

Study of the Physeal Trauma in 20 Years



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Summary

Introduction: Fractures in children present characteristics that, in their evolution and behavior, as well as in the choice of behavior before them, differ from those of adults. Target. Describe the distribution and characteristics of the physeal injuries, according to the injured anatomical region, the causal event and the behavior before the injury.

Method: A prospective and longitudinal study was carried out, taking as a sample the children injured in the musculoskeletal system at the physeal level treated at the Hospital Mártires del 9 de Abril between January 2000 and August 2020. Using scientific research, theoretical and empirical.

Results: Child athletes represent around 11% of children with physeal injuries, the male sex predominates in the sample, with ages between 12 and 14 years, these injuries affect the upper limb with a predominance in the physis of the distal radius, the majority are they are caused by accidents at home and are managed mainly with medical treatment and immobilization.

Conclusion: There are multiple injuries that children can suffer in their development, including physeal trauma; recognizing them, knowing their epidemiology and choosing appropriate behaviors contributes little-studied knowledge to our health system.

Keywords: Children; Injuries; Physeal Trauma

Introduction

Accidents represent an important cause of morbidity and mortality at any age, and the pediatric population is no exception, thus injuries in children continue to be a public health problem throughout the world. The World Health Organization (WHO) estimates that 90% of these are unintentional and are mostly caused by mechanisms such as car accidents, falls and recreational games at home or sports [1,2].

Fractures in children present characteristics that, in their evolution and behavior, as well as in the choice of behavior before them, differ from those of adults. The child is not a small adult, his musculoskeletal system has characteristics that do not occur in adults: there are growth zones (physis), whose injury can cause

deformities or shortening, if its management is not adequate, the periosteum is more vascularized, it has a greater cellular component, therefore, greater bone formation capacity, bones have greater elasticity. Children's bones have a great capacity to absorb trauma and a significant remodeling capacity, determined by the location of the fracture and age [3].

The physeal nucleus is considered a risk factor in children for suffering from SOMA injuries, there is increasing evidence, both clinical, biomechanical, and radiological, where it is referred to as the area most susceptible to injury [4]. Cartilage growth is located in three sites of the immature skeleton: epiphyseal plate, articular surface, and apophyseal attachments of the main muscle-tendon units [5]. There are multiple injuries that children can suffer in

their development, including physical traumas, recognizing them, knowing their epidemiology and the choice of behaviors can make a difference in the future. For this reason, the work is carried out on the subject of physeal injuries suffered by the children cared for in our service.

Method

A descriptive, longitudinal study was carried out with the purpose of studying the physeal lesions of the immature skeleton belonging to the Villa Clara province, treated in the orthopedic and traumatology service at the Hospital Provincial General Universitario Martires del 9 de Abril. We worked with an original and intact group, that is to say, already constituted. All children under 18 years of age with a diagnosis of physeal injury (n = 2365) were included in the study. The study period spanned 20 years (September 2000 to August 2020).

The data concerning the general basic characteristics of the children, as well as those related to the lesions presented and their management, were captured in a data collection model and / or extracted from the medical records. To characterize the physeal lesions that made up the sample, the variables were studied: age (under 5 years, between 5 and 8 years, 9-11 years,

12-14 years, 15-17 years); sex; if the child plays sports and is injured in this activity; injured anatomical region, cause of injury (traffic accidents that include accidents on public roads such as pedestrians, bicycles or cars, also accidents that include falls, trauma caused by games or recreational activities, falls from height and sports trauma); type of lesions (according to Salter and Harris classification) [6]; and conduct in the face of injury [7]. The results are expressed in absolute numbers and percentage. This research had the authorization of the administrative bodies of the institution involved and with the approval of the Villa Clara Provincial Scientific Council (Agreement 65/1996, research topic to opt for a scientific degree).

Results

Table 1 shows the distribution of children treated with physeal injuries, grouped into two groups those who practice organized sports activities (child athletes) which represent 11.28 percent (n = 267), the largest number of children are Those who suffer injuries and do not suffer their injuries in organized sports activities, are a great majority, in 20 years of study 2098 children suffered injuries. The age group with the highest number of injuries is found in the group of children between 12 and 14 years old. Male sex predominates with 73.6% of the sample.

Table 1: Age and sex distribution of children with physeal lesions (1998-2018).

Age group	Female n=624 (26,4)	Male n=1741 (73,6)	Total n=2365 (100%)
Under 5 years old	13	38	51 (1,8)
Between 5 and 8 years	51	142	193 (7,6)
Between 9 and 11 years	173	483	656 (27,5)
Between 12 and 14 years	290	807	1097(47,0)
Between 15 and 17 years	97	271	368 (16,1)

Fountain Data collection model.

Table 2: Distribution of the physeal lesions according to the affected bones.

Injured bone	Kids Athletes	Kids no Athletes	Total
Proximal distal radius	52 (19,6) 3 (1,2)	503 (24,0) 34 (1,6)	555 (23,5) 37 (1,6)
Hand Bones	71 (26,2)	319 (15,2)	390 (16,5)
Proximal humerus distal	6 (2,1) 35 (13,2)	50 (2,4) 401 (19,1)	56 (2,4) 436(18,4)
Proximal tibia distal	4 (1,6) 38 (14,3)	25 (1,2) 277 (13,2)	29 (1,2) 315 (13,3)
Foot bones	34 (12,8)	197 (9,4)	231 (9,8)
Proximal femur Distal	1 (0,3) 16 (6,1)	2 (0,1) 124 (5,9)	3 (0,1) 140 (5,9)
Other physis	7 (2,6)	166 (7,9)	173 (7,3)
Total	267 (11,28%)	2098 (88,72%)	2365(100%)

Fountain. Data collection model.

Table 2 shows the distribution of children with acute physeal trauma according to the physis of the injured bone. These children are divided into two groups (athletes and non-athletes). Most

injuries occur in the distal radius, followed by injuries to the distal humerus and to the bones of the hand (Figure 1).

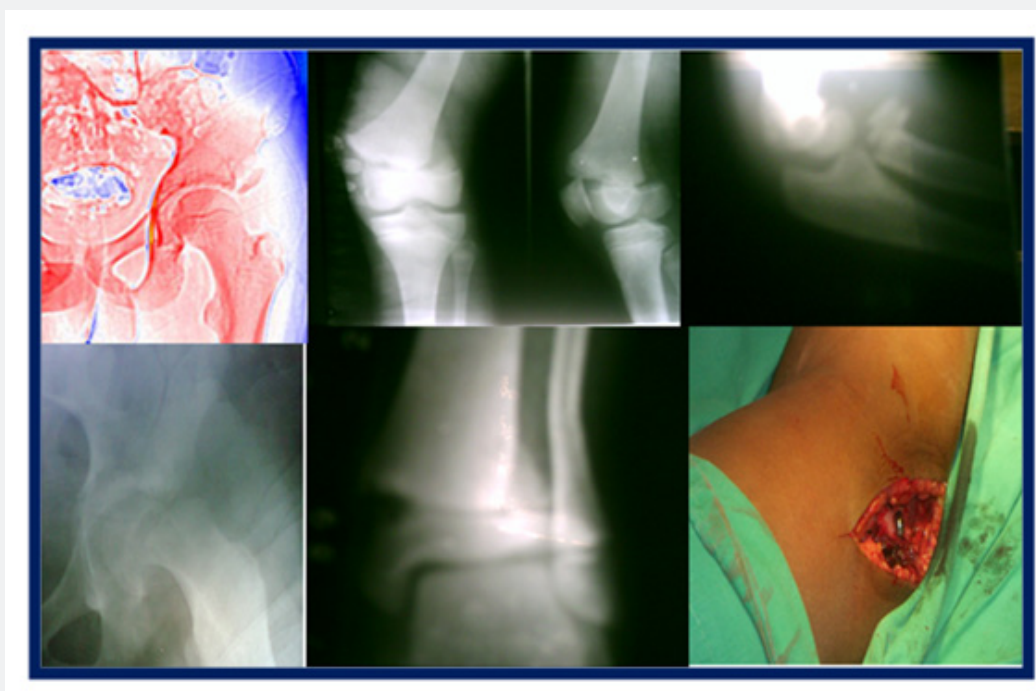


Figure 1: Various physeal lesions found in the investigation.

- i. Physeal pulling of the antero-inferior iliac spine.
- ii. Type II physeal lesion of the distal femur.
- iii. Type III physeal lesion of the proximal radius. Radial dome.
- iv. Physeal injury to the hip.
- v. Type II physeal injury of the ankle.
- vi. Rupture of the epicondyle, treated with internal fixation.

Table 3: Distribution according to the Salter and Harris classification in the sample of physeal damage and cause of injury.

Physeal fractures	Home accidents	Sports injuries	Traffic accidents	Total
Type I	376	59	24	459 (19,4)
Type II	1157	181	75	1413 (59,8)
Type III	227	35	15	277 (11,7)
Type IV	171	27	11	209 (8,8)
Type V	3	1	1	5 (0,2)
Type VI- Rang	-	-	3	3 (0,1)
Total	1934(81,9%)	303(12,8%)	129(5,3%)	2366(100 %)

Fountain. Data collection model.

Table 4: Treatment of the physeal lesions in the sample.

Treatment	Type I	Type II	Type III	Type IV	Type V	Type VI- Rang	Total
Medical treatment and immobilization	459	1070	187	119	-	-	1835
Manual reduction under anesthesia and immobilization	-	331	56	63	-	-	450
Reduction and osteosynthesis	-	12	34	27	-	-	73
Other treatments	-	-	-	-	5	3	8
Total	459	1413	277	209	5	3	2366

Fountain. Data collection model.

The physeal traumas in the children in the sample are widely distributed in Salter and Harris type II (Table 3), with more than half of the children $n = 1413$ (59.8%). In only 20 years of study, Rang’s VI injuries have been presented in three of the children, all caused by traffic accidents. Most of the physical traumas are produced by accidents at home $n = 1934$ (81.9%), followed by sports traumas with 12.8%. Table 4 shows the distribution of behavior according to the Salter and Harris classification, it is appreciable how conservative behaviors are applied in most children with injuries.

Discussion

The effects of trauma on the growth plates are always of interest to orthopedists, considering the impact they may have on the growth process. The incidence of injuries and mechanisms depends on the countries and the social and cultural environment of those affected. In less developed countries they are casual accidents, traffic accidents or civil conflicts and in countries where the cultural and social level is higher, falls from height, traffic accidents, sports dominate. In recent years, musculoskeletal injuries have increased due to the practice of games and sports.

Recent studies speak of an incidence of fractures during childhood of 42% in boys and 27% in girls, increasing linearly from birth to 12 years and later decreasing until 16 years. In the study, it was observed that after five years of age, the incidence of injuries increases with a peak incidence greater than 12 to 14 years, which coincides with other researchers [8,9]. The incidence of injuries and production mechanisms depend on the countries and the social and cultural environment of those affected. In less-developed countries they are casual accidents, traffic accidents or civil conflicts and in countries where the cultural and social level is higher, falls from height, traffic accidents and sports accidents dominate.

The most frequent fractures in children occur in the upper limb with 45.1% in the radius (dominating in its metaphysis and distal physis), 18.4% in the humerus (dominating metaphysis and distal physis), 15,1 % in the tibia, 13.8% in the clavicle and

7.6% in the femur. Physeal fractures represent 21.7% of injuries. The first two represent 75% of epiphysiolysis and are the more benign since the germ plate is not affected. The last four injure the physeal plate and can slow its growth causing epiphysiodesis [5]. Onís González and his collaborators suggest that the incidence of fractures by anatomical regions is as follows: wrist (23.3%), hand (20.1%) , elbow (12%), forearm (6.4%), clavicle (6.4%), leg (6.2%), foot (5.9%) and ankle (4.4%) [8]. Other authors report that 25.5% are sports injuries, they also refer that 15% are fractures, of which 23% occur in the fingers [9].

Osteomyoarticular injuries of traumatic cause are very common in children and mainly those that are due to sports activities, which represent 31%, followed by outdoor activities 25%, domestic accidents 19%, school accidents 13% and accidents in the public roads 12% [10]. In a study in Camagüey province, on proximal humerus injuries, it is described that accidents during children’s play occupied 34.9% of the sample, followed by domestic ones with 25.6% , those of transit 16, 3% and the sports ones with 14% [9].

Type VI Salter-Harris fractures are injuries characterized by ablation of the perichondral ring. Rang was the first to describe this lesion and, later, it was incorporated by Ogden [5] as the sixth type to the classic Salter-Harris classification. Jones, Wolf, and Herman regard them as rare injuries, but closely related to high-energy trauma [11]. Salter and Harris type VI lesions can present in a closed or open manner. Marson, Craxford, and Ollivere [12] evaluated patients with type VI ankle fractures, but these types are rare. Masquijo, Lucas and Allende [13] report similar results, with which this study agrees.

The lesion must be identified by good radiology and proceed to its perfect reduction [3]. For the treatment, it is important to restore the physeal integrity, especially in fractures III and IV, since failure to do so will most likely result in the appearance of a physeal bone bridge. Intra-articular displacement must be reduced to avoid degenerative changes in the future. Regardless of the affected bone, the treatment will always be the same, according to the classification.

Conclusion

Physel trauma occurs frequently in children between 12 and 14 years old, preferably males, these injuries mostly occur in the upper limb. Salter and Harris type II predominates, and they are resolved with conservative behaviors in their treatment.

Conflict of Interest

The authors of this article declare that they have no conflict of interest with the objectives of the research.

Declaration of the personal contribution of each author to the research

The authors of this article participated in the diagnosis, treatment, study design, and writing of the first version, as well as the final version of the manuscript in equal parts.

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