Original Article

Supracondylar Humeral Fractures in School Children: Incidence and Aetiology during School Terms and Holidays

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Abstract

Background: Supracondylar humeral fracture is a common injury in the paediatric age group. The morbidity from its complications such as vascular injury, compartment syndrome and malunion can last the entire lifetime of the child if not recognised and managed appropriately. The aim of the study is to determine the mechanisms of injury and to compare the incidence during school term and holiday periods in school age children. **Patients and Methods:** A descriptive retrospective study was carried out at the paediatric orthopaedic unit of an orthopaedic hospital. All school age children with supracondylar humeral fractures between 1 January 2014 and 31 December 2017 were included in the study. The demographic data, mechanism of injury, date of injury (to determine whether school term or holiday), Gartland classification and the mode of management were recorded. **Results:** A total of 53 patients were reviewed. The mean age was 5.94 ± 2.71 years, with a male: female ratio of 2.8:1. The most common mechanism of injury was fall from a height (30.2%). The overall incidence was 0.25/week over the 4-year period school term (0.22/week and holiday period 0.47/week). The extension type of injury occurred in 52 (98.1%) patients with 7 (13.5%), 4 (7.7%) and 41 (78.8%) being Gartland type I, II and III, respectively. **Conclusion:** The most common mechanism of injury was fall from a height and there was an increased incidence during holiday compared to the school term period. Larger studies on safety strategies during holiday activities may reduce the incidence of humeral supracondylar fractures.

Keywords: Fracture, holidays, school, supracondylar, term

Introduction

Supracondylar fractures of the humerus (SCH) is common in children, accounting for about 16% of all paediatric fractures.[1] This injury is the most common fractures in children younger than 7 years.[2] Two-thirds of all hospitalisations for paediatric elbow injuries are due to supracondylar humeral fractures[3] and it is the most investigated paediatric fracture in the literature.[4]

The peak age of incidence is between the 5th and 7th years. This injury is more common in boys than girls and the non-dominant hand is more commonly injured.[5,6]

In children <7 years of age, the supracondylar area is still undergoing remodelling and is characteristically thinner with a more slender cortex which predisposes it to fractures.[7] The previously reported common mechanism of injury is a fall on an outstretched hand with the elbow hyperextended, the olecranon is driven into the olecranon fossa and the anterior humeral cortex fails in tension.[8] The triceps muscle tends to pull the distal fragment proximally and posteriorly. This gives the extension type of injury, which constitutes about 95% of injuries.[9] The less common flexion type of injury is usually due to a fall on the flexed elbow.

Supracondylar humeral fracture is usually associated with morbidities ranging from neurovascular complications, compartment syndrome and malunion. Neurovascular complications are reported in 5%–19% of displaced fractures.[10,11]

Anecdotal evidence suggests that there is an increase in the incidence of this injury during the school holidays. There are very few studies comparing the incidence of this injury

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during school term and school holidays.[8] Identification of the common period of presentation of this injury and the common mechanisms would be essential in developing preventive strategies.

The objectives of this study were to determine the population characteristics, aetiology, side of injuries, Gartland[12] classification of SCH fractures (extension type) and methods of management over a 4-year period in an orthopaedic hospital and compare the incidence of supracondylar humeral fractures during school term and during holidays in school age children.

Patients and Methods

This is a descriptive retrospective study done at an orthopaedic hospital. The 450-bed hospital manages trauma, plastic and reconstructive surgery patients. The case notes and radiographs of school age children presenting with supracondylar humeral fractures between 1 January 2014 and 31 December 2017 were retrieved.

The age, sex, side of the body affected, time of injury, mechanism of injury, configuration of the fracture (Gartland classification), the mode of management and any complications were extracted from the case notes.

The school holiday dates were obtained from the local education authority. The children with supracondylar humeral fractures were then grouped based on the time of injuries (children with injuries sustained during school sessions or during holidays).

The data extracted were anonymised to protect confidentiality. The radiographs were examined by the same author to prevent inter-observer error and all data were analysed with SPSS (IBM SPSS NY) 19. Ethical clearance was obtained from the hospital ethical committee before the commencement of the study.

Results

A total of 53 patients' data aged between 2 years and 12 years were analysed. The mean age was 5.94 years ± 2.71. The age distribution is as shown in Table 1.

There were 39 males and 14 females as shown in Table 2 (male: female of 2.8:1).

Falls from a height, falls on level ground during play and falls on level ground from a push constituted 30.2%, 28.3% and 18.9%, respectively. The other causes are falls due to a slip (11.3%), sports injury (5.6%), motor vehicular accident (3.8%) and domestic accident (1.9%) [Table 3].

The months of January (18.9%) and October (17%) had the higher incidence of SCH [Table 4]. Thirty-two injuries (60.4%) occurred during school term period, whereas 21 (39.6%) occurred during the school holiday periods [Table 5].

The incidence of fractures was 0.25/week over the 4-year study period. The incidence during holidays was 0.47/week, whereas the incidence during school term was 0.22/week.

Table 1: Age distribution

Age range (years)	Number of patients (%)
2-5	25 (47.2)
6-9	19 (35.8)
10-12	9 (17)
Total	53 (100)

Table 2: Sex distribution

Sex	*n* (%)
Male	39 (73.6)
Female	14 (26.4)
Total	53 (100)

Table 3: Aetiology of injury

Aetiology	*n* (%)
Fall from height	16 (30.2)
Fall on level ground while playing	15 (28.3)
Fall on level ground when pushed	10 (18.9)
Fall on level ground due to a slip	6 (11.3)
Sports injury	3 (5.6)
Motor vehicular accident	2 (3.8)
Domestic accident	1 (1.9)
Total	53 (100)

Table 4: Month of the year injury occurred

Months	*n* (%)
January	10 (18.9)
February	5 (9.4)
March	2 (3.8)
April	3 (5.7)
May	1 (1.9)
June	5 (9.4)
July	2 (3.8)
August	5 (9.4)
September	5 (9.4)
October	9 (17)
November	1 (1.9)
December	5 (9.4)
Total	53 (100)

Table 5: Incidence during school and holiday periods

Time of occurrence	*n* (incidence rate/week)
School term session	32 (0.22)
Holiday session	21 (0.47)
Total	53 (0.25)

Thirty-six (67.9%) of the injuries occurred at home, 12 (22.6%) injuries occurred at school, 3 (5.7%) injuries occurred in places of worship, while 2 (3.8%) occurred on the road [Table 6].

In this study, 14 (26.4%) patients presented to our facility within 6 h of sustaining the injury, 22 (41.5%) patients presented between 6 h and 1 week after the injury, 7 (13.2%) patients presented between 1 week and 3 weeks post-injury, while 10 (18.9%) patients presented after 3 weeks of injury.

All the fractures were closed injuries. Fifty-two (98.1%) injuries were extension type of SCH fractures, while 1 (1.9%) was of the flexion type. The Gartland classification pattern of the extension type injuries includes 7 (13.5%) Gartland type I, 4 (7.7%) type II and 41 (78.8%) type III injuries [Table 7].

Twenty-seven patients had the fractures on the left limb representing 50.9%, while twenty-six (49.1%) had the injuries on the right side. None of our patients had bilateral involvement.

Twenty-two (41.5%) patients had non-operative management with cast application after fracture reduction, while thirty (56.6%) patients had surgical intervention which included closed or open reduction plus K wire fixation and corrective osteotomy for malunion. One patient (1.9%) sought for discharge against medical advice.

Discussion

The objectives of this study are to describe the epidemiology of supracondylar humeral fracture in children and to compare the incidence during school term and holiday period.

The mean age of presentation in this study (5.94 ± 2.71 years) was similar to previous reports in the literature.[5,6,8,11,13] Because non-school age children were excluded from this study, the age range of 2–12 years obtained differs from age range in previous studies that included patients of all paediatric age groups.[1,2,14,15] The results of this study suggest that efforts at reducing the incidence of this injury should be targeted at children of school age group and their caregivers.

Table 6: Location where the injury occurred

Location of fall	n (%)
Home	36 (67.9)
School	12 (22.6)
Place of worship	3 (5.7)
Road	2 (3.8)
Total	53 (100)

Table 7: Type of injury

Types of injury	*n* (%)
Flexion	1 (1.9)
Extension	52 (98.1)
Total	53 (100)
Gartland type of extension injuries	
I	7 (13.5)
II	4 (7.7)
III	41 (78.8)
Total	52 (100)

The gender ratio (2.8:1) reported in this study is similar to previous reports in the literature.[14,15] The male preponderance in this study may be due to the tendency for boys to be more adventurous and be more involved in physical or sporting activities than girls.

More injuries were sustained at home in the study; this is similar to previous reports by Loder *et al*.[13] in the United States and Mangwani *et al*. in a London Hospital.[16] However, the result is at variance with findings from a study among Chinese children.[15] Mangwani *et al*. attributed its findings to the location of the study centre in a densely populated urban area lacking in sports facilities. This is similar to the location of this study centre which is in the Lagos metropolis.

This study was carried out in the tropics with raining and dry seasons devoid of a distinct summer and winter. Peak incidences were recorded in the months of January and October; this coincides with the beginning of the first and second terms, respectively, in the local school academic calendar. In a review of 6493 fractures in Hong Kong children, the authors recorded a peak incidence in late September and early October, which also coincides with the start of the school session.[2] Previous Scandinavian study also reported a peak period in the late summer.[6,17]

The incidence during holiday periods was more than twice that of the incidence during school terms. It appears that this injury occurs more commonly during holiday periods when children are at home and engaging in many physical activities. However, a previous report from California (USA) reported no association with school session or holiday period.[18]

The more common mechanisms of injury were fall from a height (30.2%) and fall on level ground (28.3%). Previous study in North American children reported fall from height in 70% and fall on level ground in 9% of the studied population, respectively;[18] this may be due to differences in the sociocultural settings in which the studies took place.

The extension type of injury was predominant in this study; only 1.9% of the injuries were of the flexion type. This is similar to previous findings by Cheng in a Chinese population,[16] Nikola in Serbia[19] and Barr in the UK.[8]

Amongst extension types of injuries, Gartland III type was the commonest, while Gartland II type was the least common. Similar findings were reported by Cheng *et al*., these authors reported Gartland I, II and III in 30%, 24% and 45% of the study population, respectively.[15] However, this result differs from a UK study[8] in which Gartland I was the commonest reported type of injury.

The result of this study suggests that parents and guardians should be fully involved in any program aimed at reducing the incidence of this injury. Efforts at reducing the occurrence of this fracture should be intensified during the school holiday

periods. Moreover, educational campaigns emphasising fall prevention and landing surface modification should reduce the incidence of this fracture.

The incidence of paediatric fractures can be further reduced with public education, implementation of safety strategies and government legislation. Health-care professionals and paediatricians can be instrumental in reducing the incidence of paediatric injuries by participating in child education, research and programs that promote safe play.[20]

The small number of patients in this study is a limitation; therefore, multicentre studies will be beneficial in formulating educational programs that will forestall the occurrence of these injuries.

Conclusion

Supracondylar fracture of the humerus is common in children with mean age of 5.94 years and higher male preponderance.

The incidence during holiday periods is twice that of during school term. The commonest aetiology is fall from a height.

The incidence of paediatric fractures generally can be reduced with public education, implementation of safety strategies and government legislation.

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Conflicts of interest

There are no conflicts of interest.

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