Iranian Journal of Orthopaedic Surgery
Vol. 23, No. 4 (Serial No. 91), Autumn 2025, p. 194-197

The Frequency of Growth Plate Fractures Requiring Surgery in Children Under 12 Years of Age

(A retrospective study in a Tertiary Hospital)

Abstract

Introduction: Considering the importance of growth plate fractures in quality of life and the complications caused by it and the lack of information about the prevalence of this type of fracture in the target society, this study was conducted with the aim of evaluating the prevalence of this type of fracture in an Iranian society.

Materials & Methods: The information of 41 patients with fracture of growth plate including; age, gender, open and closed fracture, single and multiple fractures, type of fracture, location of fracture and presence of fracture on the right or left side of the limb were extracted from the operating room records, radiographs of the patients and their files. After collecting the data, the data were subjected to statistical analysis.

Results & Discussion: 32 boys and 9 girls with an average age of 8.24±2.48. 32 years were included the distal radius fracture was the most common (26 cases) and the medial malleolus and distal metatarsal (1 person) were the least common sites of fracture. Most of the fractures were on the left side (22 people), closed (33 people) and single injury (29 people) and Salter-Harris type 2 physeal fractures were the most common fracture patterns (35 people).

Conclusion: the growth plate fracture in children was more common in boys, left side, single fracture, and the majority of those were Salter-Harris type 2 fractures.

Keywords: Growth Plate, Salter-Harris Fractures, Orthopedic Procedures

Accepted: 42 days before printing

Shahab Eilka, MD[1], Afshin Ahmadzadeh Heshmati, MD[1], Amirreza Mirzaei Soosfidi, MD[1], Mahsa Aboie, MD[2]

1. Department of Orthopedic Surgery, University of Medical Sciences of Kerman, Kerman, Iran
2. General Practitioner, University of Medical Sciences of Kerman, Kerman, Iran

Corresponding Author:
Amirreza Mirzaei Soosfidi, MD
Email:
amirreza.mirzaei@live.com

Introduction

The growth plate is responsible for the longitudinal growth of long bones, which are unique for every bone, in terms of chondrocytes, cellular maturation, and metabolic stage.[1, 2] 15-30 percent of fractures in children involve the growth plate. The growth plate is cartilaginous in nature and weaker than bone.[3] In fact, the growth plate is the weakest part of a bone; it is located at both ends of long bones, near the joints. A severe joint injury in an adult more likely damages the ligaments, but in children, due to the relative weakness of the growth plate, injuries commonly involve the growth plate.[4, 5]

Clinical manifestations of ligament injuries and growth plate injuries are generally similar. Therefore, many children who present with symptoms resembling ligament sprain have growth plate injuries.[6, 7] Growth plate fractures must be treated promptly and accurately, as they can lead to complications such as impaired bone growth, shortening, or asymmetry in the final shape of the bone. Treatment usually varies according to the fracture type and displacement of the fragments, ranging from casting to surgical intervention.[5, 8, 9] Given the importance of growth plate fractures in individuals' quality of life, the associated complications, in the target population, this study was conducted to evaluate the prevalence of these fractures in Kerman region.

Materials & Methods

This retrospective cross-sectional study was performed using a census method on all children under 12 years of age diagnosed with a growth plate fracture requiring surgical intervention at Shahid Bahonar Hospital in Kerman in 2019. All patients under 12 years old with growth plate fractures requiring surgery were included in the study. Patients diagnosed with compartment syndrome or those with incomplete demographic information were excluded.

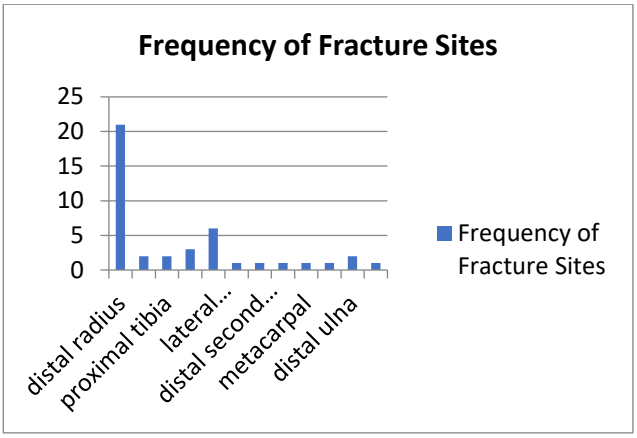

Figure 1: Frequency of Fracture Sites

Initially, patient information was extracted from the orthopedic operating room records, and additional demographic data like age, sex, type of Salter-Harris fracture classification,[10] fracture site, whether the fracture was open or closed, whether the fracture was isolated or multiple, and the presence of associated injuries—were collected from patient files. These data were then entered into the data collection form and subsequently analyzed using SPSS software.

Results

41 children with growth plate fractures were evaluated in this study. The mean age of the children was 8.24±2.48. 32 years. Of the total sample, 32 were boys and 9 were girls. Distal radius (26 patients) was the most common fracture site, while the least frequent sites were the medial malleolus and distal metatarsal (1 patient each) (Figure 1).

Most fractures occurred on the left side (22 patients), were closed (33 patients), and were isolated (29 patients). In terms of fracture type, the majority were Salter-Harris type II fractures (35 patients). Most fractures were closed (80.5%), and 85% of the fractures were classified as Salter-Harris type II. Fractures on the left side were slightly more common than those on the right (59.5% vs. 40.5%). The majority of fractures (70%) were isolated, and neurovascular injury was present in 14.6% of the patients.

Discussion

Orthopedic injuries in children are very common, and according to some reports, approximately 25% of children experience such injuries annually. Most research in this field comes from Scandinavian countries, where the lifetime risk of happening of a fracture from birth to age 16 has been reported as 42% in boys and 27% in girls.[11]

Table 1: Studied variables

Variable	Frequency	Percentage
Fracture Status (Open or Closed)		
Closed	33	80.5
Open	8	19.5
Fracture Type Based on the Salter–Harris Classification		
Type I	1	2.4
Type II	35	85.4
Type III	3	7.3
Type IV	2	4.9
Type V	0	0
Side of the Fracture in the Limb		
Right	17	40.5
Left	24	59.5
Fracture Multiplicity		
Isolated	29	70.7
Multiple	12	29.3
Neurovascular Injury		
Present	6	14.6
Absent	35	85.4

The causes of these injuries vary, the most common being trauma to the bone, followed by other acquired and congenital causes[12] Epidemiological studies in this specific area are quite limited. In a study conducted by Aghakhani et al.[13] aimed at examining the epidemiology of orthopedic injuries in children and adolescents, 1081 patients under 19 years of age with orthopedic injuries were evaluated, the majority of whom were boys (76%). This finding is consistent with our study. The reason for this higher prevalence remains unclear and is most likely related to biological and social factors, as well as greater athletic activity or higher risk-taking in males. Evaluating these contributing factors and identifying at-risk children in

both sexes may aid in preventing such injuries in these groups.

Arkader et al.[14] in 2007 have reported 83 children with femoral epiphyseal fractures, 80% of fractures occurred in boys and 20% in girls. The prevalence of growth plate fractures in boys was reported to be four times higher than in girls, which is consistent with our study. In their study, most fractures occurred on the right side (53%), whereas in our study, most fractures were on the left. Regarding fracture types, 25% were type I, 59% type II, 5.5% type III, 9.5% type IV, and 1.5% type V. Like our study, type II fractures were the most common, although in our study, type II fractures accounted for a higher percentage. Arkader et al.[14] reported only two open fractures, while in our study, eight fractures were open.

In a systematic review by Basener et al.[15] in 2009 that examined the results of multiple studies, the frequency of fractures was higher in boys (81%) than in girls (19%), a finding consistent with our study and that of Arkader. In that review, 70 children had type I fractures, 276 type II fr, 49 had type III fractures, 56 had type IV fractures, and 31 had type V fractures. As in our study, type II fractures were the most prevalent. In a study by Leary et al. (16) in 2009 examining tibial epiphyseal fractures, 67% of fractures were type II, 13% type III, 13% type IV, and 7% other types. Again, consistent with our findings, type II fractures were the most frequent.

Conclusion

The growth plate fractures were most common in boys and usually were Salter -Harris type II, closed, located on the left side, and isolated. It is recommended that this study be conducted on a larger scale and in more cities to obtain more realistic and accurate data. By collecting comprehensive information from various regions of Iran, it may be possible to reduce the prevalence of such injuries across all age groups, particularly among children, who represent a vulnerable segment of the population.

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