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ORIGINAL ARTICLE

SUPRACONDYLAR FRACTURES OF THE HUMERUS IN CHILDREN

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ABSTRACT

Objective: Evaluate the sociodemographic and clinical characteristics of pediatric patients treated at a public hospital for supracondylar fracture of the humerus. Material: Observational study based on the analysis of medical records and data from the outpatient follow-up of pediatric patients treated for supracondylar fracture of the humerus. Methods: Frequencies were collected and estimated in relation: age, gender, nerve injury in trauma, vascular injury in trauma, affected limb, classification of the type of injury according to Gartland and need for open reduction. Results: 328 children between 0 and 12 years of age were assisted (average: 5.78 2.47 years). The fixed age group between 5 and 8 years had the highest frequency of injuries (49.7%, n=163). Type III Gartland was the most frequent injury (55.8%, n= 183). Most children with supracondylar fracture of the humerus were male (55.8%, n=183), the left side (non-dominant) was the most affected (60.1%, n=199), the vascular lesion was observed in two cases (0.6%) and nerve damage in 6 cases (1.8%), in which the ulnar nerve was the most affected. In 13.4% of cases (n=44) open reduction was required. Conclusion: Supracondylar fractures of the humerus are more common in male pediatric patients, aged 5 to 8 years, with a low incidence of vascular and nerve damage, and in most cases, without need of open reduction.

KEYWORDS: HUMERAL FRACTURES; CHILD; FRACTURE FIXATION

INTRODUCTION

Supracondylar fracture of the humerus (SFH) is a typical lesion of the immature skeleton, very common in childhood and represents about 13% of all infantile fractures [1], 90% of cases occur in the age group of 5 and 7 years, with 95% being lesions in extension and 5% to 30% have associated neurovascular lesions.[2,3] In childhood, this type of fracture deserves special attention, since bones in this age group have an enormous capacity for growth and remodeling [3]. In 10% to 20% of cases, both neurological and vascular impairment complicates the displaced supracondylar fracture.[4,5]

The classification proposed by Gartland[6] is the most used and is based on the deviation of the coronal plane on elbow radiographs. Type I lesion is one in which no deviation or minimal deviation is observed and with the anterior humeral line intact. Type II shows a small deviation and the fragments are kept in contact (intact posterior cortex) and type III, in which there is complete separation of the fragments (posterior cortex lesion). In 1996, Wilkins[7] proposed a type II subdivision for SFH in children with rotational deviation and in 2006, Leitch et al.8 added a type IV subdivision, in which a multidirectional instability is observed. These of the latter types of fractures are only diagnosable intraoperatively. [9,10] The fractures were subdivided into IIa: intact posterior hinge without rotation and IIb: intact posterior hinge with rotation.[11]

The treatment of type I and II supracondylar fractures is standardized, while the treatment of type III and IV fractures is still under debate.[12] The option for surgical treatment depends on the type of fracture (IIB, III and IV) and factors such as the quality of the reduction, the ability to maintain the reduction, the degree of displacement and the stability of the fracture. [13,14] These fractures generally require an experienced surgeon to obtain a satisfactory result without deformity or functional limitation.[15] Closed reduction with or without Kishner wire fixation is the treatment of choice for most of these fractures.[1] Open reduction promotes results. accurate anatomical findings, but some complications such as infection, iatrogenic neurovascular injuries, elbow stiffness and painful scars may be observed.[16]

Thus, a study was carried out with pediatric patients diagnosed with supracondylar fracture of the humerus who underwent treatment in a public hospital, in order to assess the sociodemographic characteristics and aspects inherent to the type of injury.

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MATERIAL AND METHODS

A retrospective analysis of medical records and data from the outpatient follow-up of pediatric patients who underwent treatment for supracondylar humerus fractures between January and December 2020 in an orthopedic service of a public hospital in the state of Goiás was carried out.

Data were obtained from the electronic medical records sector, collected and estimated the frequencies in relation to the variables: age, gender, nerve injury in trauma, vascular injury in trauma, affected limb, classification of the type of injury according to Gartland6 and need for open reduction. All patients of both genders, between 1 and 12 years old, who underwent treatment for supracondylar humerus fracture were included. The medical records of patients who did not meet the inclusion criteria, children who underwent other surgical treatments in addition to the one studied, and those with incomplete data in the medical record were excluded.

The collected data were evaluated using Microsoft Excel® version 2007 and the Statistical Package for Social Sciences (SPSS®) version 17.0. This study was approved by the Research Ethics Committee, CAEE: 47350621.5.0000.5082.

RESULTS

Over a 12-month period, a total of 330 children with supracondylar fracture of the humerus were seen, two of which were excluded due to the lack of data in the medical records. The remaining 328 children had complete documentation. The mean age at the time of injury was 5.78 years (± 2.47 years) ranging from 1 to 12 years and 183 (55.8%) were boys (Table 1).

The age group between 5 and 8 years had the highest frequency of injuries (49.7%, n=163), followed by the age group from 0 to 4 years (34.8%, n=114) and 9 to 12 years (15 .5%, n=51). As for the classification of fractures (Figure 1), type III Gartland was the most frequent (55.8%, n=183), followed by type II (39.3%, n=129), type IV (3.4 %, n=11) and type I (1.5%, n=5). The left side (non-dominant) was the most affected (60.1%, n=199), vascular damage was observed in only two cases (0.6%) and nerve damage was present in six cases (1.8 %), in which the ulnar nerve was the most affected (Table 1).

In 13.4% of cases (n=44) open reduction was required, with the highest frequency of surgical intervention for fractures classified as Gartland type III in boys, followed by type IV in girls (Figure 2). When evaluating the classification of the type of fracture in relation to the mean age (Table 2), type I injuries were frequent in younger children, aged between 1 and 6 years. Type IV, on the other hand, were more frequent in older children, aged between 2 and 11 years.

Data	Values	
	n	%
Gender		
Male	183	55.8
Females	145	44,2
Affected side		
Right	129	39.3
Left	199	60.7
Vascular injury in trauma		
Yes	2	0.6
No	326	99.4
Nervous injury		
Ulnar nerve	3	0.9
Radial nerve	2	0.6
Middle nerve	1	0.3
Sem lesão	322	98.2
Open Reduction Need		
Yes	44	13.4
No	284	86.6

Figure 1. Classification of injury type according to Gartland6 in children with SFH

Classification	Values	
	n	Mean ± SD
Typel	5	4.00 ± 2.00
Type II	129	5.19 ± 2.26
Type III	183	6.17 ± 2.47
Type IV	11	7.00 ± 3.35
Total	328	5.78 ± 2.47

Figure 2. Frequency of open surgical reduction according to the Gartland6 fracture classification in children with SFH

DISCUSSION

Supracondylar fractures are the most common elbow fractures in children, especially in the first decade of life, with most cases in the age group of 5 to 8 years and result from a fall with the hand extended, resulting in hyperextension of the elbow.[10,17] The mean age at which the supracondylar fracture of the humerus occurred in the present study was 5.78 years, similar data to those observed by Simanovsky et al.[18] (5.4 years) when evaluating a sample consisting of 223 cases in a period of four years in an Israeli Orthopedics service. Barr[20] also observed a peak incidence of supracondylar fractures around 6 years of age and a predominance in males (53%).

The gender ratio observed in the present study was 1.3:1

(boy:girl). Mangwani, Nadarajah and Paterson[19] observed a similar ratio of boys to girls (1.8:1). The highest proportion in males was also evident in the studies by Barr[20] and Khademolhosseini, Rashid and Ibrahim.[21]

In the present study, 183 patients (55.8%) had type III fractures, data similar to those observed by Mangwani, Nadarajah and Paterson19 when evaluating 291 children for a period of 10 years in a university hospital in London, England. These authors reported a 22% rate of open reduction in patients, a value higher than that observed in the present study (13.4%). Both values are similar to those reported in the literature, which range between 1.3% and 46%.[22] The low incidence of severely displaced fractures may explain the lower proportion of open reduction observed in the present study.

Surgical treatment of type III and IV fractures is widely accepted and established in the literature.[4] Tarallo et al.[23] evaluated a total of 55 patients with type III supracondylar fractures of the humerus, divided into two groups, one undergoing open reduction (n=26) and the other closed reduction (n=29), and concluded that open reduction should not be considered a primary treatment option in pediatric patients with type III supracondylar humerus fracture, but in other cases open surgery should be seen as the choice with the best results, not only in the presence of neurovascular injury but also in cases of irreducible fracture.

In the present study, three out of six children had nerve damage in the ulnar nerve (Table 1), although radial nerve damage is the most common, as posterolateral displacement can cause damage to the brachial artery and median nerve.[24] Lyons , Quinn and Stanitski[25], when evaluating 210 cases of children with supracondylar fractures and neurovascular injuries, observed a higher frequency in the median nerve (58.9%), followed by radial (26.4%) and ulnar (14.7%) injuries. Foead et al.[26], when evaluating 66 children with supracondylar fractures, observed the presence of neurological damage in only two cases, one in the ulnar nerve and the other in the radial nerve.

Fracture on the left side, usually the non-dominant side, is more frequent. Baidoo et al.[27] observed a frequency of 62%, close to that observed in the present study (60.7%). Although a smaller portion of the world population has the left hand as the dominant (8% to 15%), during the fall it is common for the non-dominant hand to hit the ground first in order to try to cushion the impact.[28] Also according to Baidoo et al.[27] older children were more likely to suffer type III injuries. In the present study, the same relationship was observed (Table 2), as the more severe the type of injury, the higher the mean age, with type I injuries being more frequent in younger children and type IV in older children.

CONCLUSION

Supracondylar fracture of the humerus is more common in male pediatric patients, aged 5 to 8 years, with a low incidence of vascular and nerve damage, and in most cases, without the need for open reduction.

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