

Analysis of Fracture of the Foot Bones in Children According to the Andijan Region

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Abstract: The work is based on the study of case histories of 334 children with fractures of the foot bones, treated in the trauma department of hospital No. 3 in Andijan, which is the base of the Department of Pediatric Surgery of the Andijan Medical Institute, as well as in traumatology departments.

Keywords: Fracture of the foot bones, children, Andijan Region

INTRODUCTION

Fractures of the foot bones in children are not a rare injury and, according to a number of authors, constitute from 3% to 4% of all fractures of the bones and lower extremities. Nevertheless, little attention has been paid to this type of injury in the literature, although they often lead to persistent post-traumatic deformities and impairment of the support function of the foot [4,5,9].

A number of researchers in their works only briefly mention the fractures of the foot bones in children. They point out that only after fractures of the calcaneus and talus, as well as the phalanges of the fingers, significant deformities often develop, which cause a persistent dysfunction of the foot [1,11,18].

In the domestic literature, there is only one dissertation (Novik B.A., 1981), which deals with fractures of the foot bones in children. The author, having studied foreign (from 1904 to 1979) and domestic literature (from 1915 to 1979), found only 15 works devoted to fractures of the foot bones in children [7].

Currently, the number of such messages is slightly higher. We found only 6 publications devoted to fractures of individual bones of the foot in children. The lack of generalizing works

determines that in the literature there are no developed clinical and diagnostic criteria, justified indications for the choice of one or another method of treatment, information about the outcomes of foot fractures. There is no consensus on the timing of immobilization, the position of the foot during fixation, depending on the location of the fracture, there is no known data on the effect of injury on the supporting function of the foot, its biomechanics. The children's foot, due to its high elasticity and a kind of arcade-like structure, also has an important depreciation function. Therefore, after fractures of the foot bones, stiffness of a part of the joints, especially the plantar arch, occurs. This leads not only to a violation of the support but also to a sharp decrease in the amortization function of the foot, which can be the cause of long-term consequences due to the overload of the joints, which cannot function without the amortization function of the foot[9, 14,17].

MATERIALS AND RESEARCH METHODS

For 10 years (1983-1992) 334 children were observed with fractures of the bones of the foot, which amounted to 2.8% among children with fractures of bones of various localizations, who were treated in a hospital, the distribution of the observed patients by sex, age, location and nature of the fracture are presented in table 1.

As can be seen from the table, fractures of the metatarsal bones of the foot were most often observed. They were noted in 188 patients (56.3%). Among this group of children, 1 metatarsal bone was damaged more often - 48 patients (25.5%). The second place in frequency is taken by fractures of the III metatarsal bone - 43 children (22.9%). Fractures of the second and fifth metatarsal bones were observed almost equally often - 38 and 37 patients, respectively (20.2% and 19.7%). Obviously, this ratio reflects the circumstances of the metatarsal injury. Fractures of the first metatarsal bone occur more often when the foot strikes a hard object. Impacts on the forefoot or a fall on the foot in the flexion position determine the frequency of II and III metatarsal fractures. Excessive muscle tension often causes fractures of the base of the V metatarsal bone. The fourth metatarsal bone is the least injured.

RESULTS AND DISCUSSION

The next place in terms of the frequency of fractures is occupied by the pre-metatarsal bones - 130 patients (33.9%). Most of the injuries fall on the fractures of the calcaneus, which were observed in 100 children (76.9%). Fractures of the talus were found in 13 patients (10%).

Table 1
Distribution of patients with fractures of the foot bones by gender, age, localization, and nature of the damage

Fracture location	Sex		Age (years)				Fracture nature		Total	
	M	F	1-3	4-7	8-10	11-14	Closures	Open	Abs. Number	%
Fractures of the tarsal bones:	122	8	-	18	45	67	116	14	130	38,9
- ramming	10	3	-	5	4	4	13	-	13	

- calcaneal	95	5	-	8	36	56	88	12	100	
- navicular	5	-	-	1	2	2	5	-	5	
- cuboid	4	-	-	1	1	2	4	-	4	
- wedge-shaped	8	-	-	3	2	3	6	2	8	
Metatarsal fractures:	148	8	-	35	62	91	163	25	188	56,3
I	37	11	-	8	13	27	43	5	48	25,9
II	28	10	-	8	13	17	35	3	38	20,2
III	31	12	-	8	12	33	38	5	43	22,9
IV	17	5	-	4	7	11	18	4	22	11,7
V	33	4	-	7	12	18	29	8	37	19,7
Fractures of the phalanges of the fingers	10	6	16	-	-	-	12	4	16	4,8
Total: absolute number	280	54	16	53	107	158	291	43	334	
%	84,0	16,0	1,5	19,0	47,3	47,3	87,1	12,9	100,0	

Fractures of other tarsal bones were observed much less frequently. This distribution of fractures is understandable because fractures of the tarsal bones are observed mainly when falling from a height to the legs and the calcaneus is the first to hit the surface.

Patients with fractures of the phalanges of the fingers were observed much less often in the hospital, since such patients are more often treated on an outpatient basis.

The distribution of patients by sex is interesting. It is known that the number of injuries in boys exceeds the number of injuries in girls by 3-4 times. With fractures of the foot bones, such a ratio is not always observed. So, fractures of the foot bones in boys were observed almost 6 times more often (F: M = 1: 5.8). The ratio F: M = 1: 3.7 typical of childhood traumatism was observed only in children with fractures of the metatarsal bones. Among children with fractures of the phalanges of the fingers, this ratio was more than 2 times lower - F: M = 1.7. Fractures of the tarsal bones were found in boys more than 15 times more often than in girls (F: M = 1: 15.2). Fractures of the calcaneus in boys are 19 times the number of fractures in girls, a phenomenon that is difficult to explain. It is obvious that sexual and psychophysiological characteristics cannot cause such frequent fractures of the tarsal bones in boys.

Fractures of the foot bones were observed in all age groups, but their distribution by age and localization was also peculiar. Thus, fractures of the phalanges of the fingers prevailed in children under the age of 3 years, which is due to the mechanogenesis of trauma. Most of the fractures occurred as a result of impact with a heavy hard object. Fractures of the tarsal and metatarsal bones were not observed in children under 3 years of age. They were mainly observed in patients of the older age group (11-14 years old) - 47.3%. Fractures of the large bones of the foot (tarsus and metatarsus) were observed in one-third of children aged 8-10 years. Almost a fifth of the fractures of the large bones of the foot was noted in the age group 4-7 years old.

The overwhelming majority of fractures were not accompanied by a violation of the integrity of the skin - 291 children (87.1%). Open fractures were noted in approximately one-

eighth of patients - 43 (12.9%).

The mechanogenesis of injury largely determines the location and nature of metatarsal fractures. The distribution of patients by location and nature of the fracture is shown in Table 2.

Table 2
Distribution of patients with metatarsal fractures by location and nature of the fracture

Metatarsal bone location	Fracture type		Fracture features								Total	
	Closed	Open	Subcapital		Diaphyseal						abs. number	%
			abs. number	%	Transverse		Oblique		Base			
					abs. number	%	abs. number	%	abs. number	%		
I	43	5	7	14,6	11	22,9	13	27,1	17	35,4	48	25,5
II	35	3	11	28,9	10	26,3	9	23,7	8	21,1	38	20,2
III	38	5	11	25,6	12	27,9	11	25,6	8	20,9	43	22,9
IV	18	4	7	31,8	9	40,9	4	18,2	2	9,1	22	11,7
V	29	8	5	13,5	6	16,2	9	24,3	17	16,0	37	19,7
Total: abs. number	163	25	41		48		46		53		188	
%				21,8		25,5		24,5		28,2		100,0

As can be seen from the table, fractures (epiphysiolysis) of the base are characteristic of damage to the 1st placental bone, which was noted in more than a third of patients. This fact indicates that fractures more often occur when the foot hits a hard object. Oblique diaphyseal fractures were observed in 27.1% of children, which indicates an indirect mechanism of injury. Somewhat less frequently, transverse diaphyseal fractures occurred due to direct impact (22.9%). Subcapital fractures were the least common.

Fractures of the third metatarsal bone, which are second in frequency, resulted in 27.9% of fractures as a result of direct trauma. Subcapital, oblique, and base fractures, indicating an indirect mechanism of damage, were noted in more than ¾ of children. An approximately similar ratio was observed in fractures of the II metatarsal bone. Fractures of the 4th metatarsal bone are characterized by a high proportion of injuries caused by direct exposure to traumatic force (40.9%). With fractures of the 5th metatarsal bone, almost half of the patients (46%) had a detachable nature of the damage. In general, metatarsal base fractures were more common. Oblique and transverse diaphyseal fractures were noted in half of the patients. Subcapital fractures were the least common.

The leading place among injuries to the bones of the tarsus is occupied by fractures of the

calcaneus. The paradoxical distribution of calcaneal fractures in boys and girls can be traced in their localization and age distribution, which can be seen in Table 3.

Table 3
Distribution of patients with calcaneus fractures by sex, age, and location of the fracture

Type of fracture	Age		Age (years)			Total
	M	F	4-7	8-10	11-14	
Fractures of the internal process	7	-	-	3	4	7
Horizontal fractures of the calcaneus tubercle	6	-	1	2	3	6
Partial apophyseolysis of the tubercle	4	-	-	1	3	4
Vertical tubercle fractures: - no offset	11	1	2	5	5	12
- with offset	16	2	3	6	9	18
Compression comminuted fractures of the calcaneus body	51	2	4	21	28	53
Total	95	5	10	38	52	100

The table shows that extra-articular fractures of the calcaneus tuberosity were noted in almost half of the children. Among them, 2/3 of the fractures are not accompanied by mixing, although they occur when they fall from a height onto the heels, and only a third of children experience displacement of a fragment of the calcaneus. Fractures of the appendix, horizontal fractures of the heel of the calcaneus are relatively rare, which significantly distinguishes the epidemiology of heel fractures in children from adults. The presence of the apophysis of the calcaneus tubercle determines the occurrence of partial apophysiolyis of the calcaneus tubercle, which is characteristic only of childhood. More than half of the patients had intra-articular comminuted fractures of the calcaneus body, in most cases accompanied by displacement of fragments.

Fractures of the talus were observed in 13 children. The distribution of patients with talus fractures by the nature of the fracture, gender, age and the presence of displacement is shown in Table 4.

Table 4
Distribution of patients with talus fractures by gender, age and presence of displacement

Type of fracture	Sex		Age (years)			Displacement		Total
	M	F	4-7	8-10	11-14	YES	NO	
Isolated fractures of the posterior process	1	1	-	1	1	-	2	2
Fractures of the neck of the talus	3	1	1	2	1	3	1	4

Fractures of the body of the talus	6	1	3	2	3	6	1	7
Total	10	3	4	5	4	9	4	13

CONCLUSION

The table shows that fractures of the body of the talus were noted in more than half of the patients, and in most cases, displacement of the fragments was expressed. Fractures of the talus neck were observed in one-third of patients. Only 2 children had fractures of the posterior process of the talus.

Fractures of other tarsal bones (scaphoid, cuboid, and wedge-shaped) were noted in 17 patients. In most cases, these were fractures without significant displacement. In 2/3 of children, they were combined with fractures of the metatarsal bones and occurred when the foot was struck with a heavy object (more often with concrete slabs) or as a result of compression of the foot.

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The foot is a mechanically complex polyvalent formation that serves as springy support at rest and during movement. The bones of the foot, with the participation of the ligamentous apparatus of the muscles, form five longitudinal and one transverse arch. Each longitudinal arch begins from one point of the calcaneus, expanding in a fanlike manner, includes the bones of the distal row of the tarsus, the metatarsal bones. The transverse vault is formed by the sphenoid and cuboid bones, as well as the heads of the metatarsal bones. As a result, the support of the foot is carried out at three points - the tubercle of the calcaneus, the head of the I and V metatarsal bones. Thus, the calcaneus, scaphoid, cuboid, and wedge-shaped bones, as well as the bones of the metatarsus, constitute an arcade springy supporting organ that absorbs shock loads. The talus is of great importance as it plays the role of a bony meniscus and connects the bones of the lower leg with the foot. The skeleton of the foot begins to form at 8-12 weeks of embryonic development. At 16-20 weeks of embryogenesis, the main stage of the formation of the foot as an organ occurs. Previously, it was believed that in the fetus and newborn child, the vaulted elements of the foot are not pronounced, and only after the beginning of standing and walking normal arches develop. Studies in recent years show that in the sixth month of fetal development, the feet are fully formed and in quantitative terms correspond to the feet of children under the age of 7 years. In the process of the growth and development of the foot, additional ossification points are often formed in its bones, from which additional bones are formed, which often serves as a reason for diagnostic errors. The complex shape determines the need for mutual balance between the individual elements of the skeleton of the foot, which allows for the support function and movement at the same time. The main role in this is played by three sustentaculi: subtalar, posterior talocalcaneal, and talocalcaneal. Disorders of congruence even in one of these joints leads to the loss of the static functions of the foot and its deformation in the hind region.

The features of the clinical picture and diagnosis of fractures of the foot bones in children depending on age, mechanogenesis of the injury, the nature and localization of the damage were determined, differentiated indications for the choice of conservative, active surgical and operative treatment tactics were substantiated, the optimal methods of treatment of individual bones were established. In the feet, the results of treatment were studied in the immediate and long term after the injury.

Clinical and radiological diagnostic criteria for choosing the optimal treatment tactics for

fractures of the foot bones, depending on the location and nature of the fracture, have been determined, indications for the use of various methods of treatment have been substantiated, and the features of management of patients with fractures of the foot bones in the recovery period have been clarified.

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