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Research Article

Epidemiological Study of Paediatric Supracondylar Humeral Fractures: Experience at a Tertiary Care Centre of North India

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Abstract

Objectives: In this study we observed epidemiological pattern of paediatric supracondylar fractures presenting to a tertiary care centre of a developing country to work out factors that are preventable and need attention so as to decrease the morbidity of these difficult fractures.

Methods: All the suspected cases of supracondylar fractures of humerus in children up to 15 years of age were evaluated for following parameters: 1. Age. 2. Sex. 3. Extremity involved (dominant or non-dominant). 4. Mode of trauma. 5. Time since injury. 6. Any history of intervention and type of intervention by local bone setter or healer. 7. Any compounding of fracture and if present classification as per Gustilo-Anderson grading. 8. Anatomical type of fracture (extension or flexion type). 9. Gartland type of fracture. 10. Associated injuries. 11. Complications at presentation. Data of 140 patients was tabulated and analysed using appropriate statistics.

Conclusion: Near about one fifth of paediatric supracondylar fractures can be prevented by proper railing of roof tops and stairs. And morbidity reduced in developing nations by educating people about dangers of treatment by local bone setters. Community health workers have a pivotal role in this setting. Moreover, children with supracondylar fractures should always be screened for injury to ipsilateral forearm bones.

Keywords: Supracondylar fracture; FOOSH; Local bone setters; Volkmann's ischemic contracture; Gartland

1. Introduction

Supracondylar fracture of the humerus is one of the most common types of fractures in paediatric age group accounting for more than half of the fractures around elbow and one third of paediatric limb fractures.[1,2,3,4] These fractures are problematic in terms of diagnosis, complications and management.[5] Early diagnosis and management is important for good functional results.[6,7] Delay in management may lead to failure of closed reduction and percutaneous pinning and delayed open reduction is plagued with higher risk of myositis ossificans.[4] Local bone setters and healers are still prevalent in developing countries and their intervention in these fractures leads to delay in presentation to hospital and additional set of complications like compartment syndrome, volkmann's ischemic contracture, myositis, malunion and even limb threatening complications like gangrene.[8,9]

The aim of this study was to highlight the factors that are preventable and if properly delivered to general population using media, can reduce the incidence of supracondylar fracture as well as many of its complications in children in developing countries like India.

2. Material and Methods

This prospective study was conducted at Government Medical College Jammu; the only tertiary care centre of Jammu division of Jammu and Kashmir in north India, for a period of two years from March 2012 to January 2014. All the suspected cases of supracondylar fractures in children below 15 years of age, attending the Emergency or Out Patient Department were evaluated clinically and radiographically.

Following parameters were recorded:

1) Age, 2) Sex, 3) Extremity involved (dominant or non-dominant), 4) Mode of trauma, 5) Time since injury, 6) Any history of intervention and type of intervention by local bone setter or healer, 7) Any compounding of fracture and if present classification as per Gustilo-Anderson grading, 8) Anatomical type of fracture (extension or flexion type), 9) Gartland type of fracture, 10) Associated injuries, 11) Complications at presentation.

Fractures that were initially diagnosed as supracondylar fractures on the basis of suspicion and later turned out to be simple soft tissue injuries or some other pattern of bone injury were excluded from the study. Over a period of two years of study 140 cases of supracondylar fractures were enrolled in our study and all the data about above mentioned parameters were analysed by appropriate statistical tests.

3. Results

Most of the fractures were seen in 4 to 8 year age group with peak incidence at 4 years in girls and at 8 years in boys. Frequency was 2.5 times more in boys than girls. Left extremity was predominantly involved (Table I). Fall on outstretched hand was the predominant mechanism of injury with fall while playing, fall from roof top and fall from stairs the predominant mode (Table II). 13.6 % (n = 19) patients presented to hospital at or after 48 hours and rest within 48 hours of injury (Figure 1).

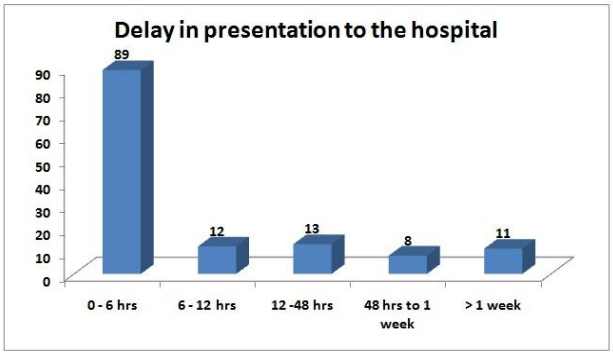
Table I: Patient demographics.

Demographic Parameter	Males	Females	Total
Age (years)	1 – 14 (7 ± 3.2)	1 – 10 (5 ±2.3)	1 – 14 (6.4 ± 3.1)
Sex	100 (71.4%)	40 (28.6%)	140
Side involved			
Left	71	18	89 (63.6%)
Right	29	22	51 (36.4%)

Table II: Mode of trauma.

S. No.	Mode of trauma	Number of cases
1.	Fall:	135 (96.4%)
	while playing	29 (20.7%)
	from roof top	22 (15.7%)
	from stairs	15 (10.7%)
	from tree	11 (7.9%)
	from bed	10 (7.1%)
	while walking	10 (7.1%)
	from bicycle	8 (5.7%)
	from wall	6 (4.3%)
	from chair	5 (3.6%)
	from vehicle	3 (2.1%)
	from horse	1 (0.7%)
2.	Road traffic accident	3 (2.1%)
3.	Twisting injury	1 (0.7%)
4.	Animal assault	1 (0.7%)

Figure 1: Delay in presentation to hospital after injury.



Only 7.2% fractures were compound injuries and extension type the predominant anatomical type of supracondylar fracture. Around two-third fractures were Gartland Type III in our study (Table III).

Table III: Fracture demographics.

A. Compounding (Gustilo – Anderson) of fracture:	
1. Simple	129 (92.1%)
2. Compound	11 (7.9%)
Compound Type I	4
Compound Type II	2
Compound Type IIIA	-
Compound Type IIIB	3
Compound Type IIIC	2
B. Anatomical type of fracture:	
1. Extension Type	135 (96.4%)
2. Flexion Type	5 (3.6%)
C. Gartland Type of fracture:	
1. Type I	19 (13.6%)
2. Type II	22 (15.7%)
3. Type III	99 (70.7%)

At presentation to hospital only two patients had brachial artery injury which required repair and both were compound fractures. One patient presented with compartment syndrome. Median nerve was the most common nerve injured in our series followed by radial and ulnar nerve. There were only two ulnar nerve palsies (Table IV). All the patients with nerve injury had involvement of a single nerve except one patient who had involvement of all the three nerves, and he had history of local massage with hot oil by a local bone setter. All the patients with myositis, volkmann's ischemic contracture, elbow stiffness, malunion and compartment syndrome, pressure sores (n = 15) had history of initial contact and treatment received by a local bone setter. Local bone healer's intervention was in the form of simple splintage using wooden planks or in the form of tight bandages or vigorous massage using warm oil, some type of soil or some herbal medicine or in the form of combination of all of these

interventions. 29 (20.7%) patients had history of such intervention before reporting to hospital in our series, out of which 11 patients had simple splintage, 8 had tight bandage application, 7 had vigorous massage and 3 had a different combination of these.

Table IV: Complications at the time of presentation to the hospital.

Complications	Number of patients
1. Nerve injury	19 (13.6%)
Median nerve injury	14 (10%)
Radial nerve injury	5 (3.6%)
Ulnar nerve injury	2 (1.4%)
2. Myositis	9 (6.4%)
3. Elbow stiffness and loss of ROM	8 (5.7%)
3. Malunion	7 (5%)
4. Volkmann's ischemic contracture	4 (2.9%)
5. Pressure sores	2 (1.4%)
6. Vascular injury	2 (1.4%)
7. Compartment syndrome	1 (0.7%)

ROM: Range of motion

Other associated bone injuries to ipsilateral extremity was present in 11 (7.9%) cases with fracture distal forearm bones and distal radial epiphyseal injuries the commonest (Table V).

Table V: Associated injuries.

Associated injury	Number of patients
Ipsilateral # both bones forearm (distal 1/3rd)	4 (2.9%)
Ipsilateral # both bones forearm (middle 1/3rd)	2 (1.4%)
Ipsilateral distal radial epiphyseal injury	4 (2.9%)
Ipsilateral proximal humeral epiphyseal injury	1 (0.7%)

4. Discussion

Supracondylar fracture of the distal humerus is the most common fracture around elbow joint in paediatric population. They constitute around more than half of paediatric elbow fractures, 3% of all the paediatric fractures, with peak incidence at age of 5 to 7 years, with boys outnumbering girls two to three times and non-dominant extremity involved 1.5 times more than the dominant.[2,3,5,10,12] In our series peak incidence was at the age of 4 to 8 years, boys had 2.5 times higher incidence than girls and non-dominant extremity was 1.7 times more commonly fractured than dominant extremity and this difference was predominantly seen in boys with girls having almost same frequency of involvement.

Supracondylar fractures are the result of fall on outstretched hand (FOOSH) mechanism.[5,13] This type of injury results in extension type of fracture while as the flexion type results from fall on flexed elbow or direct impact on back of flexed elbow.[14] In our study fall was the predominant mode of trauma with fall in playground the most common followed by fall from roof top and fall from stairs (Table II). In Jammu region of India most of the houses have roof tops without protection railing or protection decks which explains fall from roof tops as a very common mode of trauma (15.7%). Moreover, about half of the falls from the stairs were attributed to absent stair railing. In combination, absent roof top railing or decks and stair railing account for about one-fifth of the supracondylar fractures and this is the only mode of trauma in our series that is preventable. Gaudeuille *et al* in their series from Central African region had 74% of the fractures during playing.[15] Our series also had playing as the most common mode accounting for 20.7% fractures.

In our series 63.6% patients presented to hospital within six hours of injury and none had contact with a local bone setter. 20.7% patients had initial contact and intervention by some local bone setter and these patients usually presented late. All but one patient that presented beyond 48 hours had contact with local bone setters. There is a definite relationship between contact with quacks and delay in presentation to hospital.[16] There is a probability that rate of interventions by local bone setters will be more than what we actually had in this study. There may be a large group of patients that actually never reported to hospital.

Extention type of fracture is the most common and accounts for approximately 95% that is comparable to our observation.[1,5,10] Frequency of compounding is variable in different studies ranging from 1 to 3.4%.[11,15] Higher frequency of 8 % in our study could be explained by fall from roof tops as a common mode of injury.

Gartland type III was the predominant type in our series and type I the least common. This discrepancy from series by Cheng *et al* from China and by Houshian *et al* clearly depicts most of the lower grades i.e. type I and type II fractures are managed either by local bone setters or local practitioners while as higher grades i.e. type III fractures which are associated with severe local swelling, pain and higher incidence of complications present to higher medical centres.[12,17]

Associated nerve injury ranges from 3 to 22%.[4] Our series had nerve injuries in 13.6% patients. All had single nerve involvement except one who had all the three nerves involved and had history of massage by local bone setter. Median nerve is the most commonly involved nerve (28 – 60%) followed closely by radial nerve (26 – 61%) and ulnar nerve the least (11 – 15%).[1,11,18,19,20] Ulnar nerve injury occurs frequently in flexion type of supracondylar fracture.[21] We had two patients of ulnar nerve palsy, one associated with flexion type of supracondylar fracture and second one with extension type with all the three nerves involved due to vigorous massage by local bone setter. All the injuries in our series were neuropraxias except two cases of median nerve injury associated with brachial artery injury that required repair.

Complications like myositis, mal-union, compartment syndrome and volkmann's ischemic contracture, pressure sores were seen in patients that presented late and had intervention by local bone setter. Local bone setters are prevalent in developing countries of Africa, Asia and South America.[22] In Nigeria over 70% of musculoskeletal problems are dealt by local bone setters in rural areas.[23,24] In 1999, about 70,000 local bone setters and healers were operational in India that perhaps treated 60% of all the trauma patients.[25] Illiteracy, superstitious beliefs, apprehension that a doctor may perform a surgical intervention if consulted, getting treatment at a lower cost from local bone setters, availability are various factors because of which local bone setters are still flourishing in developing countries despite higher rate of morbidity offered by their treatment.[22]

Incidence of concomitant ipsilateral fractures ranges from 1 to 5%.[11,12,26] Higher incidence of 7.9% in our study may be due to fall from roof tops as a common mode of trauma. Associated fractures usually involve distal radial fractures but fractures of scaphoid and proximal humerus also do occur.[11]

5. Conclusion

Paediatric supracondylar fractures in Jammu region of India has a peak incidence from 4 to 8 years of age, boys have a higher frequency than girls and non-dominant extremity is more commonly involved than right except in girls where they are almost equally involved. Ipsilateral fractures of forearm bones, especially distal end, is a common association of paediatric supracondylar fractures in a fall from higher level and patients with supracondylar fractures should always be screened clinically as well as radiologically for such injury.

Nearly one fifth of fractures are preventable and there is need of community health workers and government authorities in educating general public, stressing upon preventing children from playing over unbounded roof tops and or railing of the roof tops and stairs to prevent such mishaps. Higher rate of morbidity in pediatric supracondylar fractures in the developing nations is attributed to intervention by local bone setters. Educating general population through media and by community health workers against such orthodox practice is need of the hour in these nations. The Government authorities need to crackdown upon such unethical practitioners or rehabilitate them by incorporating in health sector as orthopaedist assistants. In regions where there is dearth of orthopaedic surgeons these local bone healers need to be educated about dos and don'ts of managing a fracture.

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