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Treatment of children with multiple injuries of the bones forming the elbow joint

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Abstract

Introduction Diagnosis and treatment of children with multiple injuries of the bones that form the elbow joint is a relevant problem in pediatric traumatology. Due to the high variability of the cases encountered, it is necessary to differentiate the volume, timing and sequence of surgical interventions, as well as the duration of fixation of the injured limb with immobilizing means. The **aim** of the work was to study the dependence of long-term anatomical and functional treatment results in children with multiple fractures around the elbow joint on the type of injury. **Materials and methods** The medical records of 82 pediatric patients with multiple injuries of the bones forming the elbow joint were studied. The patients involved in the study were divided into two groups. Group 1 were patients with multiple fractures of the bones that make up the elbow joint (35 children), and group 2 were patients with intra-articular fractures of the distal end of the humerus and fracture-dislocations of the forearm bones in the elbow joint (47 children). The results were evaluated using the DASH questionnaire and the Broberg-Morrey rating scale. **Results** In the first group of patients with multiple fractures of the bones that make up the elbow joint, the anatomical and functional results of treatment were significantly better, and the process of restoring the function of the elbow joint was shorter. The treatment results of patients in the second group largely depended on the severity of the injuries. The use of the Ilizarov method with rational arrangements of the apparatus enables to preserve the function of the elbow joint in the course of transosseous osteosynthesis. In hybrid fixation (the use of pins and apparatus or plaster immobilization and apparatus), patients frequently developed immobilization contracture of the elbow joint and the anatomical and functional results turned out to be worse, since the fixed elbow joint needed long-term rehabilitation. **Discussion** Multiple injuries of the bones of the elbow joint are highly variable. The treatment of patients with multiple injuries of the elbow joint remains a difficult clinical task, partly because there is no differentiated approach to rehabilitation measures depending on the nature of the injury, and, accordingly, a rational approach to the treatment of this group of patients has not been developed. Due to the fact that most dislocations are usually associated with fractures, accurate diagnosis of the severity of injuries and rational surgical intervention in terms of timing and volume are necessary to achieve good anatomical and functional results. **Conclusion** Accurate and timely diagnosis of skeletal injuries of the elbow joint and rational determination of treatment tactics are of great importance in pediatric emergency traumatology. They determine the anatomical and functional outcomes of rehabilitation.

Keywords: trauma, elbow joint, children, Ilizarov method

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INTRODUCTION

The treatment of children with fractures around the elbow joint, despite the progress made, still remains an challenging problem in pediatric traumatology. Multiple bone injuries in the area of the elbow joint are of particular difficulty for the diagnosis and treatment [1-4]. Traumatic dislocations of the elbow joint with concomitant fractures account for approximately 10 to 12 % of all fractures in the pediatric population [5, 6]. Fracture dislocations of the bones of the forearm in this age group have a higher incidence (single fracture – 21 %; multiple fractures – 24 %) [7]. An isolated limb fracture, as a rule, does not threaten the life of a child, but the unique anatomy of the elbow joint and close location of the neurovascular structures may cause post-traumatic complications [8, 9].

A multiple injury of the elbow joint includes two or more different injuries of the bones that form the elbow joint. The study of literary sources showed that multiple injuries of the bones of the elbow joint have not been covered enough. According to some authors, there are no such injuries in children at all [10]. According to our data, complications encountered in everyday practice (acquired deformities, defects, including articulating surfaces, contractures and ankylosis of the elbow joint) are the result of previously undiagnosed multiple injuries. According to the literature, irrationally chosen treatment tactics predetermine the quality of patients' future life [7, 11].

The number of observations of patients with multiple and combined fractures in the elbow joint area is in foreign publications has notebly grown [12-15]. Current methods, primarily methods of radiation diagnostics, allow detection of intra-articular damage. But there are problems and significant miscalculations in the choice of tactics for the treatment of patients with complex multiple injuries of the bones of the elbow joint. Determination of the volume, timing and sequence of

surgical interventions, optimal options of osteosynthesis and fixation with immobilizing means remain unresolved and not recognized in clinical protocols, including due to the high variability of the cases encountered [16-18].

Purpose To study the dependence of long-term anatomical and functional results of treatment of children with multiple fractures in the elbow joint on the type of injury.

MATERIALS AND METHODS

Study design: a retrospective clinical study of 82 children with multiple injuries of the elbow joint (fracture of two or more bones that form the elbow joint, a combination of fracture and dislocation of the bones that form the elbow joint). The analyzed group was formed according to inclusion criteria from 946 children treated at the clinic of the State Institution "RSNPMCTO" (Tashkent) over a four-year period.

Patient inclusion criteria:

– traumatic multiple injuries of the elbow joint bones (fractures of two or more parts of the bones that make up the elbow joint, fractures and dislocations of the bones of the forearm in the area of the elbow joint);

– admission time – up to 30 days since the injury (previously treated in other clinics);

– patients under 18 years at the time of inclusion in the study.

Exclusion criteria:

– admission time: more than 30 days from since the of injury;

– purulent complications;

– open injuries.

Based on the type of injury, the analyzed clinical series was divided into two groups:

Group 1: patients with multiple fractures of the elbow joint bones (n = 35);

Group 2: patients with a combination of fracture and dislocation in the area of the elbow joint (n = 47).

The mean age of the patients was 10.5 ± 5.5 years.

The analysis of standard clinical and radiological examinations used in traumatology and orthopedic practice was carried out. All 82 patients underwent surgical treatment on inpatient basis. Long-term results of surgical interventions in all patients treated in the clinic were analyzed for the, since the operations performed before admission to our clinic did not ensure proper reduction of bone fragments and reduction of dislocations.

Treatment outcomes were assessed using an adapted DASH (Disability of the Arm, Shoulder and Hand Outcome Measure) questionnaire and the Broberg-Morrey rating scale within 15 to 18 months after surgery.

The studies were approved by the local ethics committee of the State Institution "RSNPMCTO" (protocol No. 1 dated April 13, 2020) and were carried out in accordance with the ethical standards set forth in the Declaration of Helsinki. Informed consent to the processing of personal data was obtained from the parents of the patients.

Descriptive statistics was used to determine the mean value of the values (M), the error of the mean (m), the confidence interval (σ), the minimum and maximum values of the parameters. The obtained data were processed by the methods of linear statistical analysis. Arithmetic means, standard errors of arithmetic means, standard deviations were calculated. The analysis of the significance of differences between the studied groups was carried out using Student's t-test. Differences in individual parameters in the studied groups were considered significant at $p < 0.05$ (95 % confidence level).

RESULTS

The overall analysis of the clinical cases showed a significant variability in injuries (Table 1). Fracture-dislocations of the forearm bones of Brecht and Malgenya type were encountered most frequently.

A retrospective analysis revealed 145 different complications in 82 patients (Table 2). Postoperative and immobilization stiffness (contractures) of the joints of varying severity occurred most frequently (85.4 % of patients).

The combination of a fracture of the distal humerus and a fracture of the proximal ulna prevailed in the structure of multiple fractures of the elbow joint (Table 3).

Table 1

Distribution of patients with multiple injuries of the elbow joint bones by injury types

Injuries	Patients	
	Number	%
Fractures of the distal humerus and fractures of the proximal ulna	16	19.5
Fractures of the distal humerus and fractures of the proximal radius	7	8.5
Fractures of the distal humerus and fractures of both proximal forearm bones	12	14.6
Fractures of the humerus and isolated radial head dislocation	12	14.6
Fracture dislocations of the bones of the forearm of Brecht and Malgen type	32	39.0
Fractures of the humerus and dislocations of forearm bones	3	3.7
Total	82	100

Table 2

Distribution of patients with multiple injuries of the elbow joint bones by types of complications

Complications			%
Types	Number	%	
Malunion	32	22.1	39.0
Angulations	30	20.7	36.6
Fixation stiffness	70	48.3	85.4
Bone defects of articulating surfaces	7	4.8	8.5
Neurovascular disorders in the upper limb	6	4,1	7.3
Total	145	100	

Table 3

Structure of injuries in the 1st group of patients with multiple fractures of the elbow joint

Subgroup	Injury variant	Patients	
		Number	%
1.1	Fractures of the distal end of the humerus and fractures of the proximal end of the ulna, including	16	45,7
	osteoepiphyseolysis of the head of the humeral condyle in combination with osteoepiphyseolysis of the olecranon of the ulna	5	14.3
	osteoepiphyseolysis of the block of the humerus with a fracture of the olecranon	4	11.4
	apophysiolysis of the medial epicondyle of the humerus associated with a fracture of the olecranon	3	8.6
	fracture of the block of the humerus with osteoepiphyseolysis of the coronoid process of the ulna	2	5.7
	osteoepiphyseolysis of the head of the humeral condyle of the humerus and osteoepiphyseolysis of the coronoid process of the ulna	2	5.7
1.2	Fractures of the distal humerus and fractures of the proximal radius including	7	20.0
	osteoepiphyseolysis of the head of the humeral condyle of the humerus epiphyseolysis or osteoepiphysiolysis of the head of the radius	7	20.0
1.3	Fractures of the distal humerus and fractures of both proximal forearm bones, including	12	34.3
	osteoepiphyseolysis of the head of the umeral condyle of the humerus and fractures of oth bones of the forearm	7	20.0
	fracture of the block and medial epicondyle of the humerus and fracture of both bones of the forearm	5	14.3
Total		35	100

Case reports

Patient K., 12 years old. Diagnosis: closed fracture of the head of the humeral condyle and a closed fracture of the olecranon of the ulna with displacement of bone fragments.

The radiographs (Fig. 1) revealed osteoepiphysiolysis of the head of the condyle with a part of the lateral epicondyle and rotation around its axis and angular displacement, absence of 1/3 of the humerus trochlea, a bone fragment in the projection of the olecranon; the edges of the bone fragment and the edges of the olecranon were uneven, diastasis between fragments was more than 5 mm.

Patient H., 8 years old. Diagnosis: maluniting fractures of the trochlea of the humerus and olecranon.

The radiographs and MSCT (Fig. 2) show a hemispherical bone fragment with a cortical plate in the projection of the humerus trochlea with a diastasis of more than 10 mm; in the metaphyseal region of the olecranon there is a periosteal callus along the perimeter of the metaphysis of the ulna, the axis of the olecranon is not mal-aligned.

Patient A., 14 years old. Diagnosis: closed apophyseolysis of the medial epicondyle of the humerus and fracture of the olecranon of the ulna. Radiographs (Fig. 3) revealed an evulsion of the medial epicondyle from the maternal bed with a diastasis of more than 3 mm in the medial distal direction, a fracture of the proximal end of the olecranon with a displacement in the proximal direction and a diastasis of up to 3 mm.

In group 2, fractures and dislocations of the bones of the forearm prevailed (Table 4).

All patients underwent surgical interventions, a total of 102 operations were performed.

Fig. 1 X-rays of the elbow joint in patient K. in two views

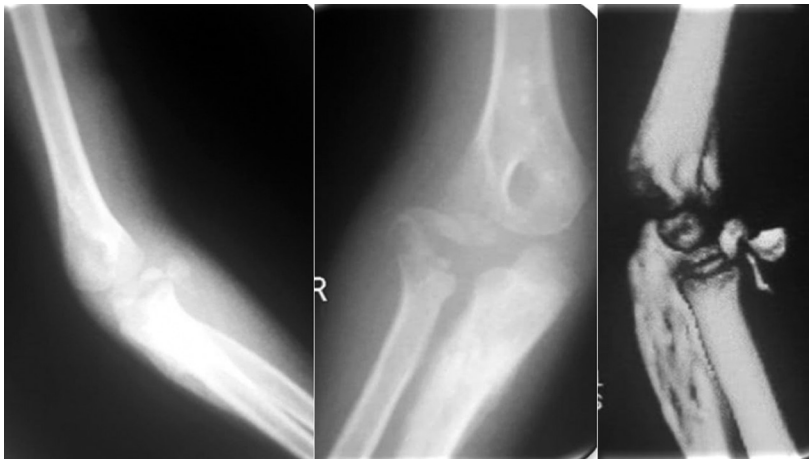

Fig. 2 X-rays in both views and MSCT of the elbow joint of patient X

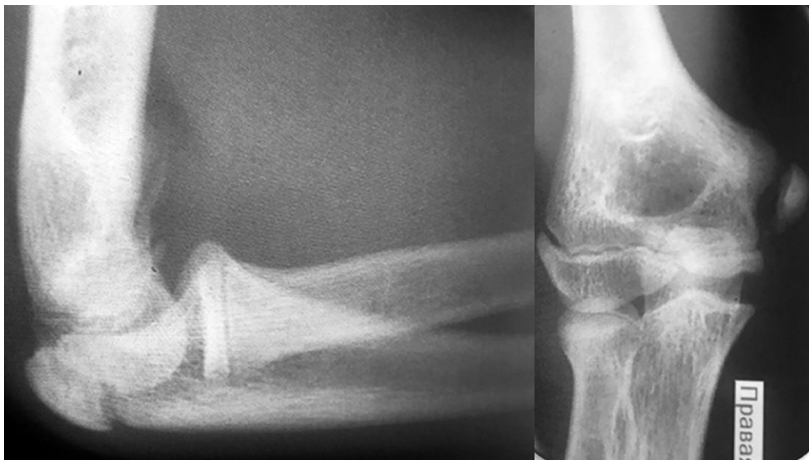

Fig. 3 X-rays of the elbow joint of ptient A in both views

Table 4

Structure of injuries in the 2nd group of patients with a combination of fracture and dislocation in the area of the elbow joint

Subgroup	Variants of injuries	Patients	
		Number	%
2.1	Fractures of the humerus associated with isolated radial head dislocation, including	12	25.5
	osteoepiphysiolysis of the head of the humeral condyle along with post-traumatic dislocation of the head of the radius	12	25.5
2.2	Fracture dislocations of the bones of the forearm of Brecht and Malgen types, including	32	68.1
	Brecht injuries	26	55.3
	Malgen injuries	6	12.8
	Distal humerus fracture associated with dislocations of both forearm bones	3	6.4
Total	47	100	

Peculiar features of surgical treatment

In patients with a combination of fractures of the distal humerus and the proximal ulna (**subgroup 1.1**), open reduction of fragments was performed by fixation with Kirschner wires and the Ilizarov apparatus. The wires were inserted tangent to (over) the joint in order to create a stable functional osteosynthesis (SFO). Open reduction of fragments in osteoepiphyseolysis of the head of the humeral condyle did not present any particular difficulties, but its combination with open reduction of the olecranon required certain skills in approaching, fixation of fragments and Ilizarov transosseous osteosynthesis. According to our method, we mounted a device consisting of separate frame parts for the shoulder and forearm with hinged nodes at the level of the elbow joint in order to preserve the function of the elbow joint. Of particular interest are patients with fractures of the distal humerus and the proximal radius (**subgroup 1.2**), since the combination of fractures (elements of the distal end) of the humerus with fractures of the head and neck of the radius always requires a differentiated approach and, in some cases, non-standard solutions. In two patients whose injuries resulted from a fall, the fractures were reduced with conservative measures and a plaster splint. However, once the swelling ceased, a secondary displacement of bone fragments occurred due to absent control, so open reduction and wire fixation of bone fragments were performed. Three patients underwent open reduction of bone fragments of the humeral condyles, transosseous osteosynthesis of the humerus using the Ilizarov apparatus, and open reduction of the radial head with Kirschner wires.

In a combination of fractures of the distal humerus and the proximal ends of both forearm bones (**subgroup 1.3**), fixation of the trochlea or head of the condyle of the humerus was not difficult; for reducing and fixing the proximal ends of the bones of the forearm, the Ilizarov apparatus was not used to create stable-functional osteosynthesis (SFO). In seven patients, the trochlea of the humerus was fixed with crossed Kirschner wires, in five patients with osteoepiphyseolysis of the head of the condyle of the humerus, the Ilizarov apparatus was installed later from two half-rings without hinged joints, and fractures of the olecranon and head of the radius were fixed with wires.

In patients with fractures of the head of the condyle of the humerus and isolated dislocation of the head of the radius (**subgroup 2.1**), we used a surgical approach along the outer lateral surface of the elbow joint. Initially, the fragments of the condyle of the humerus were reduced and dislocations of the head of the radius were eliminated. The dislocated head was fixed with a lavsan tape in one patient; the annular ligament plasty was performed in 11 children according to the method developed in the clinic, including the creation of an annular ligament from m. Onconeus (decision of the Intellectual Property Agency of the Republic of Uzbekistan of accepting the application for consideration). The rest of the patients (children over 7 years old, chronic cases) after elimination of the dislocation of the head of the radius, the Ilizarov apparatus for the SFO, consisting of half rings, was installed. The wires passed through the olecranon and through the distal ends of the bones of the forearm, the wires were tensioned and fixed in the supports of the apparatus. Then, a sagittal olive wire was inserted through the proximal end of the radius and fixed in the half-ring of the apparatus to hold the head of the radius in the reduced state (Patent DGU 00825, 17.08.2004, Patent Office of the Republic of Uzbekistan). The **subgroup 2.2** mostly consisted of patients with Brecht's injuries (fracture of the proximal metaphysis of the ulna and external subluxation of the radial head). It is known that this damage occurs in children under the age of seven years and is well eliminated, but in delayed treatment, closed reduction of fragments becomes problematic. Those patients had operations, the olecranon was reduced with intramedullary or crossed wire fixation. In all the cases of dislocation of the head of the radius, its open reduction was performed with plasty of the annular ligament according to the method developed in our clinic. This technology was used in almost all patients of this subgroup. The Ilizarov apparatus was used and consisted from rings without hinged connection only in three patients with chronic injuries for reduction and exclusion of re-dislocation of the head of the radius.

The most difficult to eliminate the consequences of injuries were patients with fracture-dislocation of the bones of the forearm (**subgroup 2.3**), apophyseolysis of the medial epicondyle with lateral dislocation of the bones of the forearm. In this study, we included patients with incarceration of a fragment of the medial epicondyle in the joint cavity after closed reduction or after self-reduction of the bones of the forearm. Such cases were often accompanied by post-traumatic neuropathy of the ulnar nerve. The surgical technique in those cases included a medio-lateral approach for revision of the ulnar nerve and bone fragment, fixation of the latter on the maternal bed with Kirschner wires, or Ilizarov transosseous osteosynthesis. In the postoperative period, medical or transcutaneous electrical nerve stimulation was performed. We noted particular difficulties in the treatment of children with a combination of fractures of the humerus and posterior dislocation of the bones of the forearm. One patient had osteoepiphysiolysis of the head of the condyle of the humerus in combination with a fracture of the head of the radius and a metaphyseal fracture of the olecranon. Primary closed reposition did not give any result, and secondary displacements of the fragments were revealed later. Patients underwent open reduction of fractures of the head of the humeral condyle,

head of the radius and ulna with Ilizarov transosseous osteosynthesis of the humerus and forearm with hinges mounted at the level of the elbow joint.

Patients of the 2nd group, as a rule, had soft tissue edema at the level of damage, complained of pain and neurotrophic disorders. Seven children were readmitted to the clinic two days after the first operation with unreduced dislocations. The very next day they underwent reosteosynthesis to eliminate dislocations of the bones of the forearm.

Long-term follow-ups

In general, the results of treatment in the 1st group were significantly better, and functional recovery of the elbow joint was shorter. The performance of daily manipulations of the upper limb, assessed in points according to the DASH and Broberg-Morrey scales, turned out to be higher than in the patients of the 2nd group (Tables 5, 6).

The results of rehabilitation measured with the Broberg-Morrey scale corresponded to the results with the DASH questionnaire.

Table 5

DASH scores (post-surgery)

Points	Group 1		Group 2	
	Number	%	Number	%
28-31	28	80.0	31	66.0
35-44	6	17.1	14	29.8
55-63	1	2.9	2	4.3
Всего	35	100	47	100

Table 6

Broberg-Morrey score in the groups (post-surgery)

Points	Group 1		Group 2	
	Number	%	Number	%
95-100 (excellent)	28	80.0	31	66.0
80-94 (good)	5	14.3	10	21.3
60-79 (fair)	2	5.7	5	10.6
Lower than 60 (poor)	0	0.0	1	2.1
Total	35	100.0	47	100.0

In patients of the 1st group, excellent and good results were 94.3 % and 87.3 % in children of the 2nd group.

In the 1st group, five patients had the total score from 80 to 93 that allows us to evaluate the results as good; two children had 60 points that corresponds to a fair result. In most patients (28 children), the score was estimated between 99 and 100 points, which corresponds to an excellent result.

In the 2nd group, the results of treatment of 10 children were rated 80-93 points what is a good score; in five children the results were rated 60 points, which is a fair result, in one patient the result was below 60 points (29 points), which is a poor result. In the remaining 31 patients, the score was equal to 99-100 points, what refers to excellent results.

In the evaluation DASH scale, the lowest scores demonstrate positive clinical manifestations. The indicators of the 1st group of patients corresponded to the estimates between the first and second line of the scale, which shows a high dynamics of the results obtained. According to the DASH formula, the rate of inability to perform certain procedures in 20 children was only 4.54 % in the 1st group, which is an excellent result. In 14 children, this indicator was up to 9.09 %, which corresponds to an average value, and in one patient it was 13.6 %, which is a low value.

According to the DASH scale, the results were more modest in children of the 2nd group. Two children showed the level of inability to perform motor functions at 22.7 %, one patient – 27.2 %, which is a low indicator. In other patients, the result was from 6.8 to 9.09 %, which is an average and high value.

According to the Broberg-Morrey scale, the results were evaluated according to 4 criteria corresponding only to the functional state of the elbow joint (Table 7). In patients of the 1st group, the strength of the muscles relative to the opposite side was 19.0 ± 0.42 points; the same indicator in patients of the 2nd group was 18.9 ± 0.44 points. Joint stability indicators in both groups were close and amounted to 4.94 ± 0.04 points in patients of the 1st group and 4.93 ± 0.06 points in patients of the 2nd group, respectively. Pain in the 1st group did not manifest itself or was minor pain after 15 months post-surgery and amounted to 33.2 ± 0.84 points, i.e. corresponded to good results; in patients of the 2nd group this indicator was slightly lower and amounted to 30.95 ± 0.99 points. The range of motion of the elbow joint in patients of the 1st group was 38.9 0.62 (individual scores from 37.5 to 40.4 points), in patients of the 2nd group this value was 36.5 ± 1.01 points. The total score in patients of the 1st group was 96.1 ± 1.7 and 91.36 in patients of the 2nd group.

Table 7

Treatment results evaluated with Broberg-Morrey system

Parameter	Maximum possible Broberg-Morrey score	Group 1	Group 2
Strength	20	19.0 ± 0.42	18.9 ± 0.44
Stability	5	4.94 ± 0.04	4.93 ± 0.06
Pain	35	33.2 ± 0.84	30.95 ± 0.99
Range of motion	40	38.9 ± 0.62	36.5 ± 1.01
Total score	100	96.1 ± 1.7 (excellent)	91.36 ± 2.33 (good)

DISCUSSION

Elbow joint injuries remain a diagnostic problem for radiologists and orthopedists, given the complex anatomy of the elbow joint, as well as the triggering of a cascade of processes of apophyseal fusion and dynamic ossification around the elbow joint in children, which are not characteristic of injuries in adults [1-4]. Focusing on the dominant injury and underestimating the severity of the consequences of concomitant injuries is typical for visualization and diagnosis in multiple fractures in children [19-23].

In our opinion, which is consistent with a number of literary sources, the treatment of patients with multiple fractures around the elbow joint remains a difficult task [31-34]. It is partly because there is no precise definition of the nature of the injuries, the specific role of structural components, and a rational approach to treatment. Unlike fractures of long bones or the proximal humerus, fractures of the elbow bones in children require precise reduction, as they heal rather quickly in childhood. Malunion poses more difficulties in achieving good long-term results [24-27]. Since the incidence of simple elbow dislocations in children is rather low, and most dislocations are usually accompanied by fractures, an accurate diagnosis and early surgical intervention are required to achieve good functional results [7, 28-31].

In our study, the use of the Ilizarov method with rational assemblies of the fixator enabled to preserve the functions of the elbow joint. In hybrid fixation (use of wires and apparatus or a plaster cast and apparatus), the results were somewhat lower, since the fixed segment needed long-term rehabilitation. The least effective was the technology in which wire-based osteosynthesis and plaster immobilization were used for fixation. Our data confirm the results of other researchers on the advantage of using external fixators in comparison with other methods of treatment in pediatric traumatology [11, 14, 15]. The age of patients in our studies ranged from 5 to 16 years, and the average age was 10.5 years. Many fracture-dislocations of the Brecht type (17 children) occurred in children under 7 years of age; and Malgen's injury occurred in children aged 10-12 years (4 children). Moreover, we observed children aged 5-7 years with fractures of the head of the humeral condyle in combination with isolated dislocations of the head of the radius (7 children). Apophysiolysis of the condyles of the distal part of the humerus was observed in children aged 9-13 years (3 children).

Gross high-energy injuries that led to multiple fractures and dislocations are typical for children from 12 to 16 years old (3 children) who play sports (martial artists, boxers). Diagnosis, especially in young children, is very difficult. Children do not demonstrate the possible range of motion of the elbow joint for X-ray examination due to pain or joint contracture. The projection "overlay" of bone fragments during the visualization of radiographs provokes diagnostic errors in the interpretation of radiographs. Therefore, the use of MSCT studies helps in making an accurate diagnosis.

The functional results we obtained in both groups depended on the treatment method. The use of technologies for creating SFOs while maintaining the function of the elbow joint had a positive effect on the anatomical and functional result (Broberg-Morrey assessment scale) and improved the quality of life (DASH questionnaire) in the immediate and long-term follow-ups.

Interpreting and analyzing in detail the obtained material, we found that multiple injuries of the bones of the elbow joint are characterized by high variability. The incidence of these injuries is relatively low (up to 29 %), but the severity of complications makes them of particular importance in pediatric traumatology. The study of long-term results was carried out in all 82 children. In the first group (multiple fractures), the long-term results depended on the size of the fragments and the possibility of their fixation, the area of damage to the articular surfaces, and also on the tactics of treatment. In the second group (fracture-dislocations), long-term results were determined by the duration of dislocations in the presence of fractures of other bones that required fixing problems. Therefore, extraordinary methods of fixing bone fragments, separate fixation of each segment, i.e., were often used, that is hybrid osteosynthesis techniques. The volume of surgical treatment depended solely on the degree of displacement of fragments and on the ability to release the joint from blocking by bone fragments. The timing of fixation also depended on the fusion of the main fragment, mainly, of course, the intra-articular part of the distal segment, which was 35.2 ± 0.3 days. It took 92-98 days to restore the range of motion of the elbow joint to 100° after the removal of the fixators.

The clinical characteristics of this category of patients differed from those with an isolated injury of the elbow joint by a longer period of swelling and pain (sometimes up to 12-14 days). The average duration of inpatient treatment also turned out to be almost 1.5 times longer than with isolated fractures of the elbow joint bones.

CONCLUSION

In both study groups of patients, it was possible to achieve a statistically significant ($p < 0.05$) regression of the initial deficit in the function of the elbow joint after surgical treatment, and an improvement in the quality of life according to all criteria of the DASH questionnaire.

There were more pronounced anatomical and functional disorders of the elbow joint in children of group 2, where the number of operations of stable functional osteosynthesis was fewer than in children of the 1st group.

A differentiated approach to the diagnosis of multiple fractures around the elbow joint refines the further tactics of treating children with these injuries. It leads to a growth in the number of good outcomes in the long-term and improves the quality of life of children.

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