CLINIC, DIAGNOSIS AND TREATMENT OF FRACTURES OF THE PROXIMAL RADIUS IN CHILDREN

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Abstract. *In our scientific work we analyzed the treatment of 147 children with fractures of neck of the radius admitted to hospital TashPMI. Of the 147 patients, 38 was applied to the traditional method of surgical treatment and timing of treatment in a hospital by an average of 18-21 days. 22 patients has been applied our proposed method operative treatment with a stable-functional osteosynthesis. This results in earlier recovery of joint function, reduced treatment time is 8-10 days and to improve economic efficiency.*

Keywords: *radial bone, injury, method of the treatment.*

Introduction. Fractures of the proximal radius in children belong to intra-articular injuries and, according to various authors, account for from 8.1 % to 53.14 % of injuries in the area of the elbow joint [2,3,5,6]. In these fractures, in contrast to other intra-articular fractures of the elbow joint, the rotational movements of the forearm are most affected and especially difficult to restore. Despite the significant progress achieved in the diagnosis and treatment of injuries of the elbow joint in children, the number of unsatisfactory results remains high and amounts to 16-21% [1, 9]. The relevance of the issue of the treatment of this pathology is dictated by the extremely important role of the radius in restoring the function of the damaged elbow joint, as well as long-term external immobilization of the upper limb with a plaster cast, which leads to stiffness in the elbow joint. The currently used traditional methods of surgical treatment of these fractures in children do not allow us to fulfill the basic conditions for the treatment of these injuries [4]. Despite the numerous methods of treatment of fractures of the radius neck, the complete restoration of joint function does not exceed 50% [6, 8, 11, 13]. Surgical methods of treatment of fractures of the radius neck in children have their own characteristics due to the continued growth of patients, and the increase in the time of consolidation due to additional trauma during the operation, which requires a differentiated approach to the choice of treatment methods [7, 10, 12, 14, 15].

The purpose of the work. Improvement of the results of treatment of fractures of the proximal radius in children.

Material and methods. We analyzed the results of clinical observations of 147 children with fractures of the proximal radius at the age of 4 to 18 years. Fractures of the proximal part of the radius with a displacement of I-II degree were in 54.4% of children, with a displacement of III-IV degree in 45.6%. In 124 (84.4%) children, the fractures were isolated, in 23 (15.6%) they were combined with other injuries of the same limb. Combined with fractures were cephalic elevations of the humerus (in 7), fractures of the ulnar process (in 9), fractures of the internal epicondyle of the humerus (in 4), dislocations of the forearm bones (in 3). Epiphyseolysis of the head of the radius was observed in 69 patients, fractures of the neck of the radius in 43, osteoepiphyseolysis of the head of the radius in 23, fracture of the head of the ray in 12.

These fractures occurred in all age groups, but most often between the ages of 8 and 18. Boys were affected 2 times more often than girls (97 and 50, respectively). Right – sided injuries occurred in 59 children (40.0%), left-sided injuries-in 88 (60.0%). The majority of patients, 110

children (70%), were treated in the hospital, where the victims with the most complex fractures were concentrated, the remaining 37 children (30%) with minor injuries were observed in the trauma center and the emergency department.

All patients underwent clinical, neurological, X-ray, Doppler, and sonographic examinations.

Results and discussion. Analyzing the data, we observed that in all cases there was both a direct and indirect mechanism of injury, but the relationship between them differs in different ways. The indirect mechanism of trauma was found in 142 patients, and the direct mechanism of trauma in only 5 victims. Analyses show that the indirect mechanism of trauma (96.6%) plays a major role in damage to the proximal radius. Analysis of the mechanism of injury and accurate diagnosis with clarification of the type of displacement of fragments and the correct interpretation of X-rays allow you to individually approach each individual case and conduct treatment tactics.

Examinations of patients with fractures of the proximal radius begin with a survey. Usually, patients indicate a fall on the outstretched arm (112 cases) or on the elbow (30 patients), only in 5 cases a direct blow to the outer surface of the elbow joint. In all cases, the appearance of severe pain in the area of the elbow joint was noted. The pain is localized, namely on the projection of the head and proximal calving of the radius. The slightest movement in the elbow joint and fingers of the hand increases the pain. When examining the area of the elbow joint, you can determine the presence of deformity, hemorrhage and swelling. Objective clinical data depend on the severity of the underlying and concomitant injury. In epiphyseolysis and osteepiphyseolysis of the head and fractures of the radius neck without significant displacement of the fragments, the forearm is somewhat penetrated, and in fractures with pronounced displacement, the forced position of the limb is noteworthy: the patient supports the damaged one with his healthy hand, which is usually bent at the elbow joint at an angle of 1300-1500 and is withdrawn in the shoulder joint. The forearm is in the middle position or somewhat pierced, which increases due to the shoulder retraction. This position of the injured arm was observed in 114 patients out of 124 children with isolated fractures of the neck and head of the radius. When examining 86 patients, we determined a slight increase in the hallux valgus position of the forearm due to damage to the internal-lateral ligaments of the elbow joint.

Active and passive movements are restricted due to pain. The sharp restriction of the supination of the forearm comes to the fore. This symptom is characteristic of a fracture of the proximal radius. Pronation is also limited and painful, but of lesser intensity. Flexion in the elbow joint often reaches the norm, and extension-sharply painful and limited. Among our 65 patients, we observed significant limitations in the extension of the forearm. The clinical examination ends with the determination of pulsation on the radial artery, sensitivity and movements in the fingers of the hand. When determining the sensitivity in 4 patients with gross displacements of the central ray fragment to the outside and anteriorly, we noted a slight paresis of the motor branch of the radial nerve. This is due to the fact that the motor branch of the radial nerve is located more than the surface and is compressed by a displaced fragment or hematoma.

In terms of examination of patients with fractures of the proximal radius, a special place is given to X-ray examinations. An X-ray of the elbow joint in two standard projections is sufficient for proper diagnosis. The radiographs determine the location and nature of the fracture, the type of displacement of the fragments, in addition to these studies, we determine the violation of the Smith line in the lateral projection and the Ginzburg line in the anterior-posterior projection.

Analysis of radiographs shows that in epiphyseolysis and osteoepiphyseolysis, the central fragment is more often displaced outwards, anteriorly and less often posteriorly. The displacement in width and the inclination of the head in relation to the long axis of the radius are of varying degrees. In fractures of the neck of the radius, the fracture line runs in the oblique and oblique directions. At the same time, angular displacement of fragments was observed in 28 patients. It should be noted that in cases of damage to the proximal epimetaphysis of the radius, the exact determination of the nature and magnitude of the displacement is very difficult. As a result, the diagnosis in most cases does not reflect the true value, which leads to errors in the choice of treatment tactics.

The study of blood circulation in the elbow joint was carried out in 14 patients, including 10 patients with displacement of bone fragments and 4 patients without displacement of bone fragments before and during treatment. The study was performed on a Hitachi AE VB-565 ultrasound machine (Japan), B Logiq -100 (USA) with a Doppler attachment and a 5.0 – 75 MHz cone-shaped sensor, with two-three-dimensional reconstruction with virtual vascular angiography. The study was conducted in the " In " mode by color energy mapping. During the study, it was revealed that the visualization of vessels vasculizing the distal parts of the forearm in the first hours after the injury increased the blood flow rate by a. radialis from 35.01 to 41.03 cm / s; a. ulnaris from 38.09 to 43.00 cm/s, i.e. twice as high as normal; the resistivity index by a. radialis from 0.61 to 0.73 cm/s; a. ulnaris from 0.89 to 0.97 cm/s.

Ultrasound examination of the elbow joint was performed on the devices " Interscan 250 (Germany), Hitachi AE VB – 565 (Japan), B Lgiq – 9 GE (USA)" operating in real time with a linear multi-frequency sensor of 3.5; 7.5 MHz. New powerful algorithms allow you to get expert-class images with the highest possible resolution across the entire scanning depth, which provides a solution to a wide range of diagnostic tasks.

To determine the degree of damage, we determined the normal ultrasound structure of the elbow joint in 14 healthy children of different ages. During the examination, the following data were revealed: the joint lumen is not expanded, the contours are even, the structures of the biceps tendon of the shoulder are unchanged, the round ligament of the radius is homogeneous, the integrity is not violated. The articular surfaces of the radius are smooth, there is no calcification, and there is no effusion in the parascapular zone. The maximum blood flow rate directly in the area of the elbow joint in the trunk of the brachial artery VMAX is 19.9 cm / s, the resistivity index (RI) is 0.48 cm/s. The state of fat bodies – the structure is not changed and is not hypertrophied. Subsequently, 20 patients were examined at the time of admission and then on the 7th and 12th day to determine the degree of consolidation.

The patients were treated with both conservative and operative methods. Conservative methods of treatment were used in 78 patients (53.8%), operative methods – in 69 children (46.2%).

Up to 2012, 38 patients with epiphyseolysis of the proximal radius underwent surgical treatment in the traditional way (group 1). In epiphesiolysis of the proximal radius with displacement - III - IV degrees, an open comparison of fragments with trans-articular fixation with a Kirschner needle with a plaster cast was used.

The operation is performed by the traditional method under general anesthesia. The patient's position on the back. The arm is withdrawn, bent at the elbow joint at an angle of 900, rotated inside and placed on a side table. A tourniquet is applied to the upper third of the shoulder.

Arcuate incision of the skin and subcutaneous tissue 5-7 cm long on the outer surface of the elbow joint. The incision begins 2-3 cm higher from the outer epicondyle of the shoulder and, rounding it, passes to the anterior surface of the forearm. In the longitudinal direction, we dissect the fascia of the forearm. After dissecting the fascia, we stupidly push aside the muscles of the extensors of the fingers and hands, exposing the articularсумкуплечелучевогосочленения. Approach to the articular bag between m. anconeus et m.extensor carpi ulnaris, which are diverted to the sides: m. anconeus to the ulna and up, and m. ext.carpiulnaris – to the radius and down. We dissect the joint capsule in the longitudinal direction, remove the blood clots. With a slight pull and counter-pull, we achieve the expansion of the shoulder-beam joint; with the thumb of the hand, we apply pressure on the head from below-up and from the outside to the inside, while with the other hand we make pronation-supination movements of the forearm. After a successful reposition, we supine the forearm, which keeps the beam head in the correct position well. In this position, we draw the Kirschner needle through the head elevation of the humerus, transarticularly into the radius to a depth of 7-8 cm. The end of the needle, bent, is left over the skin. Layer-by-layer stitches on the wound. We cover the postoperative wound and the ends of the needle with a sterile cloth and apply a posterior splint plaster bandage from the base of the fingers to the upper third of the shoulder at a right angle in the elbow joint for 3-4 weeks. After removing the plaster cast, the elbow joint is developed. When using this method of surgical treatment, the total duration of the patient's stay in the hospital varied from 18 to 21 days, and patients are discharged for outpatient observation after reaching the amplitude of flexor-extensor movements in the elbow joint of 900-1000 and rotational movements of 1000-1200. If it was difficult to restore the movements of the forearm 2 months after the operation, physiotherapy was added. Restoration of joint function occurs 40-45 days after surgery.

Since 2012, 22 patients (II-group), we used the method of surgical treatment of fractures of the proximal radius, using a specially developed stable-functional osteosynthesis on the semicircle from the Ilizarov frame (SFD) (patent for the invention №00713 FAP. 29. 03.12).

The essence of the method lies in the fact that the device for treatment of fractures of the proximal ulna is made of semi-rings of the Ilizarov apparatus with two flags on the ends. The diameter of the half-ring depends on the age of the child and the volume of the elbow joint, usually we use 100, 110 and 120 mm half-rings.

The operation is performed under general anesthesia, the injured arm is withdrawn, bent at the elbow joint at a right angle and pierced. An arc-shaped incision along the outer surface of the elbow joint with a length of up to 5-6 cm between the muscles exposes the articular bag of the elbow joint, namely the shoulder joint. Without opening the joint bag (in the absence of damage to the capsule), we place the fragment in its place with finger pressure. To hold the fragment in the correct position until the formation of a callus, through the head and neck of the radius, we conduct 2 spokes with a thrust pad.

The introduction of the needle depends on the nature of the displacement of the head of the radius. Since the head of the beam is often shifted outwards and anteriorly, the spoke through the head is carried out on this side, and the other spoke, also with a thrust pad, is carried through the neck of the beam parallel to the first, but on the opposite side. After layer-by-layer suturing of the postoperative wound, the spokes are fixed on one half-ring from the Ilizarov apparatus. The spokes are taut, the fragments are fixed in the correct position, and moderate compression is given with the help of side flags. 2-3 days after the operation, we perform a control radiography of the elbow

joint. With good standing of bone fragments, from 3-4 days after the operation and subsiding, acute pain in the postoperative wound, children begin passive development of the joint, first carry out the development of flexor-extensor movements in the joint, then, after 6-8 days, we recommend active rotational movements of the forearm. The patient is discharged for outpatient treatment on the 8th-10th day after the operation.The device is removed on the 16 – 18 day after the operation in a polyclinic with the amplitude of flexion-extension movements in the elbow joint at an angle of 1200 – 1300, while the rotational movements of the forearm reached 1300-1400.

This technique was applied in 22 patients with good anatomical and functional results. The positive side of stable-functional osteosynthesis is that the plaster cast is not used and this, in turn, makes it possible to conduct early active movements in the operated elbow joint.

A comparative assessment of both groups showed that the duration of treatment in the hospital was shorter in patients of the 2nd group by 10 days.

Long-term results were studied in 105 patients out of 147 in the period from 6 months to 5 years. When evaluating the results, we followed a three-point system: excellent, good and satisfactory.

When studying the long-term results, attention was paid to the anatomical comparison of the fragments, the timing of the fracture fusion, the presence or absence of ossifications, and the restoration of flexor-extensor, especially rotational movements in the damaged elbow joint.

Excellent cases were considered when patients did not make complaints, the visual shape of the hand did not differ from the healthy one, there were no neurological changes in the fingers of the hand. The X-ray shows a complete fusion of the fracture with normal development of the proximal epimetaphysis of the radius, the Smith and Ginzburg lines are not broken, the epiphyseal-diaphyseal angle is normal. Movement in the elbow joint in full. Good cases were considered when patients did not complain of pain in the elbow joint, or noted a slight fatigue after physical exertion. The X-ray shows a satisfactory fusion, no neurological changes in the fingers of the hand. The Smith and Ginsburg line is not broken, the restriction of flexion-extension and rotational movements is within 10-150. The cases when patients complained of periodic pain in the elbow joint, or there was a slight fatigue after physical exertion, there were no neurological changes in the fingers of the hand were considered satisfactory. The radiograph shows a slight violation of the shape of the neck of the radius. The Smith and Ginzburg line is not broken, or there is a slight inclination of the head of the radius with a decrease in the epiphysis-diaphyseal angle anteriorly and outwardly to 5-70. Restriction of flexor-extensor and rotational movements in the range of 20-250. Unsatisfactory outcomes were obtained in patients with complaints of pain and constant fatigue in the elbow joint. The X-ray showed deformity of the neck and head of the radius with violation of the Smith and Ginsburg lines, restriction of movement in the elbow joint.

The analysis of the material showed that with conservative treatment of 57 examined patients in the Department of Traumatology, 36 had excellent anatomical and functional results, 13 had good results, and 8 patients had satisfactory results, although this group included children with the most minor injuries.

Among the II group of patients, who used an open comparison with a transarticularly drawn Kirschner needle, excellent in 2, good in 7 only, satisfactory results were obtained in 3. By the supracapsular method of comparing fragments with fixation with a transarticular Kirschner needle, slightly improving the treatment outcomes, excellent anatomical and functional results were obtained in 6 patients, good in 6, satisfactory in 2 patients. The most effective method was the

supracapsular method of comparing bone fragments using stable-functional osteosynthesis on half-rings from the Ilizarov apparatus with a compression device according to the method we proposed. The use of stable-functional osteosynthesis showed that although this method is used in the most severe patients with grade IV displacement and impaired articulation of the ray head with a cephalic elevation of the humerus, excellent (in 20) and good (in 2) anatomical and functional results.

Conclusion. Thus, the lightweight method of stable-functional osteosynthesis used by us excludes the use of plaster immobilization, makes it possible to prescribe early physical therapy with complete restoration of the function of the elbow joint, and also with a thorough examination of each patient with isolated damage to the proximal radius, it is easy to establish the symptom complex of a fracture of the neck and head of the radius.

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