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DAMAGE TO THE ELBOW, FOREARM AND WRIST

Educational and methodical instructions for independent work
5th year students, medical faculty
in the specialty "Medicine"

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DAMAGE TO THE ELBOW, FOREARM AND WRIST

Actuality of theme

Injuries to the elbow joint occupy one of the leading places among injuries of the musculoskeletal system.

The elbow is a stable joint which is prone to stiffness following injury, even when the injury is relatively minor. The elbow joint functions as a simple hinge, its stability depending on the close fit of the trochlea in the trochlear notch of the ulna. The superior radio-ulnar joint functions as part of the hinge and also as the rotation point for pronation and supination of the forearm.

The upper end of the radius is a component of two joints — the elbow joint, where it contributes to the hinge mechanism, and the proximal radioulnar joint, where it provides for pronation and supination.

Both the hinge movements of the elbow and rotation of the forearm are usually still possible when the radial head is excised, but some stability to the varus and valgus stressing of the elbow is lost. Stability of the distal radioulnar joint depends on the integrity of the triangular fibro - cartilage attached to the ulnar styloid process. This structure is also a component of the wrist joint.

The wrist joint proper is the articulation between the distal surface of the radius, the triangular fi bro - cartilage and the proximal row of carpal bones — scaphoid, lunate and triquetrum. This joint allows palmar and dorsiflexion and ulnar and radial deviation. Further palmar and dorsiflexion is permitted at the joints between the proximal and distal rows of carpal bones. The metacarpals of the fingers, with the exception of the fifth, move very little at their bases, but the thumb metacarpal, which articulates only with the trapezium, has a considerable range.

The metacarpophalangeal joints (MCPJs) of the fingers allow considerable abduction and adduction in addition to flexion and extension, but the interphalangeal joints are simple hinge joints, with a collateral ligament on each side.

The purpose of the lesson

To study the method of examination of the elbow, forearm, wrist. To study the classification, clinical symptoms, and methods of treatment of fractures of these areas, dislocations of elbow joint, ruptures of ligaments and muscles in these areas.

To solve this problem, the student must know before class:

- Anatomy of the elbow joint.
- Anatomy of the forearm and wrist
- Methods of examination of these areas.

- Classification of fractures of the radius, ulnar bones of the wrist and distal part of humerus.
- Classification of elbow dislocations.
- Clinical symptoms of fractures, dislocations, muscle and ligaments damage in elbow, forearm and wrist.
- Basic methods of treating fractures, dislocations, muscle and ligaments damage in elbow, forearm and wrist.
- Indications for surgical treatment.

By the end of the practical lesson, each student should be able to:

- Collect a history and identify clinical symptoms of damage to the structures of elbow, forearm and wrist.
- Identify and describe the radiographic features of fractures and dislocations in the elbow, forearm and wrist.
- Master the techniques of repositioning dislocations of the elbow joint.
- Make a plan for conservative treatment of fractures, dislocations, ruptures of muscles, tendons and ligaments.
- Determine the indications for surgical treatment.

The main theoretical provisions of the topic..

Examination of the elbow

1 Inspection. Deformity should be noted. Flexion deformities are common and may follow even minor injuries. Trauma to the elbow may result in disturbance of growth on either side of the joint, causing cubitus valgus (increased carrying angle) or cubitus varus (decreased carrying angle). Increasing cubitus valgus carries the risk of ulnar nerve damage due to traction. Wasting of the biceps and triceps is common in many elbow conditions.

The ‘dinner fork’ deformity of a Colle’s fracture, and the ‘mallet’ or ‘boutonnière’ deformities of the fingers. Ulnar deviation of the fingers at the MCPJs is a manifestation of rheumatoid arthritis.

Wasting of individual muscle groups may be one of the first signs of neurological loss, e.g. the wasting of the thenar muscles in median nerve compression. Wasting of the interosseous muscles, best seen in the first dorsal interosseous muscle between thumb and index finger may indicate an ulnar nerve lesion (Fig. 2).

Swellings are common in the wrist and hand; their extent and exact position in relation to the surrounding tissues should be determined. A high proportion of cystic swellings around the wrist are ganglia and these usually transilluminate.

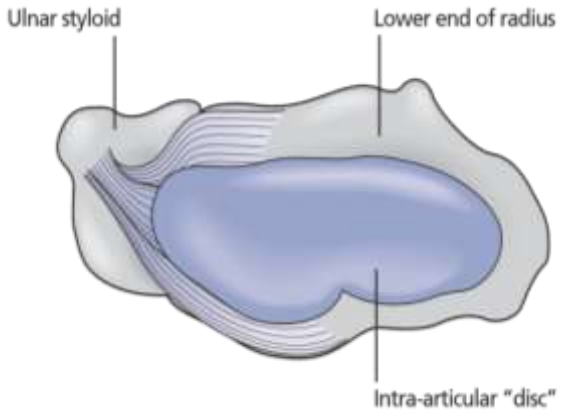

Figure 1. Proximal surface of wrist joint.

Figure 2. Intraosseous wasting in ulnar palsy.

2 Palpation. The bony landmarks are the olecranon and the two epicondyles. In the flexed position these form the points of an equilateral triangle, but when the arm is extended they lie on a straight line (Fig. 3). The radial head can be palpated below the lateral epicondyle and is often slightly tender in the normal individual.

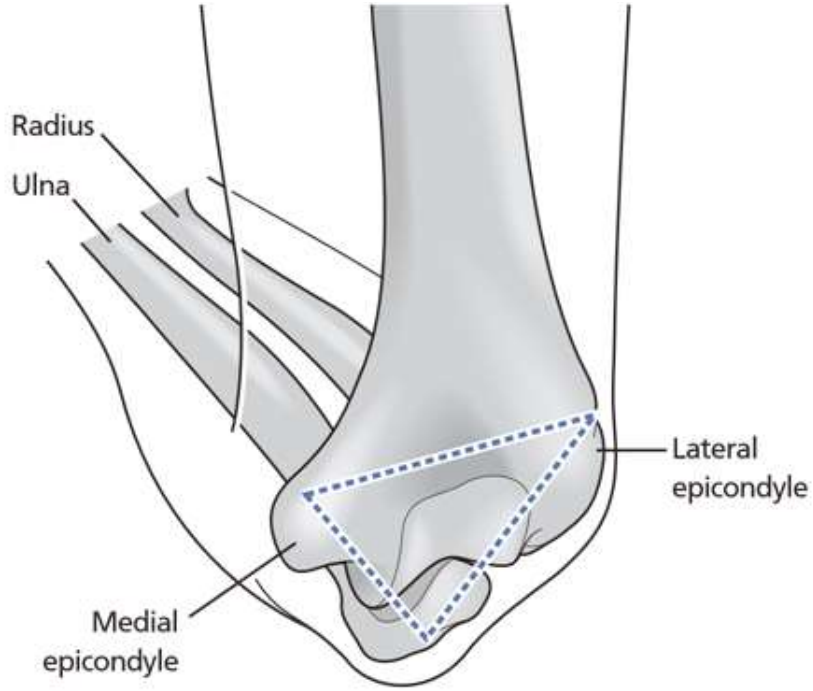

Figure 3. Relationship of the landmarks at the elbow.

Landmarks at the wrist are the styloid processes of the radius and ulna, the former normally lying more distally than the latter. The pisiform on the ulnar side and the scaphoid tubercle at the base of the thumb define the medial and lateral limits of the carpal tunnel.

Tenderness should be elicited carefully, and its exact position noted in relation to joints, ligaments, bones, tendons, etc.

Increased temperature is usual in infections of the hand and fingers. In these conditions edema is common and this normally collects on the dorsum of the hand, even when the infection is in the palm.

3 Movements. The normal elbow range of flexion and extension is from 0 to 150 degrees. Pronation and supination are 90 degrees each from the mid position. Note that the mid-prone position rather than the anatomical position is usually taken as zero. It should not be possible to tilt the forearm medially or laterally in full extension.

The range of pronation and supination is usually measured from the mid- prone position, taking this as 0 degrees, rather than the anatomical position of full supination. Rotation through 90 degrees is usually possible in both directions. Wrist flexion and extension varies considerably between individuals. Approximately 90 degrees in both directions is normal. Dorsiflexion can be easily compared on the two sides by asking the patient to place his/her palms together in a ‘praying’

position and then to elevate the elbows. Palmar flexion is similarly tested by placing the back of the hands together and dropping the elbows (Fig. 4). Radial and ulnar deviation is usually about 20 degrees, ulnar deviation being slightly greater.

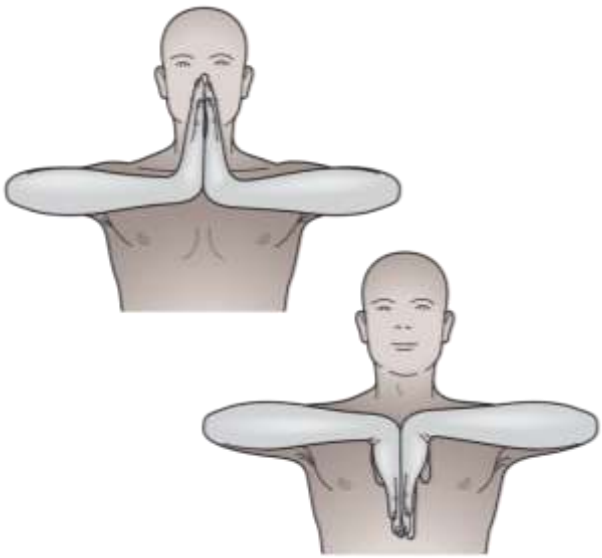

Figure 4. Testing wrist movements.

At the MCPJs, the range of flexion increases slightly from index to little finger. The range of flexion at the thumb MCPJ varies considerably from individual to individual, from a few degrees to 90 degrees (always compare both sides if pathology is suspected). The proximal interphalangeal joints of the fingers flex somewhat beyond 90 degrees and the distal joints somewhat less than 90 degrees. Movements of the thumb relative to the palm is difficult to classify, but movement of the first metacarpal in a plane at right angles to the palm is usually called abduction and adduction, and movement in the plane at right angles to this is called flexion and extension. Internal rotation movement of the metacarpal is described as opposition. This classification corresponds to the names of the various muscles moving the thumb.

4 Measurement of the forearm is rarely helpful except in assessing muscle wasting.

5 Neurological examinations.

6 Motor functions. The functions of the hand and fingers are complex, and muscle groups and individual muscles should be tested systematically. Knowledge of the normal anatomy and physiology is essential. The following rules are helpful.

- Pronation is produced mainly by the pronator quadratus and pronator teres muscles (median nerve, C6, 7). Supination is a stronger movement produced principally by the biceps and supinator muscles (musculocutaneous and posterior interosseous nerves, C5, 6).
- The wrist flexors can be tested by asking the patient to flex the wrist and palpating the radial and ulnar flexor tendons (radialis, median nerve, C6, 7; ulnaris, ulnar nerve, C8, T1).
- All joints of the fingers are flexed by flexor digitorum profundus (median nerve to index and middle fingers, ulnar nerve to ring and little, C8, T1). Apart from the index, the

profundus cannot flex individual fingers when the others are held extended. It is tested by asking the patient to flex the terminal interphalangeal joint whilst the proximal interphalangeal joint is held extended.

- The proximal interphalangeal joints are flexed by the flexor digitorum superficialis (sublimis) (median nerve, C7, 8, T1). It is tested by holding the other fingers extended and asking the patient to flex the appropriate finger.
- The MCPJs are normally flexed by the lumbrical and interosseous muscles. These also, through the dorsal expansions, extend the inter-phalangeal joints (‘threading a needle’ position). When these muscles are paralysed by an ulnar nerve lesion, the fingers take up a ‘claw’ position. Clawing of the index and middle fingers is less than the ring and little fingers because the lumbricals to these fingers are supplied by the median nerve (Fig. 5). The interossei are best tested by asking the patient to spread the fingers or to hold them tightly together. The hands can be compared by pressing the two little fingers together sideways (Fig. 6).
- The MCPJs are extended by the extensor digitorum longus, which can also extend the interphalangeal joints (posterior interosseous nerve, C7, 8).
- The thumb is flexed by the flexor pollicis longus (median nerve, C8, T1). The extensor pollicis longus extends the interphalangeal joint, and the extensor pollicis brevis extends the MCPJ and the carpometacarpal joint (posterior interosseous nerve, C7, 8).
- The thumb is abducted by the abductors pollicis brevis (median nerve, C8, T1) and longus (posterior interosseous nerve, C7, 8): adduction of the thumb and opposition by the thenar group (median nerve, C8, T1) and the adductor pollicis (ulnar nerve, C8, T1).

Figure 5. Ulnar pals

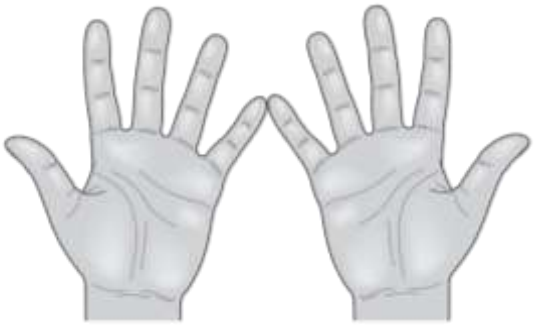

Figure 6. Testing the interossei.

- Wrist extension is produced by the extensor carpi ulnaris (posterior interosseous nerve, C7, 8), and extensor carpi radialis longus and brevis (posterior inter - osseous nerve, C6, 7).

7 Sensation. The dermatomes are as shown in the Appendix. Testing with a pin is adequate for most clinical purposes. In some circumstances, testing of two-point discrimination using dividers is a helpful test of fingertip sensory function.

8 Circulation. The radial pulse is easily palpable. The integrity of the radial and ulnar arteries can be determined using Allen’s test.

9 Lymphatic system. Lymphangitis and lymph gland enlargement are common in hand and finger infections.

Congenital conditions

Congenital dislocation of the radial head occurs very rarely. Most often it is an anterior dislocation and may be associated with other congenital malformations. Treatment is rarely necessary, but occasionally removal of the radial head in early adult life may be helpful if motion is restricted.

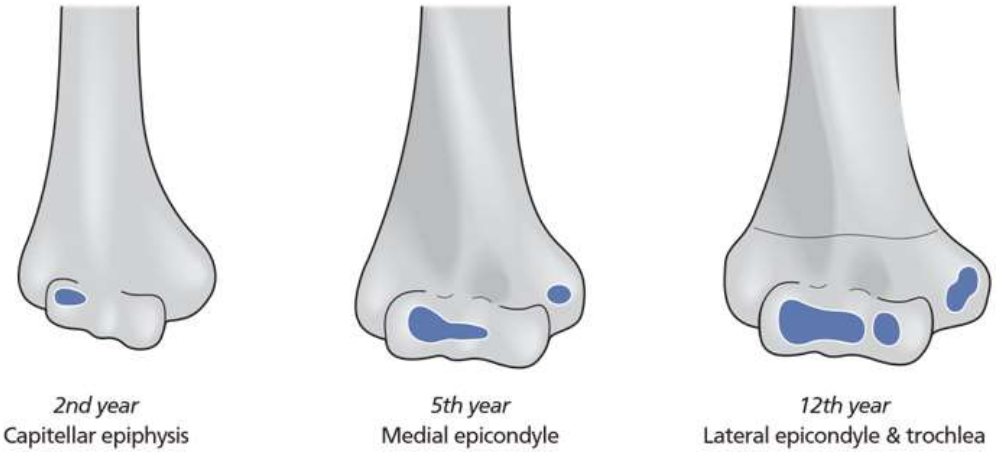

Figure 7. Ossification centres at the elbow.

Developmental conditions

1 Madelung's deformity. This is a complex deformity of the distal end of the radius. Due to a growth defect of the radius, the lower end of the ulna becomes prominent.

2 Multiple enchondromatosis (Ollier disease) usually causes multiple swellings in the digits, often with considerable interference with function. Repeated surgery may be necessary over a long period. Achondroplasia produces a hand with short fingers and often a single transverse palmar crease.

3 Trigger thumb. This common condition most often affects the thumbs of babies. Constriction of the flexor tendon sheath opposite the metacarpal head results in a flexed interphalangeal joint. A nodule can often be felt at the site of constriction. Longitudinal division of the tendon sheath is curative.

Traumatic conditions

Transcondylar fractures of the lower end of the humerus.

Transcondylar fractures of the lower end of the humerus are observed at children age after falling on an elbow and are referred to the intraarticular. The line of fracture goes in the transverse direction through the seedling zone and has the character of epiphysiolysis. Depending on the mechanism of the trauma and the kind of bone fragments displacement extensional and flexion fractures are distinguished.

Extensional fractures occur in a few times more often than flexion.

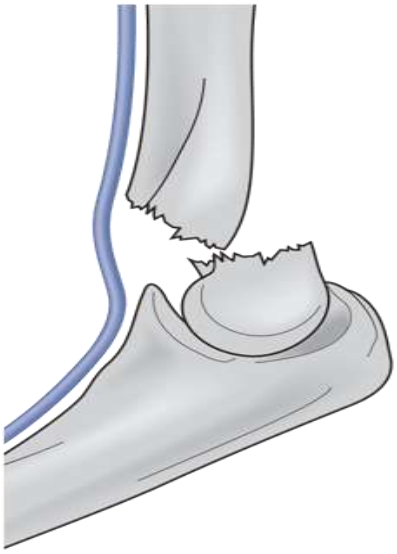

Figure 8. Supracondylar fracture of the humerus

Clinical features. Soft tissues surrounding the elbow joint are edematous, with the subcutaneous hemorrhage. Active movements in the joint are limited and painful. Sometimes it is difficult to distinguish the transcondylar fracture from supracondylar on the basis of the clinical data, therefore crucial importance has the radiological research of the injured and healthy joints in two projections. It is important not to miss the injury of vessels and nerves.

Treatment. General anesthesia. Techniques of reposition at transcondylar fractures are the same as at supracondylar fractures. However it is necessary to remember, that transcondylar fractures are intraarticular and the necessity of exact reposition of bone fragments is very important for the subsequent recovery of the joint function. After the reposition of bone fragments the extremity is fixed by the posterior plaster splint in the unbent position of the forearm for 10-12 days or the skeletal extension by the elbow process is imposed for 10 days. After the removal of the wire the immobilization of the elbow joint is for 5-7 days more. The next day's children and adults require the functional and physiotherapeutic treatment.

Intercondylar fractures of the humerus.

Fractures of the distal epiphysis of the humerus can have T-and Y-shaped form and are also intraarticular. They occur at the impact or falling on the elbow. Rather often distal end of the humerus diaphysis introduces between the dispersed condyles of the humerus. Such fractures mainly occur at adults.

Clinical symptoms. Intercondylar fractures are accompanied by the significant edema of the joint which is sharply increased in volume, especially in the transverse direction. In addition appears the hemarthrosis and the extensive hemorrhage extending to the forearm. Movements in the joint are almost impossible because of the pain. The displaced bone fragments are defined by the palpation. The diagnosis is specified by the radiography.

Treatment. Treatment of the T-and Y-shaped injuries without the displacement of bone fragments is conservative. The plaster splint bandages are imposed to the adult patients and children from the upper third of the shoulder up to the basis of fingers. The elbow joint is placed at the right angle, and the forearm - at the neutral position. Duration of the immobilization is 3-4 weeks. The physiotherapy exercises for the fingers and humeral joint are started from the first days. Development of movements in the elbow joint begins after the removal of the plaster bandage and continues up to full restoration of function. Patients start labor activity in 8-10 weeks after the fracture.

R. Watson-Johns consider that the best result of treatment comes after the reposition and immobilization in the unbent position of the hand.

Treatment of T-and Y-shaped fractures of the condyles of the humerus with the displacement of fragments is made also conservatively, by the constant skeletal extension by the elbow process. Reposition of fragments is controlled by the radiography. If bone fragments are not repositioned by the method of extension then the operative treatment is prescribed. General anesthesia. The longitudinal incision along the extension surface of the shoulder in the lower one-third (A. V. Kaplan). Preliminary the elbow nerve is separated and is taken on the handle in order to prevent its injury. The condyles shouldn't be separated from muscles attached to them and ligaments in order to preserve the vascularization and innervation. The fragments are repositioned and are fixed by the thin wires or screws. The ends of the wires are put above the skin for the subsequent removal. The plaster bandage is imposed for the period of 3-4 weeks. Development of movements in the elbow joint is prescribed after the removal of wires and of the plaster bandage. Patients after the intraarticular fractures need long rehabilitation, combining it with mud applications.

Fracture of the lateral condyle of the humerus.

It often occurs at the teenagers at falling on the elbow or hand in position of extension. During this moment the head of the radial bone rests against the head of the humerus condyle and the lateral condyle breaks off. Fractures occur without the displacement and with the displacement of the bone fragment outwards and upwards.

Clinical symptoms. The edema, sharp painfulness and the hemorrhage are defined by the external surface of the elbow joint. At the displacement the lateral condyle is higher than the medial

one. At palpation of the injury area the sharp pain appears. Movements in the elbow joint are preserved, but are also painful. At the displacement of the lateral condyle upwards the deviation of the elbow joint increases outwards, Marx's positive sign is marked. The diagnosis is specified by the radiological research in two projections.

Treatment. Fractures of the lateral condyle without the displacement are treated conservatively. The posterior plaster splint is imposed from the upper one-third of the shoulder up to the basis of fingers at the right angle in the elbow joint for the period of 3 weeks.

Fracture of the lateral condyle with displacement. Under local or general anesthesia the reposition of the fragments in position of the elbow extension is made. At the manual reposition the fragment introduces good into its bed when in the elbow joint, except for extension, a small deviation inwards is defined. In the position of bending the elbow joint is fixed with the plaster bandage for 3-4 weeks. If the displaced lateral condyle is not compared by means of manual method, then the operative reposition is prescribed. General anesthesia, intraosseous or field anesthesia. After the special preparation for operation it is recommended to make the incision along the lateral surface of the humerus condyle. The place of the fracture is opened, the introduced between the fragments the soft tissues are removed and the lateral condyle is repositioned to its place. It is necessary to watch, that neurovascular communications of the fragment with the surrounding tissues are preserved. It is necessary for the prevention of aseptic necrosis development of the avulsed fragment. The fragment is fixed with wires, bone nail or thin trihedral pins. At children the bone fragment is fixed with the catgut sutures which have been put in transosseously through the preliminary made apertures. A wound is sewn up in layers. There used immobilization during 3-4 weeks by the plaster splint in the bent position of the elbow joint. Further treatment is functional.

Fractures of medial condyle of the humerus. These fractures occur seldom and at falling on the elbow. The impact is transferred by the elbow process to the medial condyle of the humerus.

Figure 9. Fracture of the medial epicondyle.

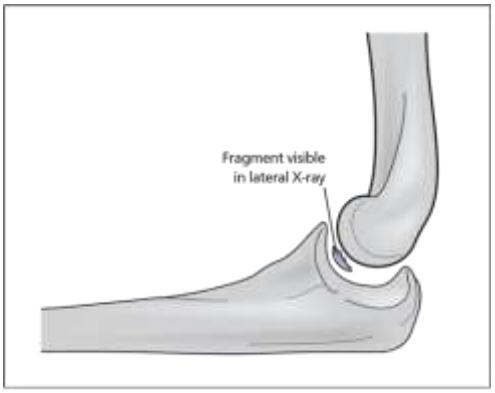

Figure 10. Trapped bone fragment with fracture of the medial epicondyle.

Figure 11. The ossified epiphysis visible on the X - ray is only a small part of a large fragment.

Clinical symptoms. In the area of the humerus medial condyle the soft tissues are edematous with hemorrhage sides, painful, especially at pressing. Movements are strained and painful, the crunch is sometimes heard. Treatment is the same, as at the fracture of the humerus lateral condyle.

Fractures of the lateral condyle head of the humerus can be isolated or be combined with the injuries of the radial bone head. The mechanism of the trauma is connected with the falling on the outstretched hand. The head of the radial bone, hitting in the articular surface of the humerus condyle head, breaks it off. Such fractures are almost always accompanied by the displacement.

Clinical symptoms. After falling the sharp painfulness in the elbow joint appears, especially in the area of the lateral condyle. At palpation the displaced forward and out wards fragment from the elbow bend can be defined. Movements in the elbow joint are painful and limited. Sometimes there are injuries of the articular cartilage with its avulsion and displacement into the joint cavity. The diagnosis is specified by the radiography, sometimes with the introduction of air into the joint. In some cases the injury of the humerus condyle head is combined with the radial bone head.

Treatment. Free bone fragments of the small sizes located in the joint cavity are removed by the operative method. Fractures of humerus condyle head with the displacement of the fragment forward and outwards are repositioned manually. Local anesthesia. 15-20 ml of 1 % Novocain solution are introduced into the fracture area. Hand of the patient is unbent in the elbow joint and is put on the sand pillow. Assistant grasps the forearm above the hand and stretches the elbow joint. The repositioning person presses the fragment in with two thumbs in the downwards and backwards direction.

It is better to carry out the fixation of the elbow joint in the unbent position as the bone at this is held more strongly. Immobilization is for 3-4 weeks. Recovery of function comes by the end of the 3-4 month after the long physiotherapeutic treatment. If the fragment is not repositioned by means of the closed manual technique, then the open reposition and fixation of it at children is indicated — with the catgut sutures to the main bed, and at adults and teenagers - with wires. A. V. Kaplan recommends introducing the wires from the extension surface side through the lateral condyle into the repositioned fragment of the humerus condyle head through the joint into the radial bone. The ends of the wires remain above the skin surface up to 3 weeks. Strong fixation of the humerus condyle head can be also gained by the application of the allonails according to the L. A. Smirnov, L. M. Golovakho's construction.

Apophyseal fracture of the humerus medial condyle. Avulsion of the medial condyle at youthful age or its injury at adults occurs because of tension of the attached to it general flexors at valgus abduction of the elbow joint which is in the unbent position. At this moment the elbow

collateral ligament at the stretching avulses the condyle. Displacement degree of the avulsed condyle depends on the injury size of the elbow collateral ligament. Minimal displacement of medial condyle is observed in cases without the rupture of the elbow collateral ligament. If the fragment is pushed downwards to the level of the articular line, then the elbow collateral ligament is stretched or ruptured. The traumatic synovitis of the joint is observed. At more significant valgus tension full rupture of the joint ligament and bursa occurs except for the avulsion. The avulsed fragment penetrates into the joint cavity. At the continuing valgus position (tension), there is the full dislocation of the forearm outwards except for the avulsion of the epicondyle. After the reposition of the dislocation the avulsed epiphysis can wedge in the joint. Displacement of the forearm outwards can be accompanied by the injury of the elbow nerve.

Clinical symptoms. There is soft tissues edema in the area of the medial epicondyle and painfulness occurs at the palpation and rather often there is the mobility of the bone fragment. Both active and passive movements in the joint insignificantly painful. If the bone fragment penetrates the joint cavity and introduces between the articular surfaces, then the movements in the elbow joint are impossible. Surrounding tissues are edematous and the synovitis is possible. The diagnosis is specified by the radiography of the elbow joint in two projections.

Treatment. At the fractures of the medial epicondyle without the displacement or with insignificant displacement - the treatment is conservative. Immobilization of the elbow joint at the right angle by the plaster bandage up to 3 weeks. In 3 weeks the physio therapy exercises are prescribed. Rather often the bone fragment of the epicondyle is displaced downwards and the fibrous union comes. However the elbow joint gets the same stability, as at the bony union. Movements in the joint are recovering during the period of several months. It is not recommended to force the movements, because it can result in the constant restriction of mobility. At the entrapment of the medial epicondyle urgent operation is prescribed. The bone fragment is repositioned and fixed to its bed. The elbow nerve is put on the handle, small bone fragments are removed.

Apophyseal fracture of the lateral epicondyle.

Avulsion of the lateral epicondyle or its injury occurs at a sharp tension of both flexors with varus position of the elbow joint. This injury occurs much less often, than the fracture of the medial epicondyle. As well as at the trauma of the internal epicondyle, various degrees of displacement, even with the entrapment between the articular surfaces of the elbow nerve are marked. Painfulness and edema are defined by the external side of the elbow joint. The injury degree is specified by the radiography, made in two projections. Treatment is the same as at the injury of the internal epicondyle.

Dislocation of the forearm.

Traumatic dislocations of the forearm take the second place among all dislocations by the frequency (18-27 %). B. K. Babich, A. V. Kaplan have offered the following classification of dislocations of the forearm bones.

1. Dislocation of both bones of the forearm: a) backwards; b) outwards; c) inwards ; d) forward; i) divergent dislocation.

2. Dislocation of one radial bone: a) forward; b) backwards; c) outwards.

3. Dislocation of one elbow bone. Dislocation of one elbow bone occurs extremely seldom. The posterior dislocation of the forearm occurs more often (up to 90 %), combined with the displacement of the forearm outwards. The second place by the frequency is taken by the dislocation of the radial bone head forward. Other kinds of dislocations occur seldom. According to the data of literature and to our observations, dislocations of the forearm are quite often combined with the fractures of the elbow or coronoid processes epicondyles of the humerus and radial bone head. Peculiarity of the elbow joint injury is also in the fact that the injury of its capsule and the brachial muscle attached to the terminal process is accompanied by the formation of the paraarticular ossificates.

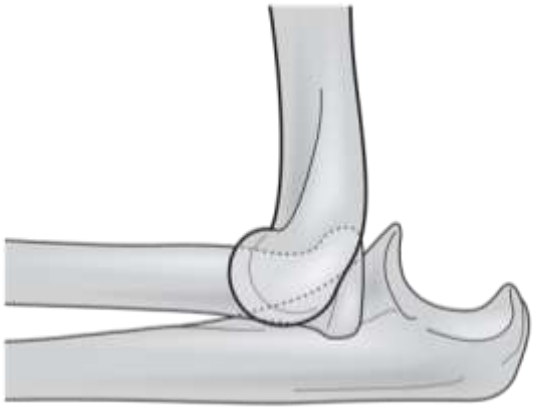

Figure 12. Dislocation of the elbow

The posterior dislocation of the forearm occurs at falling on the palm surface of the unbent hand (an indirect trauma). At the extension of the hand the elbow process rests against the antecubital fossa of the humerus, and the subcutaneous bursa of olecranon is cut at the front. Distal end of the humerus penetrates into its aperture and the forearm is displaced backwards and upwards. Sometimes the posterior dislocation of the forearm occurs because of the impact on the posterior lower surface of the shoulder of the hand bent in the elbow joint. At this moment there is the extrusion of the distal end of the shoulder forward (a direct trauma). In addition the posterior dislocation is also ac companied by the deviation of the forearm outwards. It occurs only at the rupture of the elbow collateral ligament. It often avulses from the internal epicondyle of the shoulder together with the bone fragment and the forearm is displaced backwards and outwards. Dislocation of the forearm backwards and inwards occurs rather seldom at the rupture of the radial collateral ligament.

Clinical symptoms. The injured hand is bent in the elbow joint at the right angle, and the patient keeps it by the forearm with the healthy hand. The elbow joint is deformed, the soft tissues surrounding it, are edematous. The elbow process protrudes sharply backwards, and the arcuate recess id formed around it. Outwards from the elbow process the radial bone head is prominent

under the skin. The circle of the elbow joint in the anteroposterior direction is considerably increased in reposition with the healthy hand. It hap pens due to the displacement of the forearm backwards and of the distal end of the shoulder - forward. Examination of the patient from the front at the postero-external dislocation shows the deviation of the forearm outwards and its relative shortening. The tip of the elbow process is higher than Gutter's line connecting both epicondyles for 2-3 cm. The triangle formed by the elbow process with epicondyles is turned with the tip upwards (in norm - downwards) and it appears that it is unequal-isosceles. Active and passive movements in the elbow joint are impossible. The final diagnosis is determined after the radiography of the epicondyles in two projections.

Treatment. General or local anesthesia. 20 ml of 2 % Novocain solution are introduced into the elbow joint above the protruding elbow process.

Reposition techniques. The patient is lying on the table. After the anesthesia comes into effect doctor places the shoulder of the injured hand at the right angle in relation to the body. Then grasps the shoulder with both hands above the elbow joint, and the assistant holds the hand of the injured arm of the patient and bends it in the elbow joint and gradually pulls the forearm on himself. At this moment the doctor with both thumbs presses on the elbow process which slips downwards, and there comes the reposition of the dislocation.

Treatment of the posterior dislocation of the forearm by Cooper. Anesthesia is carried out. The patient is lying on the table. His hand in the shoulder joint is abducted up to the right angle. Doctor puts a leg bent in a knee joint on a stool on the side of the dislocation, grasps with one hand the shoulder of the patient, and with another — the lower one-third of the forearm, simultaneously rests a knee against the elbow bend of the patient, and makes extension by the forearm and bends the hand in the elbow. After the reposition the hand is fixed by the plaster splint, bent in the elbow joint at the right angle, the forearm should be in the position of supination for 10-15 days. After imposing the plaster splint from the upper one-third of the shoulder up to the heads of the metacarpal bones the control radiography is made. Active movements in the elbow joint are prescribed after the removal of the plaster splint. Massage and passive movements are contraindicated.

The dislocation of the radial bone head outwards occurs as a result of the sharp pronation of the unbent forearm, at this time the annular ligament of the radial bone ruptures, and the head gets out of the joint forward. The flatness is clinically defined in the area of the elbow bend at the bent and pronated forearm. The dislocated forward radial bone head is defined by the palpation. The diagnosis is confirmed by the radiography.

Reposition of the dislocated head is carried out under the general anesthesia. The assistant keeps the forearm in the prone position. The surgeon with the same hand as the injured hand of the patient grasps the hand by the type of "handshake", and with the other - gropes for the dislocated head. Then slowly makes bending of the forearm with simultaneous supination, pushing the head aside backwards. The head of the radial bone repositions with the distinct click. Then in the position of extreme supination it is necessary to bend the forearm up to the right angle and to fix with the

bandage imposed on the elbow bend with the plaster bandage up to 2 weeks. Further -- functional treatment. Open reposition of the dislocation is prescribed in the cases if it didn't repositioned by the closed method.

Fractures of head and neck of radial bone.

The fractures occur at the falling on the outstretched hand with the rest of the radial bone head into the condyle head of the humerus. There are fractures of the head and neck of the radial bone both without displacement, and with displacement of the bone fragment are distinguished. Children often have the epiphysiolysises and fractures of the radial bone neck. Painfulness, swelling and hematoma occur in the area of the radial bone head. Movements in the sagittal plane in the elbow joint are possible, though the maximal bending and unbending are limited and painful. Rotational movements are sharply disordered because of the pain. Just at the fractures without the displacement or at the fissure of the radial bone head the disorder of the forearm rotational movements is the leading diagnostic clinical symptom. The diagnosis is specified by the radiography in two projections (Fig. 13).

Treatment. 10 ml of 1 % Novocain solution are introduced into the area of the fracture. At the fractures without the displacement the immobilization is carried out by the plaster splint from the middle of the shoulder up to the metacarpophalangeal joint in the position of the elbow joint bending at the right angle for 2 weeks, then functional treatment. Work capacity is restored in 5-8 weeks. At children at the fractures of the radial bone without the displacement of the head the term of immobilization of the elbow joint is carried out by the plaster splint for 10 days. At the displacement of the head the reposition is made under the anesthetic. The arm is unbent in the elbow joint with the additional extension by the hand and contra extension by the shoulder. The forearm is deflected in the elbow joint to the elbow side and is supinated. Pressure on the displaced head is usually carried out at the front inwards and backwards. Then the forearm is bent in the elbow joint up to the right angle. The control radiography is carried out. Immobilization by the plaster splint for 2 weeks is needed.

Operative treatment. At the splintered fractures of the radial bone head its removal is indicated. At the marginal fractures of the head with the displacement of the fragments loose bone fragment is removed with the resection of the head at adults. At children the injured head should be preserved, otherwise the valgus deformation in the elbow joint may occur.

Fractures of the coronoid process.

Fractures of the coronoid process as in the dependent injury are observed seldom and occur at the sudden sharp traction of the humeral muscle attaching to the coronoid process by the tendon. Thy are more often accompanied by the posterior dislocations of the forearm.

Clinical symptoms. There are the swelling and painfulness at the palpation in the area of the radial bone elbow incision. The active tension of the biceps muscle of the arm, bending and unbending of the forearm causes the sharp pain in the area of the elbow joint along the anterior

surface. In most cases fractures of the coronoid process are recognized as the hurts, stretches and only the radiological researches allow making the diagnosis correctly.

Treatment. At the fractures without the displacement or at the by the posterior plaster splint from the upper one-third of the shoulder up to the radiocarpal joint at the bent forearm in the elbow joint at the angle of 100. Immobilization lasts not less than 3 weeks. Work capacity is restored by 5-6 weeks. At the great displacements of fragments open reposition with the fixation of the distal fragment to the base by three catgut or lavsan interrupted sutures lead through the periosteum and surrounding soft tissues is indicated. Immobilization lasts not less than 3-4 weeks.

Fracture of the elbow process.

Fractures of the elbow process occur from the direct trauma at falling on the el bow. The fracture line almost always has the transverse direction. Fractures occur without displacement and with displacement of the bone fragment.

Clinical symptoms. Swelling and hemorrhage are defined in the area of the elbow process. Active unbending is impossible, especially at the separation of the fragments. At the palpation of the elbow joint the pain increases. Wide fissure or retraction is defined at the fracture with the displacement, furthermore the mobile bone fragment is palpated. Lateral radiography specifies the diagnosis (Fig. 14).

Figure 13. Fracture of the radial head.

Figure 14. Fracture of the olecranon.

Treatment. Conservative treatment is applied at the fractures without the displacement of fragments. The plaster bandage is imposed on the unbent hand at the angle of 140 ° for 3 weeks. Then the medical gymnastics is prescribed. Work capacity is restored by the end of the second month. Operative treatment is indicated at the fracture of the elbow process with the displacement of fragment and injury of the extensor mechanism.

Diaphyseal fractures of the forearm bones.

Fractures of the forearm bones are observed rather often and make 25,2% of the fractures of the upper extremities. They occur at the impact on the forearm (a direct trauma). Mainly there are the transverse fractures and both bones are breaking at one level. Fractures occur from the indirect trauma - at falling on the outstretched hand. In these cases the bones are injured at different levels. According to the data of the N. G. Damye, fractures of the forearm diaphysis in the upper one-third make 7,1%, in the middle one-third -63,5 and in the lower one-third - 29,4 %. Incomplete fractures are often observed at children and teenagers, by the type of the "green branch", and subperiostal fractures with the angle curvature.

The following are referred to the fractures of the forearm:

1) fractures of the diaphysis of one or both bones;

2) fractures of the elbow bone diaphysis with the dislocation of the radial bone head;

3) fractures of the radial bone diaphysis with the dislocation of the lower end of the elbow bone.

Displacement of fragments depends on the mechanism of trauma, level of fracture and muscles traction. At the fracture of both forearm bones there is the dis placement to the length, width, curvature of the axis and rotation. In the upper one-third of the forearm central fragment of the radial bone will be in the position of supination under the influence of the biceps of arm and supinator, and the distal end of the forearm together with the hand are pronated (round pronator muscle and quadrate pronator muscle are holding the peripheral end in the prone position)

Fractures of the forearm diaphysis bones in the middle one-third are between two groups of muscles.

Central end of the forearm under the action of the supinator and round pronator muscle takes the neutral position, and the peripheral - pronated (influence of the quadrate pronator muscle). At the fracture of forearm bones in the lower one-third the central fragments are in prone position under the action of both pronator muscles. These data are useful for the subsequent reposition of fragments (the peripheral end — by the central).

Clinical symptoms. There is the deformation and shortening of the forearm with the prominent mobility of fragments along the diaphysis. Local painfulness, edema of tis sues and the hemorrhage on the forearm appears. Function of the hand is disordered.

The final diagnosis is specified by the radiography made in two projections all along the forearm with the capture of the elbow and radiocarpal articulates.

Treatment. General anesthesia, but it is possible carrying out the reposition after the field or local anesthesia – 15-20 ml of 1-2 % Novocain solution are introduced into the hematoma. Then fragments are repositioned - one of the assistants makes traction along the forearm axis, grasping with one hand the thumb of the patient, and with another hand - other fingers. The other assistant tries to achieve the contra extension by means of manual traction by the lower one-third of the shoulder bent in the elbow joint of the patient's arm or imposing the cuff with fastening. After the

comparison of the fragments the peripheral end of the forearm is placed in the position of supination at the fracture of the upper one-third, in the middle one-third - in the neutral position and at the fracture in the lower one-third - in prone position. The plaster splint is imposed from the base of fingers up to the middle one third of the shoulder. Then control radiography is carried out. Taking into account the reduction of the forearm edema during the first several days after the trauma and danger of the further displacement of fragments, it is recommended to carry out the repeated radiography in 7-10 days. Immobilization at adults proceeds not less than 10 weeks, and at children -- for 6 weeks.

Operative treatment. If the fragments are not re positioned by means of the manual technique, then the open reposition with good fixation of the bone fragments is indicated. Metal nails, plates, bone rods made from auto-, allo-, and xenobone are applied for the holding of the fragments, etc. The plaster bandage after operation should be removed at the presence of a good bony callous not earlier than in 10-12 weeks. Work capacity is restored in 3,5-4,5 months. Metal fixators are removed in 6 months when full union of the fragments comes.

Fracture of the elbow bone with the dislocation of the radial bone head (Monteggia injury). There are two kinds of elbow joints fractures with the dislocation of the radial bone head distinguished: flexion and extension. The fracture occurs because of the direct trauma. Flexion fracture is a seldom occasion, fragments are displaced at an angle opened forward, and the radial bone head dislocates backwards. More often occurs the extension fracture of the elbow bone with the displacement of fragments at an angle opened backwards and the head dislocates backwards. In addition there is the displacement of bone fragments to the length and width at adults observed. Sometimes the radial nerve is injured at the dislocation of the head forward.

Figure 15. Monteggia fracture.

Clinical symptoms. The injured forearm is shortened, and is thickened in the upper one-third. Active movements in the elbow joint are restrained. The disordered continuity of the elbow bone and sharp painfulness of the fracture place is defined at the palpation. In an ulnar bend the

dislocated radial bone head can be palpated. The diagnosis is supplemented by the radiography in two projections.

Treatment of flexion fracture. General anesthesia. Reposition of the elbow bone fracture and dislocation of the radial bone head is achieved by the traction at full extension of the elbow joint. After the carried out reposition the plaster splint is imposed on the hand from the humeral joint up to the base of fingers. During the immobilization by the plaster bandage the extension of the elbow should be preserved up to the full consolidation of the fracture. In 12 weeks the plaster bandage is removed and the physiotherapy exercises are prescribed. At adults work capacity is re stored in 15-16 weeks. Operative treatment is applied seldom, is more often at chronic fracture-dislocations.

Treatment of extension fracture. General anesthesia. Fragments are compared by the manual technique – traction by the hand bent in the elbow joint at the right angle. During the stretch of the fore arm the doctor carries out the reposition of the radial bone head by pressing backwards. After the reposition the plaster bandage is imposed for the same term, as at the flexion fracture. The forearm is fixed in the position of supination. A bandage is imposed on the area of the head. This fracture is unstable, repeated displacement of fragments and the dislocation of the radial bone head are often observed. A. V. Kaplan recommends applying the closed fixation for the prevention of this complication by means of the thin wire. For this purpose the wire is introduced into the repositioned head of the radial bone from the back through the lateral condyle of the humerus in the position of the forearm bent at the right angle and at full supination. Its end remains behind above the skin surface. In this position the plaster bandage is imposed. The wire is recommended to be removed in 2 weeks, not removing the bandage. Immobilization proceeds up to 12 weeks after the reposition. Further functional treatment is recommended.

At children extension fractures are treated by the same technique, but with smaller term of fixation - up to 8 weeks.

If it is not possible to achieve the holding of the bone fragments and radial bone head in the joint then the operative treatment is indicated. It is necessary to provide the exact reposition of fragments and their strong fixation. The fragments of the elbow bone are good held by Bogdanov's nail introduced through the elbow process into the intramedullary canal. The head is also repositioned by the open technique and the ruptured annual ligament of the radial bone is sewn up. If it is impossible to sew it up, then it is replaced by the conserved allotendon. A thin tendon of the fingers flexors 10-12 cm in length are taken for this purpose and are lead round the radial bone neck and are fixed by the sutures. Then the ends of the tendon are fixed to the elbow bone intraosseously, pulled and are sewn up strongly.

Fracture of the radial bone diaphysis with the dislocation of the elbow bone head (Galleazzi injury). Fracture of the radial bone diaphysis with the dislocation of the elbow bone head occurs because of the severe direct trauma. The radial bone breaks on the border of the middle one-

third and lower one-third and then comes the dislocation of the elbow bone head as the result of the ligaments ruptures in the distal radioulnar join. Sometimes breaks the styloid process of ulna.

Clinical symptoms. There is the painfulness and edema of tis sues in the fracture area of the radial bone. Movements, especially rotational, are restrained because of the increasing pain. The head of the elbow bone is displaced to the dorsal side (seldom - to the palm side). The diagnosis is finally defined after the radiography, made in two projections.

Treatment. General or local anesthesia. The reposition of fragments at the incomplete pronation is carried out, head of the elbow bone is repositioned by the addition- al pressing on it. The plaster bandage is imposed from the base of fingers up to the upper shoulder one-third of the arm bent in the elbow joint at the right angle, and the forearm - in the neutral position, but with the deviation of the bone to the elbow side. Small bandage is imposed on the elbow bone head to hold it in the repositioned state. The plaster bandage is simulated well. Immobilization up to 8-10 weeks. Work capacity is restored in 12 weeks. If it is not possible to provide good reposition of fragments then the repeated an gular displacement occurs. In such cases skeletal extension by the distal end of the fore arm in a combination with the plaster bandage is prescribed. Open reposition with the fixation of the fragments by the plates or nails is applied, depending on the kind of the broken bone.

Figure 16a. AP X - ray of Galleazzi fracture;

Figure 16b. Lateral X - ray of Galleazzi fracture — note displacement of ulna.;

Ununited fractures and false joints of forearm bones diaphysis.

Ununited fractures and false joints of forearm bones diaphysis occur mainly as the result of the mistakes made at the treatment of fresh fractures. The basic mistakes are bad immobilization, unreasonable change of plaster bandages and premature release of the elbow joint with inclusion of the extremity in function, early termination of immobilization, wrong indications for the

conservative treatment. The best method of treatment is the strong intramedullary metal osteosynthesis in the combination with the autogenous plasty. The bone grafts are put and fixed extramedullarly.

Fractures of the radial bone in a typical place.

Extension fractures of the radial bone distal epiphysis (Colles' fracture) are the most often injuries (fig. 17). They occur mainly at people of average and elderly age as in the course of years the involuntary processes are occurring in the bones lowering its durability. Less often occur the flexion fractures of distal epiphysis (Smith's fracture). Displacement of the radial bone distal epiphysis often occurs at children and teenagers - arises the epiphysiolysis. Injury of the radial bone in a typical place was described in 1814 by Colles. It arises at falling on the palm, when the hand is unbent and directed to the radial side. Fractures of the radial bone can be with and without the displacement of fragments. Fractures are also divided into extraarticular when distal fragment remains integral, but is displaced to the dorsal side, and intraarticular, penetrating into the radiocarpal articulation. The fracture plane usually goes above the joint line for 2-4 cm. In 60-80 % of cases of the radial bone typical fractures simultaneously occurs the fracture of the styloid process of ulna. Quite often displaced fragment of the radial bone injures the median nerve, and also interosseous sensitive nervous branches of the radial nerve.

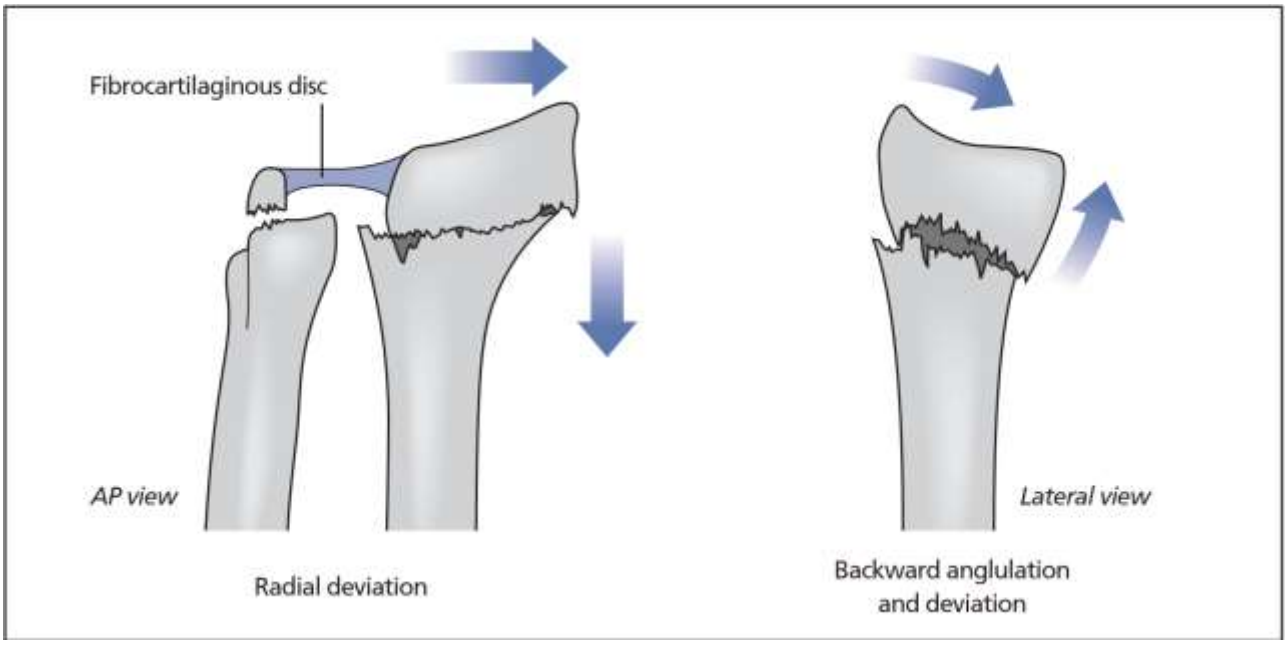

Figure 17. Colles fracture.

Flexion fracture of the radial bone in a typical place occurs at falling on the dorsal surface of the hand. In these cases peripheral fragment is displaced to the palmar side, and the central - to the dorsal side. Flexion fractures same as the extension fractures can be extraarticular and intraarticular.

Clinical symptoms. The bayonet deformation or deformation by the type of "fork back" is characteristic for the extension fracture of the radial bone in a typical place (Col les' fracture).

Active and passive movements by the hand are impossible because of the pain. The hand with the distal fragments is displaced to the back side, and often to the radial side. At the palpation well-expressed proximal end of the distal fragment in the form of the step is defined on the dorsal surface of the lower one-third of the forearm, and on the palmar side end of the proximal fragment is protruded in the form of the protuberance. The soft tissues surrounding the fracture area, are edematous and painful. Movements in the radiocarpal articulation are restrained and cause the pain in the fracture area. Local pain in the zone of the radial bone metaphysis, tumidity not influencing the area of the radiocarpal articulation are characteristic for the injuries of the radial bone in a typical place. At the hurts of the radiocarpal articulation or sprain of ligaments the edema is located in the joint area. Extended painfulness of the paraarticular tissues is marked while the metaphysis area is painless. The final diagnosis is defined after the radiological examination. At the flexion fracture of the radial bone in a typical place the same deformation is observed, but the displacement will be in the opposite direction (distal fragment is displaced to the palmar side, and the central – to the dorsal side). Fractures without the displacement are not accompanied by the deformation. The diagnosis is specified by the radiography.

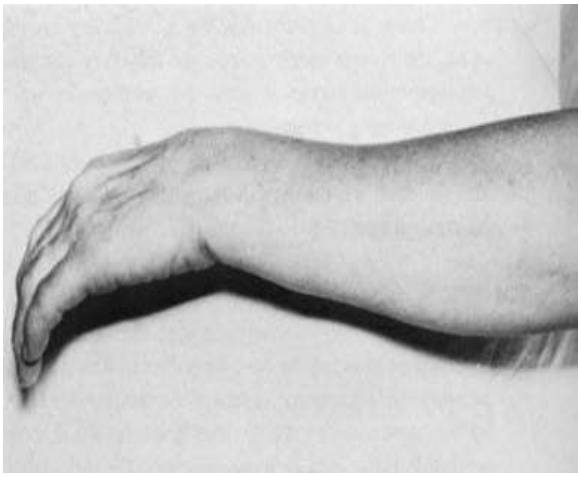

Figure 18 Dinner fork deformity of the forearm and wrist

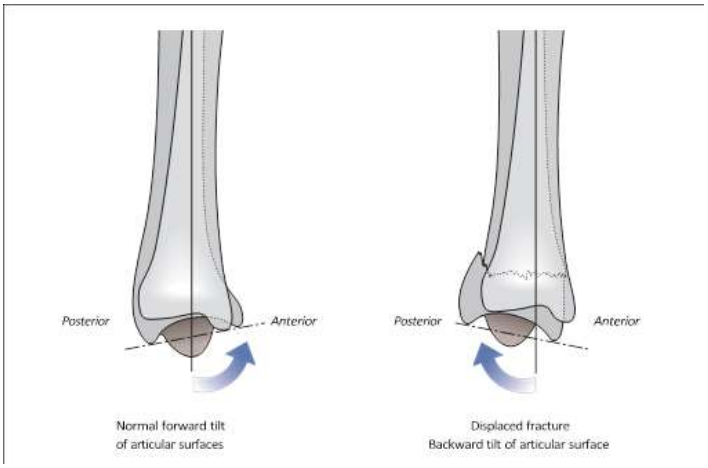

Figure 19. Colles' fracture — degree of displacement.

Treatment. Local anesthesia is carried out. Fracture without the displacement is fixed by the deep dorsal plaster splint from the base of fingers up to the elbow joint. The hand is placed on the same level with the with the forearm in the prone position and elbow abduction. In the cases of unheld epiphyseal Colles' fractures it is necessary to fix the hand in a small palm flexion, elbow abduction and pronation for the prevention of repeated displacement. Active movements by the fingers are to begin from the first days, and also in the elbow and humeral joints. The plaster bandage is removed in 3-4 weeks. Work capacity is restored in 6 weeks.

Fracture of the radial bone in a typical place with the displacement of fragments are most often repositioned by the manual technique. Three per sons are taking part in the comparison of the fragments. The assistant grasps with one hand the first (1) finger of the patient, and II, III and IV fingers - with the other hand. The second assistant grasps with two hands the shoulder in the lower

one third. Then both assistants bend the hand in the elbow joint at the right angle, and stretch the forearm and pronate it. After 3-5 minutes traction the reposition of fragments is carried out. At the extension fracture the doctor puts one hand under the lower end of the central fragment from the palmar side and wit the other hand presses on the peripheral fragment from the dorsal side, then abducts the hand to the elbow side and increases the pronation of the hand. At this time assistants continue stretching the forearm.

At the flexion fracture the reposition of fragments is carried out in the reverse order -peripheral fragment is moved from the palmar side to the dorsal. After the reposition of fragments the palmar plaster splint is imposed from the base of fingers up to the elbow joint. The hand is fixed in the position of easy extension and elbow abduction. The bandage is well simulated and is dressed with the gauze bandage. The traction of the forearm is stopped when the bandage has thickened. In addition the reposition of the radial bone fracture in a typical place can be carried on the Sokolovsky, Land, Edelstein, Ivanov's stretching apparatus, on Kaplan's table. After the reposition of fragments and imposing the plaster bandage the patient is prescribed the control radiography. During the first day and the following days the patient should be under the doctor's supervision. At the disorder of the blood circulation the compression by the bandage is removed. It is recommended to redress the forearm. After the reduction of the edema it is necessary to re place the gauze bandage with the plaster one and to carry out the repeated radiography. Active movements by the fingers are indicated. Immobilization proceeds up to 4 weeks. Warm baths, massage, curative gymnastics are prescribed after the removal of the plaster bandage. Work capacity is restored in 6-8 weeks. Operative treatment is indicated at wrong united fractures with the significant disorder of the function in the radiocarpal articulation.

Wrist bones injuries.

Bone fractures of the wrist make approximately 1 % of all the fractures. These fractures rather often cannot be defined and pass under the diagnosis of contusions and stretches. Carpal bones of the proximal layer are injured more often. Fractures of the navicular bone, dislocation of the lunate bone, fractures of the navicular bone with the dislocation of the lunate bone, and also perilunate dislocation of the wrist are referred to them. Fractures of the other bones occur very seldom.

Fracture of the navicular bone (scaphoid) refers to the intraarticular and arises at falling on palmar surface with the deviation of the wrist in the radial side. At the moment of falling the navicular bone sets against styloid process of the radial bone and breaks up into two half. Except for the injury of the body, fractures of the navicular bone tubercle occur as the result of the ligament avulsion. This is the extraarticular injury.

Clinical symptoms. There is the edema and painfulness of the radiocarpal joint, mainly from the radial side. Sharp pain appears at the palpation in the area of the "anatomic snuffbox", where the navicular bone is the bottom. Moreover, pushes transmitted along axis I and II of the finger cause painfulness in the navicular bones.

Movements in the joints of the wrist are limited, the patient can not completely clench fingers in a fist. The diagnosis is defined after the radiography, made in the dorsal-palmar and lateral directions with the deviation of the wrist in the elbow side. Fractures of the navicular bone are more often transverse, without the displacement of the fragments.

Figure 20. Fracture of the scaphoid — avascular necrosis.

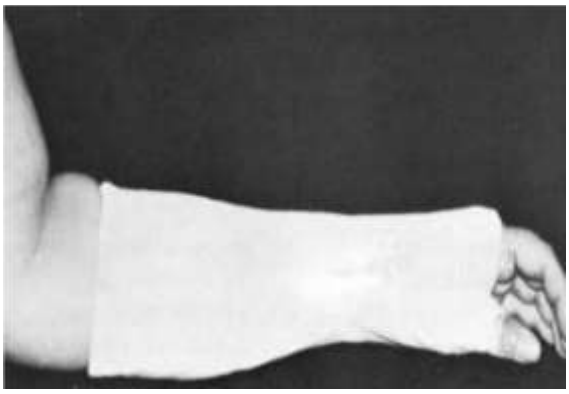

Figure 21. Scaphoid plaster - cast.

Conservative treatment of fresh fractures. The fixation of the fracture is made with the plaster bandage from the basis of fingers up to the elbow joint together with the basic phalanxes of the I and II fingers. For the best contact of the navicular bones' fragments the dorsal flexion of the I finger is made with the abduction to the radial side. Fractures of the navicular bone tubercle heal much faster. Term of immobilization with the plaster bandage is up to 4-6 weeks.

By reason of the violated blood circulation in the navicular bones' fragments immobilization of the wrist with the plaster bandage should proceed not less than 3-4 months. Work capacity is restored in 4-5 months.

At the absence of the navicular bone fracture healing patients feel the pain at movement in the radiocarpal joint and decrease in work capacity. Treatment of the navicular bone pseudoarthrosis is operative or with the help of the Ilizarov's compression distraction apparatus.

Dislocation of the lunate bone arises at falling on excessively unbent wrist. The lunate bone is displaced in the palmar side and turns on 90°. At the dislocation of the lunate bone the interrelation with the articular surface of the radial bone is violated.

Clinical symptoms. There is the painfulness in the radiocarpal joint. The wrist seems shortened and incrassate in the dorsal-palmar direction. A protrusion is defined on the palmar surface above radiocarpal joint, and a retraction on the dorsal surface. The pa tient can not completely clench fingers in a fist., extension is also limited. If help is not rendered in time at the dislocation of the lunate bone, then the neuritis of the median nerve develops under the pressure.

Treatment. General or field anesthesia. Then the wrist fingers traction is carried out with the purpose of the maximum widening of the interval between the articular sur face of the radial bone and of the capitate bone. Then the dorsal flexion of the wrist is carried out, and, not stopping the traction, the doctor with his thumb presses on the lu nate bone from the palm side and resets it.

The radiography is carried out for the control. Immobilization of the wrist with the plaster splint in the position of the palmar flexion up to 3-4 weeks. Work capacity is restored in 6 weeks.

At a dislocation of the lunate bone in a combination with the fracture of the navicu lar bone at the fresh cases first of all the dislocation of the lunate bone is reseted, and the immobilization and subsequent treatment is carried out the same way as at the fracture of the navicular bone.

Chronic fracture-dislocations of the lunate or navicular bones are reseted by the opened method.

Perilunate dislocations of the wrist (dislocation of bones between the first and second line of the wrist bones) and fractures of other wrist bones occur seldom.

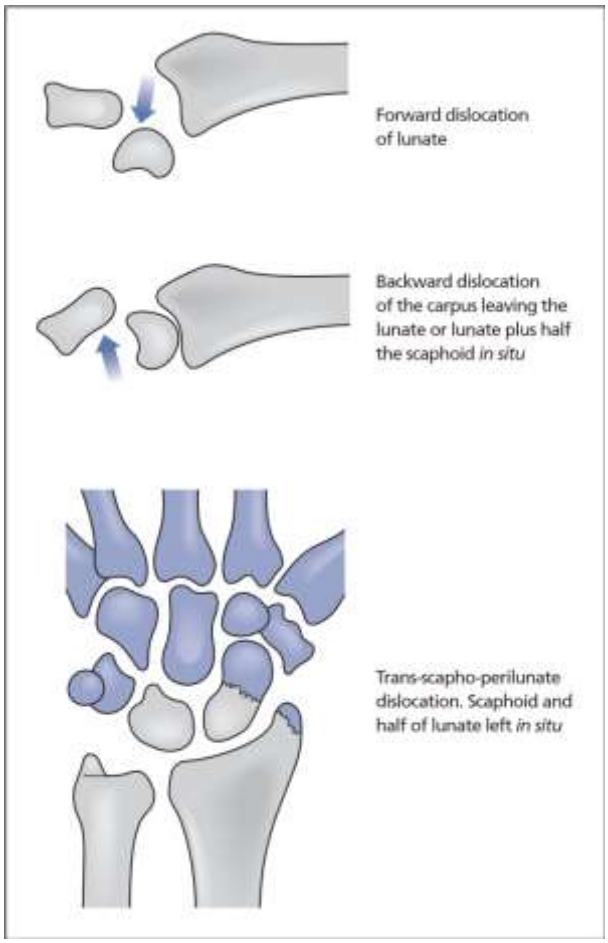

Figure 22. Dislocation/fracture of the wrist.

Fractures of the metacarpal bones.

Closed fractures of the metacarpal bones make 2,5 % of the general number of fractures.

Fracture of the base of the 1st metacarpal bone (Bennett fracture) more often occurs at falling on the radial side of the hand with the pressed pollex or from the impact. Displaced fragment sticks out from the dorsoradial side of the hand.

There are two types of fractures with the identical mechanism of injury distinguished: fracture of the base of the 1st metacarpal bone without the injury of the joint; fracture with the injury of the carpometacarpal articulation. This injury is known under the name of Bennet's fracture-dislocation.

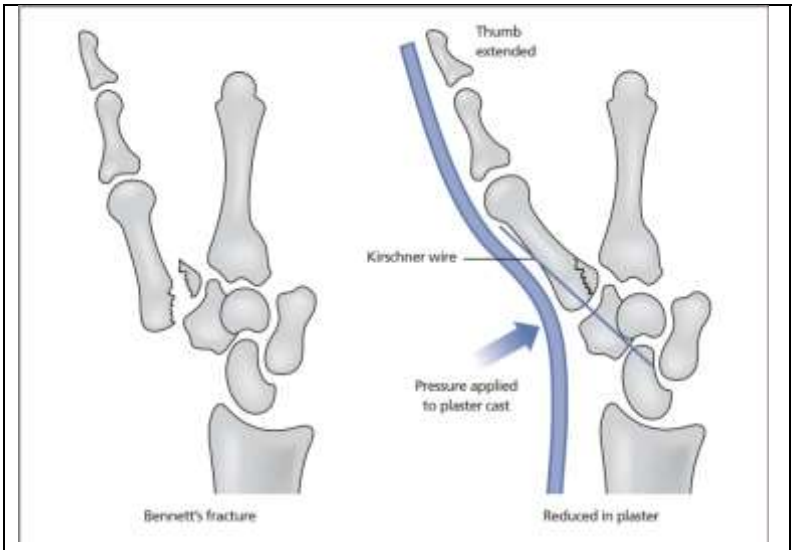

Figure 23. Bennett's fracture.

Clinical symptoms. The edema appears on the dorsal surface of the base of the 1st metacarpal bone and there is the prominence can be defined. The pollex adducted, movements in it are sharply painful. The traction by the finger in the adducted position eliminates the deformation of its base and increases the pain. The diagnosis is specified by the radiography.

Conservative treatment. Local anesthesia. After the anesthesia the assistant keeps the hand for II-IV fingers and makes manual reposition of the fragments, then he pulls aside the pollex and adducts it together with the 1st metacarpal bone. The surgeon presses from the radial part on the bone prominence and repositions the fragment. The hand in this position is kept and fixed by the splint plaster bandage with the grasp of the pollex up to the interphalangeal joint, and the others -- up to the heads of the metacarpal bones. At the fracture-dislocations (intra-articulate) after the reposition of the fragments the skeletal traction is imposed on the distal phalanx (by A. V. Kaplan). The plaster bandage is re moved in 3-4 weeks. Work capacity is restored in 6-8 weeks. The open reposition is pre scribed at the irreducible fracture-dislocations.

Fractures of the II, III, IV and V metacarpal bones occur often enough under the influence of the direct trauma. They make 2,5 % in comparison to all fractures. There are fractures which occur without displacement of the fragments and with the displacement at an angle, opened to the palmar surface (influence of the lumbrical and interosseous muscles).

Clinical symptoms. Deformation and edema of the hand, especially on the dorsal surface. Occurrence of sharp local painfulness at loading along the axis of each finger. Function of the hand is disordered. The diagnosis is specified by the radiography.

Fractures of the metacarpal bones without the displacement is fixed by the splint plaster bandage in functionally favorable position within 3-4 weeks.

Fractures of the metacarpal bones with the displacement of the fragments are subject to reposition by the traction along the axis by the fingers in combination with the pressing on the bone fragments. The immobilization of the hand is carried out by the plaster bandage or Buhler's frame in

functionally favorable position. If it is not possible to compare the fragments manually, then the open reposition of the bone fragments with the intramedullary osteosynthesis by the thin bone pins or metal wires is prescribed. Term of fixation id the same as at the conservative treatment.

Fractures of fingers phalanxes.

Fractures of fingers' phalanxes are on the first place and make 5% of all fractures by the frequency of the hand bone injuries. There occur because of the direct trauma as a result of the impact or compression of the finger. More often these are the open fractures.

Fractures of phalanxes are divided into intra-articulate, periarticular and diaphysis. Under the influence of impact and the subsequent traction of the lumbrical and in terosseous muscles there occurs the typical displacement of the fragments at an angle opened into the dorsal side.

Fractures of the middle phalanx can be accompanied by the displacement at an angle opened into the palmar side. It occurs in the cases, when the level of fracture is proximally from the attachment of tendon's cruses of the superficial flexor.

Fractures of the distal phalanxes occur mainly owing to the direct trauma - impact on the fingertip with a firm object. They are frequently splintered with the vast subungual hematoma. Sometimes occurs the avulsion of the finger flexor's tendon from its attachment place to the distal phalanx.

Clinical symptoms. There occurs the deformation of the finger with the shortening. At the typical angular displacement of the fragments the bony prominence can be defined on the palmar surface. The finger is edematous, painful, and there is the cytologic mobility with the bony crepitus appear at the place of the fracture. Type of the fracture is specified by the radiography, made in two projections.

Conservative treatment. Field anesthesia by Lukashevich-Oberst. One-stage re position of the fragments in position of finger bending is made after the anesthesia came into effect. Bone fragments should be well compared and strongly kept before the formation of the bone callus. It is extremely necessary for full restoration of function of the injured finger. At fracture of phalanxes only the injured finger in the flexed position is fixed.

The wire splints which are strongly kept on the hand by the plaster bandage are applied for the immobilization of the finger. The finger is fixed to the wire splint by the strips of the adhesive plaster for 4-5 weeks. Work capacity is restored in 6-8 weeks.

At the unstable condition of the fingers' phalanxes fragments A. V. Kaplan recommends to impose the skeletal traction by the distal phalanx. As a preliminary, the plaster bandage is imposed on the forearm and on the hand up to the metacarpophalangeal articulations. When the plaster hardens, then the wire splint is attached to the bandage from the palmar side, bent at an 45° angle on the level of metacarpophalangeal articulation. The stainless steel wire is put through the tip of the finger which is fixed with the small arch. To rubber tubule is fixed to this arch, then the one-stage reposition of the fracture is carried out. The rubber tube is pulled on and is tied to the metal loop, plastered on the palmar side of the plaster bandage

Operative treatment of the phalanxes' fractures with the displacement of the fragments is applied at the unsuccessful manual reposition. Bone fragments are fixed intramedullary by the wires, thin allopins or other biological tissues.

Partial amputation of the tip may be treated by a skin flap (Fig. 24). It is often simpler to carry out a partial amputation of the phalanx to allow skin to be fashioned to cover the finger end.

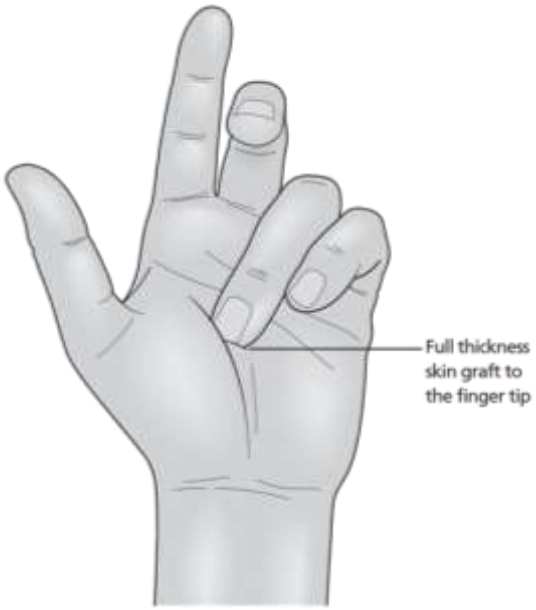

Figure 24. Full thickness skin graft to the finger tip

Contusions and injuries of the tendons.

Mallet finger

This is an avulsion injury of the extensor tendon from the base of the terminal phalanx (Fig. 25).

Treatment

It is possible to secure healing using a malleable splint to hyper-extend the terminal inter - phalangeal joint and allow flexion of the proximal interphalangeal joint (Fig. 26). Healing is more likely to occur if the tendon has avulsed a fragment of bone from the base of the phalanx. At least 6 weeks' splintage is usually necessary. Treatment is not always successful and the patient may be left with an 'extension lag , i.e. the inability to extend the terminal joint actively, even though passive extension is full. This is not usually troublesome. If the fingertip tends to 'get in the way' , the interphalangeal joint may need fusion later.

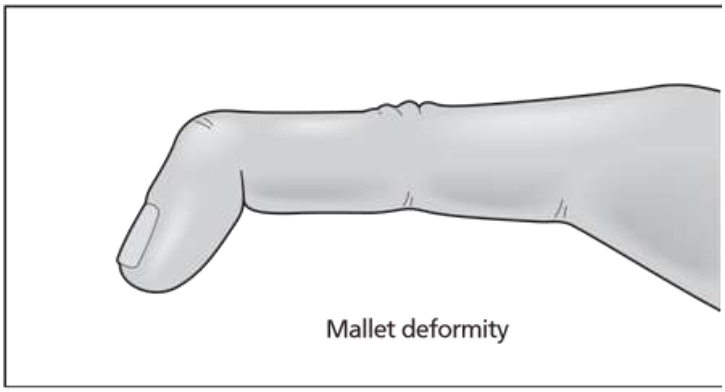

Figure 25.Mallet finger

Figure 26. Plastic mallet finger splint.

Contusions of the wrist arise because of the impacts by different blunt objects at the manufacture and in household. They are accompanied by the pain, tissues edema, hemorrhage and dysfunction.

Local hypothermia has a favorable influence on the contusion. The cold is the good sedative. Preventing the development of the hemorrhage and edema, accelerating the restoration of the injured wrist function. To achieve this, a rubber hot-water bottle or cellophane bag is filled with the ice and is applied for 2-3 days and at heavy contusions with the compression or crushing of the tissues - up to 3-4 days.

Except for the cold, immobilization of the injured extremity is also applied at the contusions. During the following days the physiotherapy exercises, gymnastics, magnetotherapy, UHF, massage, warming compresses and paraffin baths are prescribed.

More often the closed injury of the tendon occurs in the area of the distal phalanx at the impact of the finger along the axis. At this reflexively contracts deep flexor muscle of the finger, which causes the avulsion of the flexor muscle of the fingers tendon in the field of its attachment to the distal phalanx. After the trauma the distal phalanx is in the bent position and actively is not unbending.

Conservative treatment of this kind of injuries - immobilization of the phalanx in the position of the overextension and in the position of the moderate bending of the finger's middle phalanx (60°), imposes the plaster bandage for the period of 5-6 weeks. During the last years the closed transarticular fixation of the finger with a thin pin is applied. This technique provides better immobilization of the avulsed tendon. The finger is put into the position needed. The pin is introduced into the pulp of the finger-tip and is taken through the distal phalanx towards the interphalangeal joint of the wrist.

Contusions and injuries of the hand fingers.

Dislocations of fingers of the hand occur seldom. The first place in frequency is kept by the dislocation of base phalanx of the pollex. The finger is displaced in the dorsal side, the bursa and the ligaments are ruptured. The mechanism of the dorsal dislocation of the thumb is based on its sharp hyperextension in the metacarpophalangeal articulation. It occurs as a result of falling on the outstretched hand at the stop on the end phalanx of the pollex. At a dislocation the tendon of the long flexor of the thumb, fixed between the sesamoid bones, often slides off the head's smooth surface of the metacarpal bone in the ulnar side and is trapped from one side between the head of the metacarpal bone and the articulate end of the phalanx.

Clinical symptoms. There is the deformation of the pollex. The proximal phalanx is displaced in the dorsal side and is at right angles to the metacarpal bone, and on the palmar surface the head of the metacarpal bone can be defined. Function of a finger is sharply impaired. The diagnosis is specified by the radiology.

Treatment. General anesthesia or field anesthesia is applied. The patient is laid on the dressing table. After the anesthesia came into effect the assistant fixes the hand in position of the incomplete pronation, and the doctor stands from the side of the palmar surface of the fixed hand, grasps the dislocated finger with his hand and makes the string and hyperextension of the finger in the metacarpophalangeal articulation. Simultaneously with the pollex of the same hand the doctor makes pressure in the direction of the palmar side on the base of the I phalanx, and with the pollex of the other hand presses on the head of the I metacarpal bone in opposite side, i.e. the dorsal side. During this moment there is the reposition of dislocation of the pollex. After the reposition the finger, bent in the metacarpophalangeal articulation is fixed by the wire splint for the period of 3 weeks. In future - functional and physiotherapeutic treatment. Work capacity is restored in 3-4 weeks. At entrapment of the tendon if the dislocation is not repositioned by the conservative method, then opened reduction is prescribed.

Recommended Books

1. Traumatology and orthopedics : textbook for students of higher medical educational institutions / edited by Golka G. G., Burianov O. A., Klimovitskiy V. G. – Vinnytsia : Nova Knyha, 2018, – 400 p.
2. Venger, V.F. Traumatology and orthopedics / V.F. Venger, V.V. Serdyuk, Rashed Mochammad. – Odessa. Druk, 2006.- 248p.
3. Duckworth, T. Lecture notes. Orthopaedics and fractures / T. Duckworth, C.M. Blundell. – 4th ed.
4. David, Ip. Orthopedic Traumatology – A Resident’s Guide / David Ip. – 2nd ed.