observed in other studies.^{9–13} Higher incidence of major injuries among children (mainly supracondylar humerus fractures in summer) and youth emphasize urgent need of incorporating basic principles of accident prevention in the formal as well as non-formal education of children from the very beginning. It is also clear from above study that involvement of age group 21–30, which is the most productive group of society suggesting huge economic loss to the country. Male far outnumbered female, the male to female ratio being 2.06:1. Male predominance observed also by many authors^{9,12–16} suggest that in our society males being the earning members of a family are subjected work related stress and more exposure to outside environment as compared to

Fig. 1. Distribution according to Sex.

Table 1
Seasonal variation of trauma.

Season	Month	Cases	Percentage
Summer (n-3736)	march	622	7.79
	April	1028	12.88
	May	1186	14.86
	June	900	11.28
Rainy (n-2361)	July	561	5.84
	August	982	10.22
	September	420	4.38
	October	398	4.14
Winter (n-1883)	November	802	10.05
	December	432	5.41
	January	309	3.87
	february	340	4.26

Table 2
Distribution according to fractured extremity.

Extremity	Part of body injured	Distribution of cases according to season		
		Summer	Rainy	Winter
Spine	Cervical	7	7	3
	Dorsal	2	2	1
	Lumbar	67	52	32
Upper limb	Shoulder/clavicle	74	49	40
	Humerus	405	232	126
	Elbow	987	46	15
	Radius/ulna	213	183	186
	Hand & wrist	236	149	107
Lower limb	Pelvis and hip	37	37	14
	Femur	785	423	401
	Knee/patella	28	199	119
	Tibia	546	425	516
	Ankle & foot	349	557	323
TOTAL		3736	2361	1883

females who usually remain within house premises most of the time. As it is also evident that head injury (60%) being commonest injury mostly affecting 11–30 years of age group and predominantly male sex similar observation were made in other studies.^{15–18} Besides urban, our hospital caters to semi-urban and rural population as well, so the study population includes patients representing situation of real India, especially central India. A Higher magnitude of the problem in a rural setting is due to an ill-controlled hostile environment associated with instability of agricultural, employment, low income with deficient educational system provides a milieu that is rendering them more prone to injuries.^{9,12,13} Labourers were the commonest victim of trauma followed by farmers,^{14,19–20} the reason being among the 830 lakh engaged in the unorganized sector (82.2%), agriculture is the major activity followed by workers and laborers.⁹ Maximum cases of trauma occurred during summer followed by rainy and winter season respectively.^{14,21–23} In rural settings harvesting during summer leads to interpersonal disputes and assault injuries. In rainy season trauma cases are mainly of fall from a tree and RTA due to the very poor road condition and unsafe driving especially by the smaller vehicle. Some studies showed maximum cases during winter followed by summer due to different geographical condition.¹⁸ A Maximum number of injuries occurred on road (62.10%) followed by working places (25.98%).^{13,17,21} High incidence of trauma on roadside may be attributed to the following reasons: There is almost no segregation of pedestrian from wheeled traffic, widespread disregard of traffic rules and defective layout of crossroads and speed breakers. Among the various injuries, RTA was the commonest cause of injury (46.85%) followed by assault and fall injuries in adults and pediatric age group. A Predominance of RTA as a cause of injury shown in other studies followed by fall or assault depending upon socioeconomic condition.^{10,11,17} It has also been observed in another study that being knocked down and falling off vehicles as a most common mode of injury which is best explained by the fact that major vehicles involved in the study were two wheelers.¹⁹ In RTA involving pedestrian-vehicle bumper, the impact was the only mode of injury (100%).⁴ In cases of fall injuries fall from tree among adults and pediatric age group (mostly fracture supracondylar humerus in pediatric age group) was the commonest mode (33.78%),^{24,25} followed by the fall from roof²⁶ and fall into the well (16.21% each); similar results have also been shown in the other studies as well. In a rural setting where people mainly depend on the forest for food, fodder and fuel fall

from tree constitutes a most common mode of injuries. Fall from the roof is more common during summer as most of the people sleep on the roof which often does not have protective boundaries; summer is also the season of kite flying causes fall injury in children and adolescents. In assault cases, blunt object constitutes the commonest mode of injury (60.41%)^{17,27,28} followed by the sharp object (29.16%) while in few studies sharp object was the commonest mode because of the habit of carrying knives in a particular community.²⁹ Most of the injuries in the study group were unintentional (68%).¹⁶ Alcohol intoxication was present in 11.07% cases and the majority of them were assault cases (16%) followed by RTA (11.58%). After sustaining an injury, high mortality is seen among 11–30 years of age group and male sex belonging to rural population.⁹ Complete recovery is seen in 43.4% of cases, partial recovery, and disability in 24% and 16% respectively. The death occurred in 16.57%; most of them having sustained severe head injury.¹⁶

5. Conclusion

Orthopedic trauma consults and admissions at our level 3 trauma center do vary significantly with the weather and are highest in the summer season. Trauma in India is a significant social and financial burden which requires prioritized attention. Data from the similar study can be used as a tool for making policy and planning of trauma program. Trauma System should be to provide universal emergency care with equity of access and considered as basic right. Trauma is bound to consume resources regardless of whether there are systems capable of achieving favorable outcomes. Cost-effectiveness should be the concern while making planning and policies.

Conflict of interest

None.

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References

- Livingston Kristin S, Miller Patricia E, Lierhaus Anneliese, Matheney Travis H, Susan T. Does weather matter? The effect of weather patterns and temporal factors on pediatric orthopedic trauma volume. *Open Orthop J*. 2016;17 (10):550–558.
- Rising WR, O'Daniel JA, Roberts CS. Correlating weather and trauma admissions at a level trauma center. *J Trauma*. 2006;60(5):1096–1100.
- Cashman JP, Green CJ, McEllistrem B, Masterson E, Condon F. The effect of inclement weather on trauma orthopedic workload. *Ir J Med Sci*. 2011;180 (3):679–682.
- Peden M, Sminkey L. World Health Organization dedicates world health day to road safety. *Inj Prev*. 2004;10(2):67.
- Tursz A. Epidemiological studies of accident morbidity in children and young people: problems of methodology. *World Health Stat Q*. 1986;39(3):257–267.
- Zwi AB. Injuries in developing countries: policy response needed now. *Trans R Soc Trop Med Hyg*. 1996;90(6):593–595.
- Krug EG, Sharma GK, Lozano R. The global burden of injuries. *Am J Publ Health*. 2000;90(4):523–526.
- Murray CJ, Lopez AD. Alternative projections of mortality and disability by cause 1990–2020: global burden of disease study. *Lancet*. 1997;349 (9064):1498–1504.
- Gururaj G. Injuries in India: a national perspective in background papers: burden of disease. New Delhi: The National Commission on macroeconomics and health. *Min Health Fam Welf*. 2005;9(1):325–347.
- Demircan Ahmet, Keles Ayfer. Forensic emergency medicine –six-year experience of 13823 cases in a university emergency department. *Turk J Med Sci*. 2008;38(6):567–575.
- Singh B. Profile of trauma related mortality at Manipal. *Kathmandu Univ Med J (KUMJ)*. 2008;6(23) 393–297.
- Mishra B, Sinha ND, Sukhla SK, Sinha AK. Epidemiological study of road traffic accident cases from Western Nepal. *Indian J Commun Med*. 2010;35(1):115–121.

13. Ma J, Guo X, Xu A, et al. Epidemiological analysis of injury in Shandong Province, China. *BMC Publ Health*. 2008;8(1):122.
14. Jha N, Agrawal CS. Epidemiological study of road traffic accident cases: a study from eastern Nepal. *Reg Health Forum WHO South-East Asia Reg*. 2004;8(1):15–22.
15. Malhotra C, Singh MM, Garg S, Malhotra R, Dhaon BK, Mehra M. Pattern and severity of injuries in victims of road traffic crashes attending a tertiary care hospital of Delhi. *Anil Aggrawal's Internet J Forensic Med Toxicol*. 2005;6(3):5.
16. Karbakhsh M, Zandi NS, Rouzrokh M, Zarei MR. Injury epidemiology in Kermanshah: The National Trauma Project in Islamic Republic of Iran. *East Mediterr Health J*. 2009;15(1):57–64.
17. Brink O, Vesterby A, Jensen Jr. Pattern of injuries due to interpersonal violence. *Injury*. 1998;29(9):705–709.
18. Lahiri SK, Mandal P, Mandi P, Mitra SP, Chatterjee T. A study on cases contracting road traffic accidents in rural area and attending the Tarakeswar rural hospital west Bengal. *Indian J Prev Soc Med*. 2005;36(3&4):94–101.
19. Jha Nilambar, Srinivasa DK, Roy Gautam, Jagdish S, Minocha RK. Epidemiological study of road traffic accident cases: a study from south India. *Indian J Commun Med*. 2004;29(1):20.
20. Ghimire A, Nagesh S, Jha N, Niraula SR, Devkota S. An epidemiological study of injury among urban population. *Kathmandu Univ Med J (KUMJ)*. 2009;7(28):402–407.
21. Stomp W, Fidler V, Ten Duis HJ, Nijsten MW. Relation of the weather and the lunar cycle with the incidence of trauma in the Groningen region over a 36-year period. *J Trauma*. 2009;67(5):1103–1108.
22. Bhattacharyya T, Millham FH. Relationship between weather, seasonal factors and trauma admission volume at a level I trauma center. *J Trauma*. 2001;51(1):118–122.
23. Friede KA, Roesler JS, Azam A, et al. Predicting trauma admissions: the effect of weather, weekday and other variables. *Minn Med*. 2009;92(11):47–49.
24. Peden M, Oyebite K, Ozanne-Smith, Hyder A, Branche C, Bartolomeos, eds. *World report on child injury prevention*, vol. 39. Geneva: WHO Press; 2008 5.
25. Rezapur-Shahkolai F, Naghavi M, Shokouhi M, Laflamme L. Unintentional injuries in the rural population of Twisarkan, Iran: a cross-sectional study on their incidence, characteristics and preventability. *BMC Publ Health*. 2008;8(1):269.
26. Al B, Yildirim C, Coban S. Falls from heights in and around the city of Batman. *Ulus Travma Acil Cerrahi Derg*. 2009;15(2):141–147.
27. Hocking MA. Assaults in south east London. *J R Soc Med*. 1989;82(5):281–284.
28. Wright J, Kariya A. Assault patients attending a Scottish accident and emergency department. *J R Soc Med*. 1997;41(4):322–326.
29. Garuar M, Karbakhsh M, Zarei MR. Patterns of assault: experience from an urban hospital-based study in a developing country. *Med J Iran Hosp*. 2004;6(2):50–54.