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Patterns of fracture and its management in the 1st decade of life at a tertiary care centre in north India

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Abstract
Fractures and dislocations involving the developing skeleton may differ significantly from those of the adult skeleton. The pattern of injuries children may sustain via a certain injury mechanism usually differs from that of adults and so often requires different diagnostic and treatment protocols. With this study we have tried to study the incidence, mode, pattern and complications during management of fractures in paediatric population. We came across 510 patients of paediatric fractures and due various causes followed a total number of 134 cases and present our findings with this study.

Keywords: Patterns, fracture, management, life, tertiary care centre

Introduction
Children are not small adults and for a variety of reasons fractures in children demand separate consideration. The main purpose of fracture epidemiology and epidemiological studies in general is to find the etiology of disease or at least a direction in which to search for the etiology. Studies regarding this have, so far, been almost entirely limited to adults. Literature on childhood injuries usually focus on fracture rates and not on incidence rates which thereby makes task of child health care organizations and bodies concerned with social planning a bit more difficult as data on knowledge of when, where and how accidents occur is limited.
There are not many epidemiological studies of fractures of children reported from India. An attempt, to study the pattern of fractures in children and the functional outcome of various modalities of treatment available in this hospital, is thus undertaken during the first decade of life.

Aims and Objectives
1. To study the pattern of fractures in children.
2. To study the incidence, mode and place of trauma for children.
3. To manage the injuries and follow up the patients for any complications.

Material and Methods
"Patterns of fracture and its management in first decade of life" was a prospective study conducted in Department of Orthopaedic surgery, SGRRIMHS, Dehradun Uttarakhand, India. The total no. of case studied were 134 among which 94 were of upper limb fractures and 40 were of lower limb fractures during 2016-2017
Children 0-10 years of age and all fractures with or without any associated injury were included in the study. All children less than 10 years of age, were first seen either in the emergency department or in the orthopaedic surgery outpatient department. Detailed histories were taken & thorough clinical & radiological examination was done & findings were recorded.
Also general physical and systemic examination was carried out and recorded. After first aid in the form of analgesics and splints, roentgen films were taken, to find out the site, type and displacement of fractures. Fractures were classified based on their anatomic site, the location of the injury occurrence (home, playground, footpath, school and sports facility). Epiphyseal

fracture separation was studied according to Salter and Harris classification. Open fractures were classified as per Gustilo's classification.

Bilateral fractures of the same bones of both limbs were recorded as two fractures. Two fractures of the same bone were recorded as one fracture & fracture both bones of the forearm & leg as one fracture. Old fractures, birth injuries as well as pathological fractures were not included in this study.

Three Descriptive Categories of Landin's Modified Trauma Levels Used in This Study. They were descriptives indicating slight trauma, descriptives indicating moderate trauma and the descriptives indicating severe trauma.

The patients were managed accordingly as per the bone involved, the fracture pattern and the soft tissue condition. They were then followed up for one year to monitor the period of fracture healing and watch out for any complications.

Results

There were total 16,690 cases of bone and joint diseases

During the period of study, out of which total number of cases of fracture of various bones were 1460. Out of these total numbers of cases, fractures in children were 510 during the period of study. Out of this, only 184 patients were in first decade of life. Fifty patients did not turn up for follow up and therefore excluded and only 134 cases were followed till final outcome. In the present series greatest number of children sustaining fractures were in the age group of 8-10 years (29.8%) while the minimum being below 2 years (5.9%) of age. Male predominance was seen in all age groups and male female ratio being 2.2:1.

In males & females the maximum number of fractures were in the age group of 8-10 years (20.6%) and (8.9%) respectively. In the age group of 0-2 years and 2-4 years, males and females were almost equally involved and with the increase in age males outnumbered females.

Table 1: Distribution of fractures according to age & sex and area

Age	Males	Females	Urban	Rural	Total
0-2	5 (3.7%)	3 (2.2%)	5(3.7%)	3 (3.2%)	8
2-4	13 (9.7%)	5 (3.7%)	10(7.4%)	8 (6.2%)	18
4-6	23 (17.3%)	10 (7.4%)	17(12.7%)	16(11.9%)	33
6-8	24 (17.9%)	11 (8.2%)	19(14.3%)	16(11.9%)	35
8-10	28(20.6%)	12(8.9%)	21(15.6%)	19(14.3%)	40

The patients who attended the hospital belonged to both urban and rural areas. 62 patients (46.3%) belonged to the rural population and 72 patients (53.7%) belonged to the urban population.

In this study, it was observed that 53.74% children belonged to the families with low socio-economic strata. Traumatic lesions were least in higher socio-economic strata. The three major groups sustaining fractures were the children of in-service parents, farmers and labourers. There were 38 children of in service parent, 13 of businessmen, 45 of labourers and 38 of the farmers. It was also observed that in 21 cases the mother was also working.

Table 2: Incidence as per socio-economic status

Limb	No. of patients	Percentage
Upper	10	7.46
Middle	52	38.80
Lower	72	53.74
Total	134	100.00

Table 3: Parental occupation and incidence of fracture in children

Parental occupation	No. of patients	Percentage
Service	38	28..36
Businessmen	13	9.70
Labour	45	33.58
Farmer	38	28.36
Total	134	100.00

The highest incidence of childhood trauma was observed in the school going age (70.40%) as compared to the incidence of 19.3% in pre-school children.

Table 4: Education wise incidence of fractures

	Total	Percentage
(a) Pre-school	26	19.3
(b) School going	94	70.4
(c) Not school going	14	10.3
Total	134	100.0

In the present study 54.37% children had fractures at home, 27.6% at playground, 13.4% at roadside and 5.3% at school. On the road children suffered from mild to severe grade of trauma and sustained fractures as pedestrians and cyclists. 127 cases sustained trauma during outdoor activities and only 7 cases sustained trauma inside the school.

Table 5: Distribution of fractures in children according to place of injury

Place	No. of cases	Percentage
Home	72	53.7
Playground	37	27.6
School	7	5.3
Road	18	13.4

In the present study, different modes of injury were instrumental in producing fractures. Most common mode of injury (81.34%) leading to fracture was various falls & slips such as from beds, chairs, stairs, ladders, bicycles, cattle's, scooters, trees and roofs. Few cases (14.17%) were due to road traffic accidents (e. g. motor car, bus, tractor trolley & two wheeler accidents). Six cases were caused by physical assault where child was beaten by playground partners or family members.

There were 84 patients who sustained fractures due to mild trauma in the form of falls to ground from standing or playing or from a height less than 0.5 meters. 41 patient sustained fractures due to moderate trauma-falling from between 0.5-3 meters. Severe trauma in the form of falls from a height exceeding 3 meters and traffic accident were responsible in 9 patients for fractures.

Table 6: Severity of trauma causing fractures

Groups	No. of patients	Percentage
Mild	84	62.69
Moderate	41	30.60
Severe	9	6.71
Total	134	100.00

As is evident from this table, upper limbs were involved more commonly than lower limb-more than twice. It was observed that the left side was involved more than the right. Upper limbs were involved in 70.12% and the lower limbs in 29.88%. Regarding the side, left was observed in 52.22% and right in 47.78%.

Table 7: Anatomical site of fractures

Bone	**Upper limb**	**Bone**	**Lower limb**
Clavicle	4(2.98%)	Patella	1(0.74%)
Humerus	28(20.90%)	Femur	10(7.50)
Radius	16(11.94%)	Tibia	13(9.70%)
Ulna	3(2.24%)	Fibula	Nil
Both Radius & Ulna	38(28.36%)	Both Tibia & Fibula	14(10.45)
Small bones of hand	5(3.7%)	Small bones of foot	2(1.49%)
Total	94(70.12%)	Total	40(29.88%)

Only 13 patients had compound fractures 6 patient had in the upper limbs while 7 patients had in the lower limbs. Falls from height more than three feet and road-side injuries were mainly responsible for these compound fractures. The compound fractures were classified as per Gustilo classification. All fracture were of Gustilo type-1 and rest were of Gustilo type IIIa variety.

Table 8: Incidence of compound fractures in children

Group	**No. of cases**
Tibia	5
Femur	2
Both bone forearm	3
Supracondylar humerus	3
Total	13

In the present study, the compound fractures seen were in 9.7% of children. 2.9% patients had it in the upper limbs, while 6.7% had it in the lower limbs.77% cases were of Gustilo type I followed by type III a (23%). These fractures were sustained as a result of severe trauma such as falls from height and traffic accidents.

Table 9: Variety of epiphyseal injuries in children

Group	**No. of cases**	**Percentage**
Lateral condyle humerus	6	23.07
Medial epicondyle humerus	2	07.69
Distal epiphysis radius	7	26.92
Distal epiphysis ulna	2	07.69
Distal epiphysis tibia	6	23.07
Phalanges	3	11.5
Total	26	100.00

In the present study, there were 19.40% epiphyseal injuries (26 cases). 22 cases (84.6%) were seen in upper limb. Lower epiphyses of radius was most commonly involved 7 cases (26.9%) followed by lower epiphyses of tibia and lateral condyle humerus, 6 cases (23.1%) each. Most cases were of Salter and Harris type II (61.5%), followed by Salter and Harris type I, III and IV as 23%, 4% and 11.5% respectively.
Six patients had an associated head injury, one patient had abdominal injury and bones involved were tibia-fibula in three, radius & ulna in two and femur in two. Only 6 children sustained more than one fracture. In three patients it was bilateral radius and ulna, in one supracondylar fracture humerus with tibia-fibula and two supracondylar humerus with radius ulna. No case of polytrauma was seen. Only three supracondylar fractures of humerus were associated with nerve injuries In 1 case the radial nerve was involved while in the other 2 it was the median nerve.

Table 10: Clinical & radiological location of the site of fractures

Age	**Total No. of Cases**	**Non Physeal Fractures**									**Physeal Fractures**	
		Segment			**# Line/Type**				**No. of #**			
					Complete #	**Green Stick**	**Torus**					
		U	**M**	**L**	**No. of #**	**No. of #**	**UL**	**LL**	**U L**	**L L**	**UL**	**LL**
0-2	8	2	4	1	3	1	1	2	4	3	1	-
2-4	18	2	8	3	7	2	4	-	8	5	4	1
4-6	33	6	8	11	14	7	3	1	19	6	6	2
6-8	35	4	9	15	17	10	1	-	20	8	6	1
8-10	40	3	10	22	19	15	-	1	24	11	3	2
Total	134	17	39	52	60	35	9	4	75	33	20	6

A total of 134 fractures were studied out of which 108 were non physeal fracture and rests 26 were physeal fracture. Among non-physeal fracture, most common segment involved was lower 1/3rd. Upper limbs were involved in 75 cases and lower limb in 33 cases. Transverse fracture was the most common fracture line followed by oblique & spiral. Green stick fracture was observed in 35 cases and torus fracture in 13 cases. Among physeal fracture upper limb was involved in 20 cases followed by lower limb in 6 cases.

Table 11: Distribution of fractures

Age	No. of cases	Non-physeal #							Physeal #
		Bones			Fracture line/type				
		Tibia	Fibula	Both Bone	Tr.	Obl.	Sp.	Torus	
0-2	2	2	-	-	-	-	-	2	-
2-4	4	2	-	1	1	2	-	-	1
4-6	6	2	-	2	1	3	-	1	2
6-8	7	2	-	4	4	2	-	-	1
8-10	8	2	-	4	-	2	4	1	2
Total	27	10	-	11	6	9	4	4	6

Table 12: Distribution of fractures in femur

Age	No. of cases	Segment			Fracture line			Physeal fracture
		Proximal	Middle	Distal	Tr.	Obl.	Sp.	
0-2	2	1	1	-	1	1	-	-
2-4	1	-	1	-	-	1	-	-
4-6	1	-	1	-	-	1	-	-
6-8	2	-	1	1	-	1	1	-
8-10	4	1	2	1	-	-	4	-
Total	10	2	6	2	1	4	5	-

Type of fracture

Type	No. of cases
Open fractures	2
Closed fractures	8

Table 13: Distribution of fractures in humerus

Age	Site								Total
	Proximal ME Region	Diaphysis			Distal ME Region				
		U	M	L	SC	LC	MC	MEp	
0-2	-	1	-	-	-	-	-	-	1
2-4	-	-	-	-	3	-	-	-	3
4-6	-	1	1	-	4	3	-	-	9
6-8	-	-	1	-	6	2	-	1	10
8-10	-	1	-	-	2	1	-	1	5
Total	-	3	2	-	15	6	-	2	28

Pattern of Humeral shaft fractures

Age	No. of cases	*Fracture line/type*				
		Tr.	Obl.	Sp.	GS	Torus
0-2	1	-	-	-	-	1
2-4	-	-	-	-	-	-
4-6	2	2	-	-	-	-
6-8	1	1	-	-	-	-
8-10	1	-	1	-	-	-
Total	5	3	1	-	-	-

Distribution of fractures of forearm bone

Age	No. of cases	Non-physeal fractures								Physeal fractures	
		Site			Fracture line/type						
		Ulna	Radius	Both bone	Tr.	Obl.	Sp.	G.S.	Torus	Ulna	Radius
0-2	1	-	1	-	-	-	-	1	-	-	-
2-4	8	1	2	5	-	-	-	2	4	2	2
4-6	12	1	3	8	-	-	-	7	3	-	2
6-8	15	-	4	11	2	1	-	10	1	-	1
8-10	21	1	6	14	3	1	-	15	-	-	2
Total	57	3	16	38	5	2	-	35	8	2	7

Distribution of fractures Tibia and Fibula

Age	No. of cases	Non-physeal #							Physeal #
		Bones			Fracture line/type				
		Tibia	Fibula	Both Bone	Tr.	Obl.	Sp.	Torus	
0-2	2	2	-	-	-	-	-	2	-
2-4	4	2	-	1	1	2	-	-	1
4-6	6	2	-	2	1	3	-	1	2
6-8	7	2	-	4	4	2	-	-	1
8-10	8	2	-	4	-	2	4	1	2
Total	27	10	-	11	6	9	4	4	6

Type of fractures

Open fractures	5
Closed fractures	22

Discussion

Children are gradually growing to adulthood and have softer bones and comparatively strong ligaments. They are also prone to various types of injuries leading to damage to their skeletal frame and are also vulnerable to trauma usually while playing and rarely may they sustain severe trauma in road traffic accidents. It has been observed that dislocations are much less common than fracture of bones. In this study we have tried to observe the pattern of injuries of the bones of children for furtherance of our knowledge regarding their problem & management.

In the present series greatest number of children sustaining fractures were in the age group of 8-10 years (29.8%) while the minimum being below 2 years (5.9%) of age. Male predominance was seen in all age groups with male female ratio being 2.2:1. Hanlon and Estes (1954) [1] found the maximum fractures in older children & least in 0-2 years of age. Landin (1983) [2] also observed that fractures were more common among boys in all age groups and in older children they became twice as common as in girls. Bhalla *et al*. (1991) [3] in their study had seen the maximum incidence of fractures (15.42%) in 8-10 years and the minimum number of fractures (5.45%) in 0-2 years of age.

Izant and Hubay (1966) [4] reported male and female ratio as 2: 1.

The urban patients formed the largest group reporting to the hospital for treatment (53.7%). This was due to the fact that the hospital was nearer to their home and easy/early availability of transportation means. Rural patients (46.3%) were late in reporting to the hospital, but majority reported within 24 hours. Those patients who reported after 24 hours were late due to various reasons like ignorance, non-availability of transport, visit to quacks and traditional bone setters.

Garrettson *et al*. (1985) [5] observed urban population to be affected more than rural. They also observed that incidence of falls and number of male children to be more frequently involved in the urban areas. Bhalla *et al*. (1991) reported the incidence of fractures in children both in urban and rural population to be almost equal.

The highest incidence of childhood trauma was observed in the school going age (70.40%) as compared to the incidence of 19.3% in pre-school children,. This can be explained by the number of hours per day a child is away from home, either in the school, on the road or playground which thereby means increased outdoor activities and freedom to play.

In the present study 54.37% children had fractures at home, 27.6% at playground, 13.4% at roadside and 5.3% at school. On the road children suffered from mild to severe grade of trauma and sustained fractures as pedestrians and cyclists. 127 cases sustained trauma during outdoor activities and only 7 cases sustained trauma inside the school.

Hanlon and Estes (1954) reported 21.5% of cases as home injuries, 15.2% at playground and 6.9% in school. Dickson *et al*. (1964) [6] had also documented that fractures in children commonly occur at home (45%) and the kitchen being the most frequent site, with the bedroom a close second.

Most common mode of injury (81.34%) leading to fracture was various falls & slips such as from beds, chairs, stairs, ladders, bicycles, cattles, scooters, trees and roofs. Home was the most common place where majority of falls occurred, followed by playground where fractures occurred while playing. Few cases (14.17%) were due to road traffic accidents (e. g. motor car, bus, tractor trolley & two wheeler accidents). Six cases were caused by physical assault where child was beaten by playground partners or family members.

Hanlon and Estes (1954) observed in his study 25.6% cases due to falls from height, on steps, trees and furniture. Fractures resulting from accidents were recorded in 12.9% and various sports accounted for 30.9%. Bhalla *et al*. (1991) observed the commonest mode of injury due to fall resulting in 55.32% fractures followed by traffic accidents in 36.27%.

It was also observed that severity of trauma causing fractures in the present study was found to be mild in 62.69%, moderate in 30.60% and severe in 6.71% of cases. Landin (1983) observed that the fractures caused by trauma were classified as mild in 66%, moderate in 19% and severe in 7% of cases in his study

In the present study, the upper limbs were involved in 70.12% cases and the lower limbs in 29.88% cases. Regarding the side, left was observed in 52.22% and right in 47.78% cases. Hanlon and Estes (1954) documented that fractures being commoner in the left upper limbs (57.5%). Reed (1977) [7] also reported fractures in children to be common on the left upper limbs. In the present series, fractures of both bones forearm were the most common injury sustained by children (28.36%). followed by the fracture of humerus (20.90%), fracture of radius alone (11.94%) and both bone leg (10.45%) were next in order of frequency. Fractures of small bones of hand, foot and patella were rare.

In the present study, the compound fractures were seen in 9.7% of children. 2.9% patients had compound fractures in the upper limb, while 6.7% had in the lower limbs.77% cases were of Gustilo type I variety followed by type III a (23 %). These fractures were sustained as a result of severe trauma such as falls from height and road traffic accidents. Hanlon and Estes (1954) reported 2.6% compound fractures in their series and over one-half of these resulted from either a vehicle accident or machinery injury. Cases were equally divided between the upper and lower extremities in their series. Bhalla *et al*. (1991) reported compound fractures to be one-fourth of the simple fractures.

In the present study, there were 19.40% epiphyseal injuries (26 cases) out of which 22 cases (84.6%) were seen in upper limbs. Lower epiphyses of radius was most commonly involved in 7 cases (26.9%) followed by lower epiphyses of tibia and lateral condyle humerus, 6 cases (23.1%) each. Most cases were of Salter and Harris type II variety (61.5%), followed by Salter and Harris type I, III and IV as 23%, 4% and 11.5% respectively. Hanlon and Estes (1954) found 17% cases of epiphyseal injuries in their series. They found it to be commoner in males and more common in older children and much commoner in the upper extremities (72.7%). Bhalla *et al.* (1991) in their series reported 8% contribution by the epiphyseal injuries and the commonest site being lower end of radius. The commonest cause of injury was fall while playing (60%) and commonest type as Salter and Harris type II (80%).

Seven patients (5.22%) had associated injuries with head injuries in 6 cases and abdominal injury in 1 case, which were managed jointly with the help of General Surgery Department. All cases resulted due to severe trauma and bones involved were tibia-fibula in three, radius-ulna in two and femur in two cases. Hanlon and Estes (1954) reported 6.4% children to sustain multiple injuries. Reed (1977) found 2.76% patients sustaining multiple fractures in his series of 398 patients and motor-vehicle accidents to be the main cause of fractures in 7 patients. Bhalla *et al.* (1991) also reported head injury to be the most common associated injury with fractures in children.

Fractures of the clavicle in the present study were 2.99% cases of all fractures. They were common upto 6 years of life. Most of the fractures occurred in the middle third of bone and were caused while playing as a result of fall. Beekman and Sullivan (1941) [8] reported that fractures of the clavicle in children occur in the middle third of the bone. The majority (71%) involved the middle third of the bone and 47% were caused by falls. Landin (1983) observed fractures of the clavicle contributed 8.1% of all fractures and falls to be the most common cause of injury. Fractures of the clavicle in the present study were managed by either sling or by figure of eight bandage. Both forms of treatment gave remarkably good results.

Anderson K, Jenson PO, Lauritzen J (1987) in their study compared figure of 8 strapping & sling in treatment of fractures of clavicle and observed similar final outcome. Rubin A (1964) in his study treated young patients by sling & found remarkably good result with rare complaints of bump noticed by parents. All these bumps disappeared spontaneously and completely.

In the present study, the fracture of humerus accounted for 20.89% of total fractures. The various sites involved were the shaft, supracondylar and condylar regions. Fracture humerus was observed in almost all the age groups and fall was the commonest cause. Beekman and Sullivan (1941) observed the incidence of fractures of humerus as 19%. Iqbal (1974) [9] reported humeral fractures as 28% of the total and falls to account for 77% of these fractures.

In the present study, 53.57% of all fractures of humerus occurred in the supracondylar region, & 28.57% in the condylar region (lateral condyle 21.4% & medial epicondyle 7%) & 17.86% occured in the shaft of humeral fractures. Beekman and Sullivan (1941) quoted fractures of the shaft of humerus as 14% of the fractures of the humerus and distal end humerus as 70% of the fractures of the humerus in their series. There were 69% supracondylar fractures, 17% lateral condyle and 14% medial epicondylar fractures. Landin (1983) observed that supracondylar fractures contributed 3.3% of all fractures in children. Bhalla *et al*. (1991) observed supracondylar fractures to be 50% of all humeral fractures.

All supracondylar fractures were of extension type. 20% of supracondylar fractures were ndisplaced and three fractures were associated with nerve injuries. In no case vascular injury was observed. Regarding the side 65.21% occurred on the left side and 34.7% on the right side. In the present series median nerve was the most common nerve to be injured. All cases of nerve injury recovered completely and spontaneously during the follow up period. This is comparable to the incidence recorded by Flynn JC (1973) and Sharkawi A. H (1965)

Fractures of the both bones of the forearm were the most common fracture encountered in this study (42.54%), radius alone was fractured in 11.94% and ulna alone in 2.24% cases. Radiologically, the fractures were of torus (8 cases), greenstlck (35 cases), transverse (5 cases), oblique (2 cases), undisplaced (1 case) and displaced (6 cases) varieties. In Beekman and Sullivan (1941) study, most fractures of the forearm occurred in the distal halves of the bones, 82% in the distal third. In Lichtenberg's (1954) [10] study, forearm fractures were 41% of all fractures. There were 6.1% in the upper third, 20.9% in the middle third and 73% cases in the distal third of the forearm fractures.

The ratio of left and right sided fracture being 1.08:1. The commonest radiological type being transverse 70.39% in radius and 82.24% in ulna followed by oblique 15.79% in radius and 9.21% in ulna. The lower third fractures were seen to be the commonest site in 71.06% cases

In the present study, the epiphyseal injuries of the lower epiphyses of the radius and ulna were seen in 7 & 2 cases respectively. 6.7% of epiphyseal injuries of forearm were observed out of which 55.5 % were of Salter Harris type II variety & rest were classified as type I. Distal radial epiphyseal injuries were noted in 5.2% cases & lower ulnar epiphyseal injuries in 1.4% cases.

In the present study greenstick fractures (35 cases) were the most common fracture (61.40%) followed by torus fracture as 14% (8 cases).

Fractures of the femur were 7.46% of all fractures in the present study and ranked fifth in sequence. It was seen in all the age groups, the majority (40%) being in the age group of 8-10 years. There were 20% fractures in the upper third of the shaft, 60% in the middle third and 20% in the lower third of the all femur fractures. Iqbal (1974) documented femoral fractures as 4% of all fractures and all resulted from falls. About 39% of these involved the midshaft segment, and 23% involved the upper third. In the present study all fractures were non-comminuted, most common site was middle third with spiral fracture most common.

In the present study, fractures of tibia alone were 12.14% & both tibia and fibula as 14% of all fractures. Fracture fibula alone was not recorded in this series. Beekman and Sullivan (1941) observed the fracture tibia alone to be in 67.76% of all leg bone fractures. The shaft of tibia was fractured in its lower third in 71% of cases. In Lichtenberg's (1954) study, fractures of the tibia and fibula accounted for 14.5%. Of these, the tibia was fractured alone in 61%, both bones in 30% and the fibula alone in 9% of the cases.

Bhalla *et al*. (1991) reported the commonest mode of injury in fractures of the both bones of leg to be traffic accidents (64.4%) followed by fall from height (14.11%). The most common radiological type was transverse (43.22%) followed by oblique (24.58%).They observed isolated tibial fracture in 9.75% of lower limb fractures. Yong J & Letts M. (1997) in

their study observed that 70% of paediatric tibial fracture are isolate injuries & 30% of pediatric tibial diaphyseal fractures have associated fibular fracture.

In present study 4.4% (6 cases) cases of distal tibial physeal injuries were observed 66.6% (4 cases) were classified as Salter Harries Type II & 16.66% were classified as Salter Harris type I & III each.

In the present study, fracture patella was observed in one case, who was male and of 9 years of age & was managed conservatively. Ray and Handrix (1992) reported fracture patella in skeletally immature patients as rare.

In the present study 5 cases of fractures in hand bone were observed. Three fractures were in phalanx and two were in metacarpal. All the three epiphyseal injuries were seen in phalanx and all were of Salter-Harris type II variety.

In the present series 2 cases (1.49%) were observed, both in metatarsals. Among other fractures, fractures of scapula, fractures and fracture dislocations of spine and pelvis were not recorded in this series. Bhalla *et al.* (1991) reported foot fractures to be 1.71% of lower extremity fractures. The commonest mode of injury was traffic accidents in 57.4% and falls while playing being 14.29%.

Conclusion

To conclude, it may be emphasized that this type of study is important as it tells us certain risk factors which make children more vulnerable to injuries and avoiding these factors they may become less prone to sustain fractures.

Paediatric trauma is the leading health problem affecting children older than 1 year of age. With a more mordenisation of society, serious injuries to children will continue to occur with increasing frequency. Effective care of the child with skeletal injuries depends on knowledge of paediatric injury patterns, appropriate diagnosis and treatment.

The high percentage of bony injuries in poly traumatized children should be kept in mind so that an appropriate series of diagnoses can be made in the emergency room and managed accordingly.

Fractures in children are less common than in adults. This is a result of the paediatric anatomy. The periosteum in children is thicker, stronger, more vascularized, has a higher biological activity and is usually not affected by trauma. The paediatric bone has a higher plasticity and elasticity. This results in a partially reversible deformation without a manifest fracture. Moreover, the cortical substance of the bone is wider. As a result bony injury patterns are quite different as compared to adults.

Most of the times the fractures can be managed conservatively in case of closed minimally displaced fractures. One of the matter of concern in paediatric age group is the epiphyseal cartilage which is the most sensitive part of the growing bone and injury to which if not managed adequately can lead to growth abnormalities.

Thus the different presentation and pattern of bony injuries in paediatric age group should be kept in mind so that these injuries can be prevented and if at all they occur they can be managed accordingly without complications.

References

1. Hanlon CR, Estes WL. Fractures in childhood-A statistical analysis. Am. J Surg. 1954; 87:312-322.
2. Landin LA. Acta Ortho. Scand. 1983; 202(54):1-101.
3. Bhalla R, Gupta P, Paul S. Fracture patterns in children, Indian J Ortho. 1999; 25(2):79-82.
   Blount WP. Forearm fractures in children CI Orthop. No. 1967; 51:93-107.
4. Izant RJ, Hubay CA. The annual injury of 15,000,000 children: A limited study of childhood accidental injury and death.J Trauma. 1966; 6(1):65-74.
5. Garrettson LK, Gallagher SS. Falls in children and youth Ped Clin of North America. 1985; 32(1):153-162.
6. Dickson DG, Schlesinger Er, Westaby JR, Lowen L. Medically attended injuries among young children AM. J Dis. of child. 1964; 107:618-623.
7. Reed MH. Fractures and dislocations of the extremities in children J Trauma. 1977; 17(5):351-354.
8. Beekman F, Sullivan JE. Some observations on fractures of long bones in children. Am. J Surg. 1941; 51:722-738.
9. Iqbal QM. Long bone fractures among children in Malaysia. International Surg. 1974; 59(5):410-415.
10. Lichtenberg RP. A study of 2532 fractures in children. Am. J Surg. 1954; 87(1-3):330-338.
11. Ray JM, Hendrix J. Incidence, mechanism of injury and treatment of fractures of the patella in children. J Trauma, Apr. 1992; 32(4):464-7.