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Original Research Article

Pediatric Orthopedic Trauma in Hills; a Clinico-Epidemiological Study in Kumaon Region of Uttrakhand

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ABSTRACT

Background: This is a retrospective clinico-epidemiological study of musculoskeletal-injury in pediatric group of patients presented at tertiary health center in predominantly hilly region 'Kumaon' of northern state of India 'Uttrakhand'. It will help to plan preventive measures for pediatric age group and management strategies for orthopedic trauma of pediatric group of patients in hilly region.
Materials and Methods: This retrospective study includes musculoskeletal injured pediatric age group children (up to age of 18) in hilly Kumaon region who were managed by orthopedic surgeon team supported by pediatrician and surgeon team. All medical record files of children with orthopedic injury including other major injuries like head injury and spinal injury from Jan 2004 to Jan 2013 in the Medical Record Section of Government medical college, Haldwani, Nainital (1st post graduate Medical institute in Uttrakhand) were studied. The preformed pro forma consisting age, sex, place of living, mode of injury, time of presentation, level of injury, site of injury, associated injury, and treatment modality etc. were filled from the record files of children. These parameters were analyzed by EPI INFO 2002.
Results: Total 1955 (1072 male and 883female) pediatric patient with mean age of 11.7 ± 4.3 years were studied. Fall from height were the commonest mode of injury followed by domestic injury and Road traffic accident. Maximum children (973) were treated conservatively.
Conclusion: Orthopedic Trauma of children is growing up where as its prehospital care is lagging behind, which is even more crucial than adults. Most of injury were preventable and trauma management were mainly conservative with little shifting toward surgical care. These specific observations help us in further strengthening for preventive measures and trauma care in our setting.

Keywords: Clinico-epidemiological study, retrospective review, orthopedic injuries, Kumaon, hills, pediatric

Conflict of interest: - None
Source of support: - None

INTRODUCTION

Uttrakhand is newly formed northern state of India consisting mainly of hilly region. Uttrakhand was formed on the 9th November 2000 as the 27th State of India, when it was carved out of northern Uttar Pradesh. Uttrakhand has a total area of 53,566 km, of which 93% is mountainous and 64% is covered by forest. According to the 2011 census of India Uttrakhand has a population of 10,116,752, making it the 19th most populous state in India. [1] Uttrakhand has a multiethnic population spread across two geocultural regions: the Garhwal, and the Kumaon with a total of 13 districts. The Kumaon division includes Almora, Bageswar, Champawat, Nainital, Pithoragarh Udham Singh Nagar district. Out of six districts five districts are situated on hills and 78.98% of Kumaon region population is staying at hills. Economy of Uttrakhand is predominantly dependent on mountain agriculture. Medical infrastructure of Kumaon region are not well developed and roadway connectivity of different district and their blocks are not good, especially in rainy season when landslide are common that leading to blockade of roadways. However after state formation overall growth of almost all sector boost up compared to before. Assumption of poor life quality can be taken from data like average hill district electricity 50.43% roadways 318.78 Km and Net irrigated area 10.52% compared to plain 70.11, 799.5Km, 81.06% respectively. [1] All healthcare parameter and Access to health care in the rural parts of mountain districts continues to be poor despite of Uttrakhand existence. Connectivity between villages are poor and also dangerous due to slippery rocks and soil especially in rainy seasons, Vehicles on roads are also under threat due to narrow road with lot of turnings and landslide.

Unfortunately, our's is a state which does not have uniform surgical facilities in hilly region. Patients have to travel a long distance to get treatment without the availability of proper and quick transportation. Our institution Government medical college and associated Dr Shushila Tiwari hospital is situated at foot hill area 'Haldwani'. This institution is largest institution of government of Uttrakhand and key referral centre. Hence it was considered worthwhile to have a retrospective hospital-based analysis of such type of injuries in pediatric patient in order to know the actual burden of pediatric trauma and its consequences so that further planning in terms of preventive measures, as well as management protocol, can be made accordingly.

MATERIALS AND METHODS

The objective of this retrospective hospital based study is to analyze the magnitude, epidemiological, clinical profile, pattern and outcome of these of musculoskeletal injuries of children in hilly region of Kumaon of Uttrakhand who presented at orthopedic and Emergency department of government medical college, Haldwani from Jan 2004 to Jan 2013. Our general protocol is to evaluate every injured child presented to our emergency and outdoor with proper clinical examination and investigation. Primary management is to be done for musculoskeletal injury and referral to other concerned specialty was done accordingly. We excluded all those minor injured children who did not require any orthopedic intervention except few supportive medication and rest for few days(less than one week). Data was collected by searching all required medical record files from the Medical Record Section of Hospital. We have taken help from pediatric department and surgery department in epidemiology, diagnosis and treatment. Detailed clinical history and examination, demographics, mechanism of

injury, nature of injury, time of reporting in emergency, treatment offered (operative or non operative management) were recorded in a preformed pro forma. We have also noted residence of children, place of injury and presentation time to tertiary referral centre. Admitted children were further evaluated in detail by the orthopedic team under the supervision of senior consultant and the indications for operative or non operative management decided depending upon diagnosis and other relevant associated factors and investigations. Epidemiological factors like the magnitude of the problem, clinical profile, demographics, mechanism and mode of injury, place of injury time of presentation since the injury, details of injuries according to relevant organ or system, management details (conservative or operative) were assessed during the period of study. Data was put in Excel sheet and was analyzed with the help of EPI INFO 2002, computer-based statistical analysis for frequency, mean, tables and correlation. This is a large retrospective study of musculoskeletal injured children in the last 09 years in the hilly region (predominantly rural population) of Kumaon zone of Uttrakhand. It gives an overview of clinico-epidemiological characteristics and burden of musculoskeletal-injured children in hills, as well as the over view of cause of delay to approach to appropriate medical centre. This study will formulate a basis to evaluate the treatment modalities offered to these children and help to plan preventive aspects of such injuries at the community level. We have reviewed some of the large retrospective studies of musculoskeletal and other related injuries at different places and in different situations, which are similar to our study but of different importance and with valued recommendations and suggestions.

RESULTS

Table -1- Year wise distribution of children

Year	2012-13	2011-12	2011-10	2010-09	2009-08	2008-07	2007-06	2006-05	2005-04
Total	302(15.5%)	285(14.5%)	281(14.3%)	237(12.1%)	219(11.2%)	212(10.8%)	165(8.4%)	112(5.7%)	102(5.2%)

Table -2- Different Cause of injury of children

Type of injury		Male	Female	Total
Road traffic accident	Low energy	186	168	354
	High energy	117	81	198
Fall from height		398	377	775
Domestic injury while Playing, doing normal activity		359	234	593
Domestic violence		12	23	35
Total		1072	883	1955

Table -3 Trauma incidences in different hilly district of Kumaon region of Uttrakhand.

District	Male	Female	Total
Almora	202	160	362
Bageshwar	180	145	325
Nainital	463	409	872
Pithorgarh	176	136	312
Chamapwat	51	33	84
Total	1072	883	1995

Table-4 Musculoskeletal injury with Associated Injury pattern

Injury pattern	Male	Female	Total	Referral	Management	
					Conservative	Operative
Musculoskeletal injury associated with Head injury	127	70	197	61	72	64
Musculoskeletal injury associated with Chest injury	68	28	96	20	40	26
Musculoskeletal injury associated with Abdominal injury	52	29	81	31	31	19
Musculoskeletal injury with Spinal injury	88	60	148	33	67	48

Table -5 Orthopedic Pattern of injuries of our children in study group

Injury pattern		Male	Female	Total	Referral	Management	
						Conservative	operative
skeletal injury (Including association with other injury as described)	Long bone shaft fracture	290	256	546	09	302	235
	Small bone fracture of hand, foot and clavicle	191	157	348	04	207	137
	Fracture-Dislocation/ Dislocation of joints	142	91	233	18	135	80
	Pelvic fracture	31	21	52	08	36	08
	Fracture around major joint like hip, knee, shoulder, elbow, ankle and wrist	249	233	482	21	181	280
Crush injury of extremities		16	08	24	04	04	16
Spinal injury		117	75	202	102	92	08
Poly trauma children		36	32	68	09	16	43
Total		1072	883	1955	175	973	807

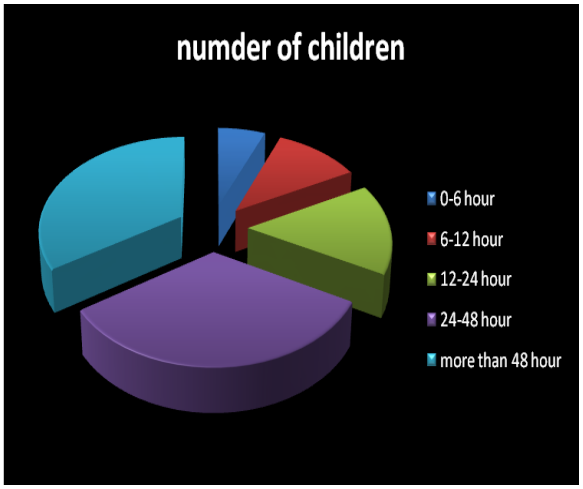

Fig-1- children reporting to institute after injury

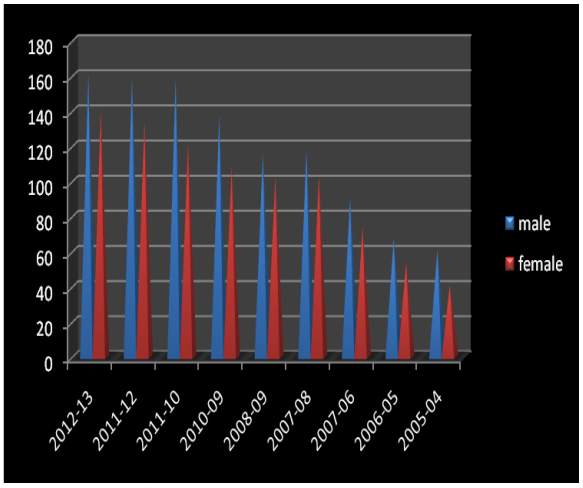

Fig-2- number of children per year

A total 1955 children attended the emergency and outdoor of orthopedic department, who were admitted in the ward for further management Out of which 175 were referred to concerned specialty of same hospital or other centre of excellence. 1072 are male and 883 are female patient. Male of age group 15-18 and female of age group 10-15 are maximum. The mean age of the children was 11.7±4.3 years. Majority of the children belonged to the age group of 10-15 years and the male to female ratio was 1.2:1. The commonest causes of injury were fall from height, outdoor activity like playing and road traffic accident respectively. On descriptive analysis we have found that in maximum number of children are of long bone fractures (546 cases) followed by injury around major joint (482 cases). With respect to the other site of injury associated with musculoskeletal injury, the most common site was the head (197) followed by the spine injury (148). There were 68 cases with multiple site injury in children. Only 212 children got primary pre hospital management. The mean duration of presentation since the incident was 32.8± 9.2 of hours. Majority of children (34.11%) present to us after delay of more than 48 hours. only 6.18% children reported within 6 hour. 11.15% children came to us within 6 to 12 hour, 15.44% reported in 12-24 hour and 33.09% reported in 24-48 hour. Few children even come after weeks from day of injury. Maximum number of children (872 patients) comes from Nainital district, as this hospital is situated in this district, followed by Almora district (362 patients). 973

children were managed conservatively and 807 children underwent operative management for musculoskeletal injuries. Death of musculoskeletal injured children with or without any associated lesions, who are managed by us are three only, these children were associated with multiple co morbidity and poly trauma. Most of the traumatic brain injury cases were due to RTA, followed by fall. Most of the cases of head injury are of mild of grade (GCS>13). About One third of the children of spinal cord injury have a complete neurologic injury on initial examination, with no preservation of motor or sensory function below the injury level. Any children of having history of loss of consciousness, seizure, vomiting, ENT bleed or children of GCS<13 were evaluated with proper neurological examination and CT scan. Abnormalities seen on chest X-ray were hemothorax, pneumothorax, pneumoperitoneum, fracture ribs alone and fracture ribs with hemothorax or flail chest respectively. The most common cause of chest injury was fall followed by RTA. Of these, intercostal chest tube drainage for hemothorax/pneumothorax or a combination of both. There were a total of 81 cases with abdominal trauma. The majority of abdominal injury cases were secondary to fall followed by RTA.

DISCUSSION

Trauma has been man's constant companion since the earliest time, however, despite its huge importance and considered as common killer of human; trauma has been called neglected disease of modern society especially in underdeveloped areas like Hills. Trauma is one of the common surgical emergencies presenting at govt. medical college, Haldwani a tertiary referral center catering to the needs of the population of Kumaon region of Uttrakhand.

Skeletal injuries are common in children. Skeletal injuries occur in 78% of multiply injured children. [2] In a review of over 8000 children's fractures, Landin [3] estimated that over 40% of boys and 25% of girls had sustained a fracture by 16 years of age. Because of the properties of the immature skeleton, these injuries have different characteristics, complications, and management than similar injuries in adults. A number of studies have examined the epidemiology of fractures in children. [3,5,7,9] Most studies have shown a male predominance, particularly in adolescence. Fractures in children younger than 18 months of age are rare and should raise the question of non accidental trauma. Combining the data from five large epidemiologic studies reveals fractures of the distal forearm to be the most common fracture in children, accounting for nearly 25% of 12,946 fractures. The clavicle is the next most commonly injured site, representing over 8% of all children's fractures. [3,7,9] Blunt trauma is the leading cause of death in children older than 1 year of age. Although a number of these deaths are from such massive injuries that there is no chance of resuscitation, there are deaths that could be prevented with proper trauma care. [4,10-12] it is important for all physicians, including orthopaedists, caring for victims of acute trauma to be thoroughly familiar with the systematic, multidisciplinary approach to the assessment and resuscitation of the polytraumatized child. [4] The principles of assessment and resuscitation are outlined and well presented in the Advanced Trauma Life Support course provided by the American College of Surgeons.

Children possess a number of anatomic and physiologic characteristics that make their injuries and their injury response different from adults'. Head and visceral injuries are more common in children,

whereas chest and thorax injuries are less frequent. Several factors contribute to the fact that head injuries occur in over 80% of polytraumatized children. First, because a child's head is relatively large compared with the trunk, the head is usually the point of first contact during high-energy injuries. Second, the cortical bone of the cranial vault is thinner in children. Finally, a child's brain is less myelinated than an adult's and more easily injured. Fortunately, there are also several characteristics that make recovery from head injury more favorable in children. These include a larger subarachnoid space, greater extracellular space, and open cranial sutures. Visceral injuries are also more common in children than in adults, in part because there is less abdominal musculature and less subcutaneous fat. Conversely, the elasticity of the thoracic cage makes fractures of the ribs and sternum not very common in children. [6,8,14,15,17] A child's response to injury is also different from an adult's. It is unusual for children to have preexisting disease, and they usually have large cardiopulmonary reserves. Consequently they can often maintain a normal systolic blood pressure in the presence of significant hypovolemia, although they will develop tachycardia. Children also become hypothermic rapidly because their surface area is large relative to their body mass. This hypothermia can compound the lactic acidosis associated with hypovolemic shock. A 20-year review of all cervical spine fractures at the Henry Ford Hospital found that only 12 (1.9%) of 631 children were younger than 15 years. [6] Others report a similar incidence of fractures in children as in adults. [8] In contrast to what is seen in adults, most cervical spine injuries in young children occur between the occiput and C2 because of increased ligamentous laxity and hypermobility together with a relatively larger head size, which results in the fulcrum of injury being above C3.The mechanism of injury depends on the age of the child. Obstetric cervical spine injury can occur, particularly in infants with hyperextension of the head in the breech presentation. Cesarean delivery may prevent this catastrophic complication. [3,13,20] Careful clinical evaluation is important in this age group because a significant number of these injuries may have normal plain radiographs or "spinal cord injury without radiographic abnormality" (SCIWORA). [7,20] In older children, cervical spine injuries are more often due to motor vehicle accidents, pedestrian–motor vehicle encounters, falls from heights, and athletic injuries. [18,20] It has been estimated that 1% to 1.5% of all children are abused each year. [19,21]

Children reporting to our institute is mostly delayed from hilly region probably because of some reasons like; Nonavailability of vehicle, lack of connecting road, presence of forest and its wild animal, possibility of Road blockade (specially in rainy seasons). Most of the children presents to us after 24 hours from the injury.108 services to tackle the disaster call and bringing the children to nearby hospitals worth to improve on the spot care as well as reduction of hour to reach the nearby hospitals. Most of the children (121 cases) come to our emergency within 6 hour of injury is by the help of 108 services. [16] After analysis of orthopedic injury pattern we find that long bone fractures (546 cases) are commonest presentation followed fracture around joint (482 cases) respectively. Fall from the height and RTA is major cause of long bone fracture and spinal injury as well as head injury. Upper limb long bone fractures are more common than lower limb. In upper limb distal radius fractures are outnumbered. High energy RTA generally leads to poly trauma (68 cases), Pelvic fractures (52 cases) as well as fracture dislocation of major joint. Clavicle

fracture and Supracondylar fractures of humerus are among the commonest fracture pattern observed in pediatric age group, Crush injury of foot and hand (24 pts) are generally due to fall of rocks to the limb and RTA. Most common association with musculoskeletal injury is head injury (197 cases) followed by spinal injury (148 cases). As modernization and advancement in orthopedics is going on gradually, treatment plan are also shifting towards surgical side. Here in our study we operated 973 children whereas 807 children are managed conservatively. Dorsolumber spinal injury is commonest site because of anatomical reasons. The dorsal spine is fixed and less mobile because of rib cage as compared to lumbar spine which is very mobile segment of spine. The sudden transition from fixed to mobile portion of spine makes dorsolumber spine more venerable to trauma.

Though it is only a hospital-based retrospective review, it would certainly prove to be an important document or research work for this subcontinent to enable us to know about clinico-epidemiological characteristics of musculoskeletal-injured children in hilly region (predominately rural population). Pediatric injuries should be prevented with a very sound preventive program in the community. There is an urgent need to reduce the delay in bringing the trauma children from site of injury to tertiary care hospital. Analysis of the trend of injury and its cause and associated risk factors influence the planning of preventive and remedial measures pertaining to the human habitations, roadways and in the setup of health care institutions for any eventualities. [13] This study has shown that majority of the trauma cases are due to preventable causes like, improper and slippery roads, lack of lighting on roads, bad planning of houses. The Government need to consider these factors into the national health policy so as to reduce the mortality and morbidity from trauma in pediatric population. The need for trauma care systems (regional / local / national) should be the priority for any developing country based on their regional geography and health care systems. Education too plays a major role in getting better medical care. Last, but not the least, the health department must actively recruit medical centers on the highways/roads/local or district levels, with training in basic ABC in trauma resuscitation specially in care of pediatric population for early intervention and referral to save lives.

CONCLUSION

In developing countries like India, statistics regarding epidemiology of trauma incidence and pattern especially in hilly region are very poor. This clinico-epidemiological study provides valuable information on magnitude of problem, resultant demand of health care in form of pediatric trauma care centers and also preventive measures. This study clearly reflects the increasing burden of musculoskeletal injured children for treatment in this part of the country. We should have little modified comprehensive trauma management protocol for children according to geographical region, Health resources, literacy, and socio economic status. There is also need of performing a prospective study for further strengthening of association.

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