



Original article

Epidemiologic pattern of paediatric supracondylar fractures of humerus in a teaching hospital of rural India: A prospective study of 263 cases

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ARTICLE INFO

Article history:

Received 8 March 2016

Received in revised form

10 December 2016

Accepted 2 February 2017

Available online 19 April 2017

Keywords:

Supracondylar fractures

Humerus

Epidemiology

ABSTRACT

Purpose: This prospective study aimed to investigate the epidemiologic parameters of supracondylar humeral fractures in children admitted to a teaching institution of a developing country primarily catering to rural population, to find any preventable cause of such injuries.

Methods: All suspected cases of supracondylar humeral fracture reporting to emergency or outpatients department were analysed for various epidemiologic parameters including age, sex, laterality, time of presentation, associated injuries, neurovascular complications and classification over a period of four years.

Results: We analysed a total of 263 patients and most of the fractures were seen in 5–8-year age group with a mean of 7.9 years. A total of 157 cases were males and non-dominant extremity was involved in 65% of fractures in our series. Fall on outstretched hand was the predominant cause of injury and fall from rooftop was the predominant mode. In all patients, 36.12% reported to our hospital 1 week after injury, 39.92% presented to hospital within 48 h after trauma and the remaining 23.95% presented 48 h to 1 week after trauma. None had a bilateral injury. Gartland type 3 fractures constituted 54.37% of patients, followed by type 1 (23.95%) and type 2 (21.67%).

Conclusion: Almost one fourth of supracondylar humeral fractures in children can be prevented by installing railing of rooftops and stairs. It is necessary to educate people on hazards of treatment by traditional bonesetters. Moreover, the children with supracondylar humeral fractures should be screened for associated injuries.

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Supracondylar fractures of humerus are the most common elbow fractures in children.^{1,2} In an epidemiologic study of elbow fractures in children, Houshian et al³ identified the incidence of supracondylar fractures to be 58%. The mean age group in which most of supracondylar humeral fractures occur is 5–6 years.⁴ The incidence of supracondylar humeral fracture in boys was reported to be higher than that in girls, however recent studies indicated no significant difference, and some series even reported higher incidence in girls.³ The left side is more frequently injured than the right side. Early diagnosis and treatment is essential in achieving a good functional outcome.³ However, in rural areas of developing countries like India, the prevalence of local bonesetter and lack of awareness are responsible for neglect of such injuries and delay in

treatment, resulting in an increased incidence of complications like compartment syndrome, Volkmann ischemic contracture, malunion, even gangrene. The objective of this study was to analyse the various epidemiological parameters like age, gender distribution, presentation (time after injury), mechanism of injury and associated complications.

Materials and methods

This prospective study was done in Maharishi Markandeshwar Institute of Medical Sciences, which was a tertiary care centre of north India primarily catering to rural population. All cases of suspected supracondylar fracture of humerus that reported to emergency department or outpatient department were assessed clinically and radiographically from January 2012 to December 2015. The following epidemiological parameters were analysed: age, sex, injured side, fracture type (flexion/extension), fracture classification (Gartland), presentation (time after injury), nerve injury, vascular injury, open/closed injury, and associated injuries.

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Peer review under responsibility of Daping Hospital and the Research Institute of Surgery of the Third Military Medical University.

Table 1
Epidemiologic parameters of 263 patients with supracondylar fractures.

Parameters	Percentage (%)
Gender	
Male	59.69
Female	40.31
Laterality	
Right	34.99
Left	65.01
Type	
Extension	1.90
Flexion	98.10
Nerve injury	4.94
Radial nerve	38.46
Median nerve	53.84
Ulnar nerve	7.69
Open fracture	3.42
Gartland classification	
Type 1	23.95
Type 2	21.68
Type 3	54.37
Vascular injury	0.76
Presentation	
Within 48 h	39.92
In 48 h to 1 week	23.95
>1 week	36.12

The patients who were radiologically confirmed with no supracondylar fractures and the patients over 15 years old were excluded from the study. A total of 263 patients with supracondylar fractures were enrolled during four-year period from January 2012 to December 2015. All the data were analysed for the above-listed epidemiologic parameters using SPSS version 22.0.0.0 software.

Results

All 263 patients were 1–14 years old and most of the fractures were seen in age group of 5–8 years. The mean age was 7.9 years with a median of 5 years. A total of 157 (59.70%) cases were males and 106 (40.30%) cases were females. Non-dominant extremity was more commonly involved, constituting 65% of fractures in our series. The demographic parameters are listed in Table 1. Fall on outstretched hand was the predominant mechanism of injury, followed by fall from rooftop or stairs and fall while playing. Ninety-five patients (36.12%) reported fractures 1 week after injury due to lack of awareness among rural population and the prevalent local quacks or bonesetters, including three suffering gangrene of forearm up to elbow caused by tight bandage. Totally 105 patients (39.92%) were admitted into hospital within 48 h after trauma and the remaining 23.95% within 48 h to 1 week after trauma. None in our series had bilateral injury. Gartland type 3 fractures constituted the majority of patients (54.37%), followed by type 1 (23.95%) and type 2 (21.68%). There were five patients with flexion fracture (2%), including one associated with ulnar nerve palsy at presentation. Thirteen patients had nerve injury and median nerve was most commonly affected, followed by radial nerve. The documented brachial artery injury confirmed by color Doppler ultrasound was seen in two patients. These patients underwent immediate exploration and vascular repair by a vascular surgeon. Associated fractures of ipsilateral forearm, distal radius, proximal humerus and clavicle were seen in eleven patients (4.94%), in which six had ipsilateral forearm fracture.

Discussion

Supracondylar fracture of humerus is the most common paediatric elbow fracture, constituting about 15% of all paediatric fractures and more than half of paediatric elbow fractures. These

fractures have a peak incidence at the age of 5–7 years, with boys more affected. However, many new epidemiology series have reported an equal incidence in boys and girls and even a higher incidence in girls.^{5,6} The non-dominant extremity was involved 1.5 times more commonly than the dominant.^{7,8} The peak incidence in our series was at the age of 5–8 years. The incidence in males was 1.5 times higher than that in females and the incidence of non-dominant extremity fracture was 1.8 times higher than that of dominant extremity. The results were consistent with the previous studies. The commonest mechanism of supracondylar fractures is fall on outstretched hand with elbow extended, leading to extension injury, while flexion injury results from fall on flexed elbow.^{7,9} Our series regarded fall from height (rooftop/stairs) as the predominant mode of trauma followed by fall while playing. The houses in rural regions of India mostly lack protection over rooftops to prevent accidental falls, usually wooden or steel made, which explains our common mode of trauma. Moreover, the use of a ladder (wooden) to reach roof was another common preventable cause of falls in this age group. Gaudeville et al¹⁰ reported 74% of the fractures in playing. Extension type of supracondylar fracture was the most common type seen in our series accounting for 98% and only five cases of flexion fractures were reported, which was consistent with previous studies (97%–99%).¹¹

In our series, 39.92% of patients presented to hospital within 48 h after injury without any contact with local bonesetters and 60.08% of patients reported to our institute 48 h after injury, out of which 74.68% had a contact with a traditional bonesetter and some intervention was already done, and gravest complication was gangrene of forearm and hand. It was apparent that the patients who reported to hospital later than postoperative 48 h were more commonly dealt initially by quacks and thence presented with neglected and mismanaged injuries. In the remaining 25.32% of patients that presented beyond 48 h, lack of awareness was the cause for delayed presentation. Seven patients presented beyond three weeks after injury and the fractured ends were clinically and radiologically united in a non-anatomical position, requiring surgical intervention at a later stage. There was definitely a relationship between delayed presentation and intervention by local bonesetter and there was a high probability that the figure might be bigger than that reported as many patients never reported to hospital at all. Open fractures in our series constituted 3.4%, which was comparable to the previous studies reporting an incidence of 1%–3.4%.¹² Gartland type III was the predominant type in our series (54.37%) and type II was the least common (21.67%), which was comparable to most series. However, many studies reported type I fractures to be the least common owing to their non-operative management available at healthcare centers. Supracondylar humeral fractures complicated by nerve injury comprised of 3%–22% in different studies.¹³ In our series, the incidence of nerve injuries was 4.94%, median nerve was most commonly injured, accounting for 53.48% (7 cases), including two patients with associated brachial artery injury requiring repair. There was only one case of ulnar nerve injury associated with flexion fracture. Associated injuries included fractures of ipsilateral forearm, proximal humerus and clavicle, with an incidence of less than 5% in different studies.^{4,12,14} In our study, 11 had associated injuries accounting for 4.94%, including 6 ipsilateral forearm fractures, 2 ipsilateral clavicular fractures, one proximal humeral fracture and 2 distal radial physeal injury. Complications such as compartment syndrome, myositis, malunion, Volkmann ischemic contracture and gangrene of limb were seen in patients that were managed initially by traditional bonesetters and admitted to hospital later. Traditional bonesetters are prevalent in developing countries of Asia, South America and Africa.¹⁵ In a study on traditional bone setting, Omololu et al¹⁶ reported that more than 70% of musculoskeletal

injuries were dealt by traditional bonesetters in rural areas. Onuminya et al¹⁷ reported similar practices of traditional bonesetters. Arora et al¹⁸ stated that about 70,000 traditional bonesetters were operational in India, particularly in rural areas. Illiteracy, lack of awareness, superstitious beliefs, cost, fear of surgery and availability are common factors that promote traditional bonesetters in rural areas of developing countries despite increased morbidity and disastrous complications.¹⁵

This prospective study investigated the epidemiological parameters of supracondylar humeral fractures in children in a teaching institution of India primarily catering to rural population over a four-year period. In this study, the distribution of supracondylar humeral fractures in age, gender, laterality, type, classification, associated injuries and neurovascular injuries was consistent with previous studies. However, one fourth of fractures in our series caused by fall from roof were preventable. We recommended educating people in rural areas, preventing children from playing over rooftops lacking railing and securing the rooftop with protective decks. Our results provided evidences that the practice of traditional bonesetters in rural areas of developing countries is associated with delayed presentation, significant morbidity and increased rate of complications. It is necessary to raise people's awareness of complications caused by traditional bonesetters. Moreover, the government should take adequate action to curb this practice.

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