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Shoulder Dislocations

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ABSTRACT Shoulder dislocations are among the most common injuries and occupy the first place among all dislocations of limbs. Currently, the conventional approach to the treatment and diagnosis of this pathology is preserved. The closed reduction is performed under local anesthesia, the limb is immobilized with a bandage sling. There is no single opinion on the period of immobilization. Common indications for surgical treatment are unreduced, habitual and open shoulder dislocations. The preference is given to operations with the restoration of anatomy, while at the end of the last century, techniques were often used to limit the amplitude of movements in the shoulder joint. Currently unphysiological reconstruction methods are not favourable, since they violate the normal biomechanics of the shoulder joint and do not directly affect the pathological substrate of damage. Outcomes after arthroscopic options for operations are not inferior to those after open interventions. This article provides an overview of clinical and radiological methods for examining patients and treatment options for this pathology.

Keywords: shoulder joint, traumatic shoulder dislocation, instability of the shoulder joint, x-ray diagnosis of shoulder dislocation, stabilization of the shoulder joint, conservative treatment, open surgery for shoulder dislocation, arthroscopic treatment

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CT — computed tomography
MRI — magnetic resonance imaging
RCS — rotator cuff of the shoulder

Traumatic dislocations of the shoulder are one of the most common injuries and rank first among all dislocations of the extremities (over 45%) [1]. Anterior shoulder dislocation occurs in 85% of cases. The incidence ranges from 8.2 to 23.9 cases per 100,000 people per year. In this case, both young and old people are equally affected [2].

Considering the steady growth in the popularity of an active lifestyle, playing sports, especially among untrained people, the frequency of dislocations and instability of the shoulder joint has increased in recent decades. Accordingly, the volume of accumulated experience, presented in various publications on this topic, also grew. Over the past century, humanity has significantly increased knowledge about the etiology, diagnosis, treatment and outcomes of shoulder instability, especially since the advent of methods such as magnetic resonance imaging (MRI) and computed tomography (CT). However, despite the fact that the study of this pathology continues throughout human history, methods of diagnosis and treatment of shoulder joint instability continue to develop.

The aim of this article is to study and summarize the literature data concerning shoulder dislocations.

MECHANISM OF TRAUMA

It is often difficult to determine the mechanism of damage that led to the instability of the shoulder joint. This is especially true for patients with weakness of the ligamentous apparatus or patients with lost muscle tone in the shoulder. However, in most patients, shoulder instability develops after a very clear traumatic episode. According to research by S. Rowe, up to 96% of fresh dislocations are traumatic. For such patients, the energy of the traumatic effect is a significant factor. The larger it is, the more likely the occurrence of other bone or soft tissue injuries in the area of the shoulder joint, as well as the development of rare types of dislocations with displacement of the humeral head into the pleural cavity or even retroperitoneally [3].

The occurrence of **anterior dislocation** is associated with trauma in the position of the shoulder in abduction, extension, and external rotation. In this case, the anterior part of the joint capsule and ligaments, the articular lip, and the rotator cuff are damaged. The head of the humerus is displaced anteriorly in relation to the glenoid cavity and downward in relation to the coracoid process of the scapula. This is how subcoracoid dislocation develops [4]. Other types of anterior dislocations include: dislocation, when the head of the humerus is located anteriorly and under the articular cavity of the scapula (subglenoid dislocation), subclavian dislocation - the head of the humerus is located medially from the coracoid process and under the lower edge of the clavicle, as well as the intrathoracic and retroperitoneal dislocation [5, 6].

Posterior dislocation of the shoulder is the result of the application of force to the limb in the adduction position, internal rotation, flexion, and can also follow excessive muscle contractions during electrical trauma and convulsions. In the latter cases, the total strength of the internal powerful rotators of the shoulder (m. Latissimus dorsi, m. Pectoralis major and m. Subscapularis) overcomes the resistance of the external rotators (m. Infraspinatus and m. Teres minor), and the head of the humerus from excessive internal rotation becomes reversed throughout the articular surface, and the small tubercle thus turns to the glenoid cavity of the scapula. After non-convulsive posterior dislocation, the head of the shoulder may be moved into the subacromial space (behind the glenoid and under the acromial process of the scapula), into the space posteriorly and below the articular process of the scapula, into the space under the spine of the scapula (the head is located medial to the acromial process and under the spine of the scapula). The most common subacromial posterior shoulder dislocations [7].

With **lower dislocation** of the humerus, excessive shoulder abduction occurs, the acromial process of the scapula becomes the fulcrum of the neck of the humerus, and as a result of the large lever, the head is dislocated from the capsule downward. It should be noted that these lesions are extremely rare and are called "luxatio erecta". These dislocations are accompanied by severe soft tissue injuries and fractures of the proximal humerus. M. supraspinatus, m. pectoralis major or m. teres minor are most frequently damaged, fractures of the greater tubercle are observed. Neurocirculatory disorders are usually noted [8].

Upper dislocation. In modern literature, descriptions of these dislocations are rare. A common cause of these dislocations is excessive force applied to the fully adducted arm and directed upward and forward. When the head of the humerus is displaced upward, fractures of the acromial process of the scapula, ruptures of the acromioclavicular joint, fractures of the clavicle, coracoid process, fractures of the humeral tubercles may occur. This type of dislocation is accompanied by severe damage to soft tissues: rupture of the joint capsule, rotator cuff, tendon of the long head of the biceps and surrounding muscles. Clinically, with this dislocation, the head of the humerus is located above the level of the acromial process of the scapula, the limb is shortened and brought to the trunk. As with inferior dislocations, neurocirculatory disorders are usually noted. These dislocations may occur a second time as a result of massive ruptures of the muscles of the rotator cuff [9].

CLASSIFICATION

Currently, there is no generally accepted classification of shoulder joint instability. In our country, the classification of A.V. Kaplan, in which subclavian dislocation, subclavicular dislocation with separation of the greater tubercle of the humerus, subclavian, axillary and posterior dislocation of the shoulder are distinguished [10].

Descriptive classifications are also used in foreign literature. By severity, dislocations and subluxations of the shoulder are distinguished, by duration — fresh and old (not eliminated within 3 weeks), by relapses — single or habitual, by mechanism — traumatic or non-traumatic, in the direction of dislocation — anterior, posterior, lower, upper. Because such classifications are descriptive, several terms apply to the same patient. Fresh dislocation is considered before the expiration of 24–36 hours after the injury. Attempts of closed elimination with fresh dislocations are more often successful. On the contrary, in chronic dislocation, especially after 4 weeks, closed shoulder repositioning is almost impossible [11].

It should be noted that in the descriptive part of dislocation in foreign literature there are concepts such as "blocked (uncontrolled) dislocation" — unrecoverable dislocation during conventional closed manipulations, "unstable dislocation" — a relapse occurs immediately after the elimination.

In 1989, Thomas and Matsen proposed to divide instability (dislocation) of the shoulder joint, depending on the leading etiopathogenetic factor, into two types, denoted by the abbreviations TUBS and AMBRI. The first is TUBS, where T is traumatic, U is unidirectional, B is Bankart, and S is surgery. And the second is AMBRI, where A is atraumatic, M is multidirectional, B is bilateral, R is rehabilitation, I - inferior capsular shift is often performed during surgery [11].

The possibility of using arthroscopy has made it possible to create a number of arthroscopic classifications of injuries arising from acute and chronic shoulder dislocations, which are currently widely used in the world. One of the pioneers in this area was Baker, who identified three types of arthroscopic assessment of acute lip injury [12].

In 2018, the US Orthopedic Traumatology Association updated the alphanumeric classification issued back in 1996 and revised in 2007. According to the latest classification, shoulder dislocation corresponds to "10A". The number "1" is assigned to the shoulder girdle - the first digit, "0" - the second digit - indicates a dislocation. The location of the dislocation is specified by the letter code: "A" is shoulder joint, "B" is sternoclavicular joint, "C" is acromioclavicular joint. The number after the letter code indicates the direction of the dislocation: "1" is anterior, "2" is posterior, "3" is lateral; "4" is medial "5" is other. Thus, according to this classification, the anterior dislocation in the shoulder joint will be designated "10-A1" [13].

In 2018 M. Hettrich et al. offered the most complete classification of shoulder joint instability, also based on descriptive characteristics [14].

ANATOMY AND PATHOLOGIC ANATOMY

Normally, the head of the humerus during active movements is displaced relative to the center of the articular surface only within 1 mm. The shoulder joint is stabilized by dynamic and static anatomical elements (formations). Static include the articular lip, the articular surface of the articular process of the scapula, negative intra-articular pressure and the ligamentous-capsular apparatus. The dynamic formations that stabilize the shoulder joint are the muscles of the rotator cuff of the shoulder (especially the subscapularis muscles), m. pectoralis major, m. latissimus dorsi, m. biceps brachii and pericapsular musculature. In general, the capsular-ligamentous apparatus provides stability at the end points of the trajectory of the shoulder movement, while in its middle part the capsular-ligamentous apparatus is relaxed, and stabilization occurs due to dynamic compression of the joint. Shoulder joint instability occurs when there is a failure or deficiency of bone, soft tissue, or dynamic formations that stabilize the shoulder joint [15]. In this regard, rehabilitation after shoulder dislocation is aimed at strengthening the dynamic stabilizers (muscles), while during surgery, static stabilizers of the shoulder joint (ligaments, joint capsule) are restored [16].

Anterior dislocation is usually the result of an indirect force exerted on the limb in abduction and external rotation. In this position, the anterior part of the lower articular-humeral ligament is stretched in front of the anterior part of the glenoid. Together with the glenoid lip, the ligament prevents further displacement of the head anteriorly. When applied with sufficient force, the anterior portion of the inferior humeral ligament breaks off (Bankart injury) and an anterior shoulder dislocation occurs. This injury is a characteristic pathological feature of anterior shoulder dislocations, and complete anatomical restoration of Bankart injuries is the basis for stabilizing intervention on the joint [4, 15].

CONCOMITANT INJURIES

Various injuries can accompany shoulder instability. Most of them occur during the initial episode of dislocation or subluxation of the joint and can include both soft tissue damage and bone structures. These include, but are not limited to, humeral head defects, humeral tubercle fractures, scapula articular fractures, humerus neck fractures, rotator cuff ruptures of the shoulder, vascular and nerve injuries. Identifying these lesions is critical because they require additional treatment and affect outcome. Some of them are the most common and require special attention [17, 18].

Defects of the humeral head occur with traumatic dislocation of the shoulder. During an injury (dislocation), the head of the humerus is strongly supported by the edge of the articular process of the scapula, and the relatively soft spongy tissue of the head of the humerus is crushed. As a result, an impression "imprint" of the edge of the glenoid is formed on the head of the humerus. Such defects are often called impression fractures. In connection with the muscle spasms developing after the dislocation, the area of impression on the head of the humerus may increase. In patients after primary traumatic dislocation, defects of the humerus head are observed with a frequency of 38 to 47%. In patients with habitual dislocation, their frequency is higher and reaches 50–67% [19].

In anterior shoulder dislocations, the defect occurs on the posterolateral part of the humeral head and is called a Hill-Sachs injury. In posterior shoulder dislocations, the defect occurs in the anteromedial part of the humeral head, sometimes called Hill-Sachs reverse lesions. Thus, the location of bone defects may indicate the direction of the primary shoulder dislocation. In addition, the presence of such defects suggests precisely the traumatic nature of the dislocation, since they practically do not occur in patients with nontraumatic instability of the shoulder joint. While most small defects of the humeral head do not affect treatment tactics and prognosis, large bone defects may require special surgical treatment [20]. Rotator cuff ruptures (RCS) may accompany anterior and inferior shoulder dislocations. The frequency of bladder rupture depends on the age of the victim. Although the overall incidence of these injuries may not reach 15%, ruptures occur in 35–40% of patients over 40 years of age. And in patients over 60 years of age, the incidence of concomitant bladder cancer is 80% [21]. These patients usually present with weakness and inability to abduct the shoulder and external rotation. Often, on admission, these injuries are mistaken for a consequence of nerve injury. Therefore, any patient who shows weakness, inability to actively move in the shoulder joint after a dislocation, should be performed tests to diagnose damage to the shoulder rotators. The earliest detection and treatment of bladder rupture is considered decisive in the outcomes of these injuries [17, 19].

Due to the peculiarities of the anatomical location during shoulder dislocation, damage to the axillary nerve and brachial plexus is often observed. Based on the results of electromyography, the frequency of damage to these structures can reach 65% [17].

However, the incidence of clinically significant neurological disorders is much lower and amounts to 5–25%. According to research data, the axillary nerve is most often injured; the frequency of damage to this structure is higher in elderly patients. The clinical picture is dominated by limb weakness and numbness [22].

DIAGNOSIS

Clinical examination. The history taking should include clarification of the mechanism of injury, including the position of the limb at the time of injury, the amount of force applied to the limb, and the point of application of this force. In the event of an injury in the position of the upper limb in a state of extension, abduction and external rotation, an anterior dislocation of the shoulder should be assumed. An electrical injury, a history of seizures, or a fall with the limb in flexion, adduction is usually associated with a posterior dislocation of the shoulder. If the patient has a habitual dislocation of the shoulder, it is necessary to find out the etiology of the primary episode of trauma, how many episodes of dislocation were there in total, in what position or with what movements of the limb the dislocation recurs, how long the limb has been in dislocation (with chronic dislocation), whether there are radiographs of the shoulder in the state of dislocation, how the dislocation was eliminated. When taking anamnesis, it is also necessary to find out the presence of neurological disorders or damage to the rotator cuff of the shoulder in previous episodes of dislocation. Information about the treatment performed and its effectiveness is important [4, 11, 23].

Much attention should be paid to the physical examination. With an anterior dislocation of the shoulder, the pain is very intense. The muscles of the shoulder after a dislocation are in a spasmodic state in an attempt to stabilize the joint. The head of the humerus can be palpated anteriorly from its anatomical normal position. In the lateral and posterior parts of the shoulder, there is a characteristic retraction of the soft tissues under the acromial process of the scapula. The patient holds the hand in a forced position, in a slightly abducted position. Passive and active movements are limited by pain. Due to the possible concomitant damage to the nerves, and less often to the vessels, an important part of the physical examination for anterior shoulder dislocations is to assess the neurovascular status of the upper limb and record these data until the dislocation is corrected [10, 11].

With posterior shoulder dislocation, the clinical picture may be less vivid. Because posterior dislocation is inherently more of an impaction fracture than a dislocation, diagnosing a posterior dislocation can be difficult. The reasons for this are the absence of pronounced deformity and the absence of a forced position of the limb. On the contrary, the patient holds his hand in a kerchief in a natural adduction and internal rotation position. However, direct physical examination allows for the diagnosis. The classic symptoms of posterior dislocation are: severe limitation of external shoulder rotation; limiting the elevation of the limb (often less than 90 degrees); the presence of a protrusion along the back surface of the joint; smoothing of the contours of the shoulder joint, especially along the anterior surface, in comparison with the intact shoulder; projection of the coracoid process on the side of the dislocation. In posterior dislocation, shoulder movements are always limited, since the head of the humerus is either fixed in a vicious position on the posterior part of the glenoid cavity by muscle force, or literally "strung" on the edge of the glenoid. The asymmetry of the shoulder joints is easy to determine when examining the patient from above, standing behind his back [7, 11].

Radiation diagnostics. X-ray. X-ray examination is mandatory for all patients with suspected dislocation or instability of the shoulder joint. With radiography, it is possible to establish the direction of the dislocation, the presence of concomitant fractures or bone defects, anatomical obstacles to the elimination of the dislocation. Due to the oblique position of the scapula in the chest on the usual anteroposterior projection of the shoulder joint, the glenoid cavity is elliptical, and therefore in the normal shoulder joint the shadow of the articular surface of the humeral head is superimposed on the ellipsoid shadow of the glenoid [24].

With a dislocated shoulder, this superposition of shadows is significantly impaired. A distance of more than 6 mm between the anterior edge of the glenoid and the head of the humerus is an indication of a posterior dislocation of the shoulder (a sign of an empty glenoid cavity). A true anteroposterior projection when examining the shoulder joint can be obtained when the X-ray emitter beam is directed perpendicular to the plane of the scapula, at an angle of 35–45 degrees to the sagittal plane of the body [24, 25].

In this projection, we observe the shoulder joint in such a way that there is no stratification between the glenoid cavity and the head of the humerus. In a normal shoulder joint, the contours of the glenoid and the articular surface of the humerus are coaxial and repeat each other. If any superposition of the glenoid cavity and humeral head shadows is detected in this projection, a shoulder dislocation should be suspected. It is important that any anteroposterior view of the shoulder is accompanied by an orthogonal ("lateral") view to determine the position of the humeral head. In this case, the preference is given to the axillary projection, because it is easy to determine the location of the humerus head relative to the glenoid, as well as to clearly visualize the bone structures. This projection is obtained when the cassette is located in the upper part of the shoulder joint and the direction of the emitter beam between the chest and the abducted arm [24–26].

For patients who cannot abduct a limb, two additional projection techniques are proposed. In foreign literature, they are called “lateral axillary projection in trauma” and Velpeau projection. Their implementation requires minimal arm abduction, and they provide information comparable to that obtained with the axillary projection of the shoulder joint [24, 27].

If it is not possible to obtain an axillary lateral projection in any modification, it is allowed to perform a lateral projection of the scapula, which can also be used to judge the location of the humeral head. Radiographs in this projection are obtained when the cassette is positioned along the lateral part of the shoulder joint and the direction of the emitter parallel to the spine of the scapula. This projection is perpendicular to the true anteroposterior projection of the scapula. The latter on such radiographs is represented as the letter Y. Therefore, this projection is sometimes called the Y-projection of the scapula. The two upper arms of the Y represent the spine of the scapula and the coracoid process, respectively, and the lower arm of the Y represents the body of the scapula. The glenoid is located in the center of the Y, where all parts of the letter intersect. Thus, the head of the humerus should normally be in the center of the Y [27, 28].

Another lateral projection is the so-called transthoracic projection. In this projection, the emitter is directed through the chest to the cassette, which is located laterally from the shoulder. Due to the presence of a large number of anatomical structures on the radiographs obtained in this way, their interpretation is difficult. Therefore, this projection is not recommended in the presence of shoulder dislocation [24].

In addition to evaluating the joint itself, radiographs should be carefully examined to identify associated fractures and deformities. If defects in other structures are suspected, X-rays should be taken in additional views to fully describe the damage. If a glenoid bone defect is suspected, an additional axillary projection called “Westpoint” should be performed. This projection is performed with the patient in prone position with the injured shoulder slightly raised on a pillow. The cassette is positioned on the top of the shoulder, and the emitter is directed into the armpit and is positioned at an angle of 25 degrees downward and 25 degrees inward. In this case, a tangential projection of the anterior part of the glenoid cavity is obtained, in which fractures of the anterior edge of the glenoid are easily identified [25, 27].

Another projection that can assist in identifying glenoid defects is called the apical oblique projection (Garth projection). This projection is similar to the true anteroposterior projection of the shoulder, but the emitter is additionally directed at an angle of 45 degrees from top to bottom [29].

In some patients, defects of the humerus head are easily detected by X-ray of the shoulder in normal or true anteroposterior projections. Since the Hill-Sachs lesion is located in the posterolateral part of the humeral head, internal rotation of the humerus when performing "straight" projections improves the visualization of the defect. In addition, there is a special projection for Hill-Sachs damage assessment [27].

For its implementation, the patient lies on his back, his arm is in flexion at the shoulder (120 degrees) and elbow joints so that the elbow is directed above the face upwards. The patient's hand lies on the head. The emitter is directed about 10 degrees cranially onto a cassette placed under the injured shoulder. According to several studies, it is in this projection that it is possible to accurately define and characterize Hill-Sachs damage [24, 27].

Dorgan and McLaughlin note in their works that the assessment of radiographs of the shoulder joint in the anteroposterior and transthoracic projections will inevitably lead the doctor into a diagnostic trap [30]. According to Matsen and Rockwood, an accurate diagnosis of shoulder instability requires radiography in three standard projections: true anteroposterior, lateral scapula, and axillary. Radiography in fewer projections or in other projections may not allow revealing significant pathological changes in the joint [11]. If, for some reason, it is not possible to perform X-ray in all three projections or, according to the available data, it is impossible to establish an accurate diagnosis, if a clarification of the relative position of bone structures is required, CT of the shoulder joint should be performed. With CT, you can not only determine the size and extent of bone defects. Recent developments in the field of CT make it possible to obtain such accurate 3D reconstructions of the shoulder joint that even the smallest defects and disturbances of its anatomy can be detected [31].

If we evaluate bone structures in X-ray and CT examinations, then MRI should be used to detect soft tissue damage. With MRI, we get images in different planes in high resolution, which allows us to fully describe the existing defects. According to numerous studies, MRI plays a leading role in the accurate diagnosis of rupture of the rotator cuff and damage to the articular lip. According to one such study, MRI has 100% sensitivity and 95% specificity in the diagnosis of full-thickness rotator cuff ruptures. In addition, MRI demonstrates 88% sensitivity and 93% specificity in the diagnosis of labial pathology. In one of the latest studies confirming these data, the authors observed 100% coincidence of the magnetic resonance and arthroscopic picture in the diagnosis of injuries of the anterior articular lip, as well as in Hill-Sachs injury [32]. Sensitivity in determining intra-articular soft tissue injuries can be increased by injecting a contrast agent into the joint. These studies, which are called MR-arthrograms, can provide invaluable assistance in identifying the exact boundaries of bone defects and are a necessary addition for preoperative planning [24, 33].

TREATMENT

Reposition time and pain relief. Fresh dislocations should be repaired as early as possible, ideally immediately after obtaining X-ray data in the necessary projections to identify concomitant bone damage. Early reposition allows you to get rid of tension and compression of the neurovascular structures, minimizes muscle spasm, and prevents the progressive increase in the defect of the humeral head with blocked dislocations [15].

When choosing an anesthesia method for performing a gentle (non-coarse) reduction, it is necessary to take into account a number of factors, such as the initial strength of the traumatic effect, the duration of the dislocation, the number of previous reductions, blocked dislocation or not, and the patient's ability to independently relax the shoulder muscles [11]. It is known that some dislocations may be managed without anesthesia. Others, such as chronic blocked dislocations, require brachial plexus block or general anesthesia with muscle relaxants [34]. There is a practice of using narcotic pain relief and muscle relaxants in the elimination of any dislocation of the shoulder. However, there is a danger as the dose required to relax the shoulder muscles in case of dislocation may be sufficient to develop respiratory depression immediately after its elimination. Therefore, it is recommended to inject these drugs only through an intravenous catheter, preferably a central one. This route of administration provides a quick and short action of the drug and allows more precise control of its dose. In addition, a pre-installed intravenous catheter will provide an early start to resuscitation when needed. Aids for tracheal intubation should always be available [11, 34].

S.L. Miller et al. conducted a study that compared two methods of anesthesia for shoulder reduction: intravenous anesthesia with muscle relaxants and intra-articular lidocaine. It was found that the intra-articular use of lidocaine required less effort, money and time of observation of the patient in the intensive care unit [35]. The effectiveness of this method of anesthesia has been confirmed by other studies [36]. Thus, lidocaine anesthesia is particularly successful in correcting dislocation within 5.5 hours of injury [37].

According to this technique, 20 ml of 1% undiluted lidocaine are injected into the joint with an 18–20 gauge needle from a point located 2 cm below the lateral edge of the acromion, posterior to the dislocated head of the humerus towards the articular process of the scapula. The correct position of the needle in the joint is confirmed by the sensation of the passage of the joint capsule and the aspiration of intra-articular accumulated blood. To make sure that the needle has not penetrated the vessel, it is recommended to gently palpate the articular process of the scapula with the needle and focus on the absence of resistance when injecting lidocaine. The time to achieve the maximum anesthetic effect is 15 minutes [37].

Old dislocations require elimination in the operating room after the administration of muscle relaxants and pain medications. If closed methods of reduction do not lead to success, surgeons resort to open elimination of such dislocations. The classic method of surgical treatment is the Dollinger method. The shoulder joint is exposed layer-by-layer with an incision along the deltopectoral

groove. The tendon of the subscapularis muscle is transversely cut off, and the head of the humerus according to Kocher is set into the cavity. The wound is sewn up tightly.

METHODS OF REPOSITION

Once relaxation of the shoulder and shoulder girdle is achieved, various methods can be used to manage dislocation. Shoulder reposition methods are traction and lever. In this literature review, we will not dwell on their description.

TREATMENT AFTER REPOSITION

Assessment. After the elimination of the dislocation, it is necessary to perform X-ray of the shoulder joint in the anteroposterior and lateral projections in the plane of the scapula to assess the adequacy of the reduction and to determine the fractures of the glenoid and proximal humerus. The neurological status, including sensory and motor function of all five major nerves of the upper limb, is reassessed. Pulse filling and the presence of bruises or signs of hematoma in the upper limb are determined [38]. Rotator cuff integrity is determined by the isometric force of external rotation and shoulder abduction. In their work, Trimmings et al. demonstrate that evacuation of blood from the shoulder joint significantly reduces patient discomfort after elimination of the dislocation [39].

Fixation. Since the most common complication after dislocation is recurrence, post-reduction treatment is aimed at increasing shoulder stability. The main elements of treatment are fixation and rehabilitation aimed at strengthening the muscles. In their study, Reeves et al. show that after restoration of the subscapularis muscle in primates, the formation of normal collagen bundles of the joint capsule requires at least 3 months, 5 months before the restoration of the histological structure of the muscle tendon and 4–5 months before the restoration of muscle strength (tension) [40]. It is not known to date whether ruptures of the labrum and tendon tears from the glenoid heal and how long it takes to recover. In any case, it is obvious that it is impossible to immobilize the shoulder joint for the period of complete recovery of damaged structures. In 2001, Itoi et al. offered immobilization of the shoulder joint in the position of external rotation [41]. As a result of the study, it was revealed that, according to MRI data, the anterior lip in this position from the glenoid was separated by a distance of only 0.1 mm, while in the normal position of internal rotation this distance was 1.9 mm. However, in later works, in particular the review by Whelan et al., It was proved in a large sample of 632 patients that there was no advantage in the form of a decrease in the number of relapses after fixing the shoulder in the position of external rotation. There were also no significant differences in the quality of life of patients treated after dislocation in different fixation positions [42]. Therefore, the use of the method of fixing the shoulder in the position of external rotation is not advisable and remains at the discretion of the doctor.

The method of choice for fixing the humerus is a gusset bandage. Compared to the “kerchief”, the use of a Velpeau or Deso dressing does not reduce the incidence of chronic instability and relapse. Thus, the use of bulky and inconvenient bandages for the patient, and even more so their plaster counterparts, is not indicated [43].

The duration of immobilization after the elimination of the dislocation remains a subject of discussion. Most authors recommend immobilization for 3-4 weeks in patients younger than 30 years old and 7-10 days in patients older than 30-40 years old [44]. However, one of the studies conducted revealed a significant decrease in the number of relapses (from 78 to 44% in the first year and from 85 to 69% in the second year), if the limb was immobilized for 4-7 instead of 0-3 weeks. The relapse-free period also increased from 4 to 14 months with longer fixation [45].

On the other hand, Hovelius et al. performed a prospective randomized study with a ten-year follow-up and found that the duration of immobilization does not affect the rate of relapse in the long term [46].

Currently, when choosing the time of immobilization, most authors recommend proceeding from the patient's age, since the duration of immobilization (3 weeks) is significant in young patients (less than 30 years old), while in middle-aged people, the time of fixation has a minimal effect on the development of relapse [47].

One of the protocols for managing patients after the elimination of primary dislocation, offerd by Rockwood, Matsen, includes the following steps. The limb is fixed with a kerchief bandage for 3 weeks. For this period, young patients are limited to flexion in the shoulder joint to 100 degrees, external rotation to 20 degrees, while isometric tension of the rotator muscles and the deltoid muscle is performed. Full flexion / extension of the elbow joint is recommended several times a day to prevent the development of immobilization contracture. Since contractures of the joints of the upper extremity form faster in patients over 30 years of age, the period of immobilization progressively decreases with increasing age [11].

After 3 weeks, during a second examination, the doctor pays attention to the development / absence of contractures. If it is difficult for the patient to perform external rotation to 0 degrees, appropriate muscle stretching exercises are prescribed. If there are no such restrictions, it is allowed to use the hand within the limits of one's own comfortable sensations. The authors use a similar tactic for managing patients after surgery. After 3 weeks, the patient is allowed to begin more intense exercises to strengthen the muscles of the rotator cuff using rubber bands and weights. The patient is informed that strengthening the subscapularis and infraspinatus muscles significantly increases the stability of the shoulder joint [48, 49]. Burkhead and Rockwood, Glousman et al., Tibone and Bradley in their works emphasize the importance of strengthening not only the rotator muscles, but also the stabilizer muscles of the scapula due to their great importance for the normal function of the shoulder joint [48, 50]. Even in cases of chronic shoulder dislocations, Burkhead and Rockwood found that 12% of patients with traumatic shoulder subluxation, 80% of patients with non-traumatic anterior subluxation, and 90% of patients with posterior shoulder instability were cured by completing a full rehabilitation program to strengthen muscles [48]. Brostrom et al. found that 28 out of 33 patients regressed signs of chronic instability, both traumatic and atraumatic genesis after undergoing a course of physiotherapy exercises [51].

To increase endurance and improve coordination 6 weeks after the dislocation, it is recommended to start swimming. By 3 months after the dislocation, most patients have recovered almost complete flexion and rotation of the shoulder. Patients are not allowed to return to sports activity and work with a straight limb raised above the head until normal strength of the rotator muscles of the shoulder, comfortable and almost complete flexion (front) of the arm and stability of the shoulder in positions necessary for the intended activity of the patient [51, 52].

SURGICAL TREATMENT OF ANTERIOR SHOULDER INSTABILITY (ANTERIOR SHOULDER DISLOCATIONS)

Surgical treatment of anterior shoulder dislocations and anterior shoulder instability is indicated in a number of conditions. These include unsuccessful correct conservative treatment, recurrent dislocation in young people, uncontrolled dislocation, open dislocation, and unstable shoulder dislocation [53]. In addition, young active people and athletes are candidates for surgical treatment [47]. Despite the fact that the general principles are clear enough, the exact indications for surgical treatment remain relatively conditional and are interpreted ambiguously by different surgeons. The patient's own expectations must also be taken into account. Thus, some people prefer early surgical intervention to conservative treatment, which may ultimately be unsuccessful [54].

There are several types of surgical treatment for anterior shoulder instability. They include arthroscopic techniques, open procedures with soft tissue repair or augmentation, and open surgery with bone augmentation [47].

The advantages of arthroscopic operations, substantiated in publications, in theory include: shorter operation time, shorter hospital stay, fewer intraoperative complications, lower cost of treatment, less pain in the early postoperative period, reduced incidence of postoperative complications, and better cosmetic effect [55]. However, it should be borne in mind that arthroscopic methods are technically more demanding and difficult to perform in cases of revision operations [53]. It should be noted that the time required for healing remains unchanged when using the arthroscopic technique. These patients need a sufficient period of immobilization and rehabilitation, no less than with open interventions [52].

There are some specific situations where most surgeons prefer to use the open technique. These include operations requiring the isolation and fixation of a bone fragment. Therefore, in cases of large Hill-Sachs lesions or significant glenoid defects, it is recommended to operate openly. Another pathology in which the use of arthroscopic techniques is not the optimal choice is separation of the articular-humeral ligament from the shoulder (HAGL injury). In addition, most surgeons use open surgery for disturbed anatomy in the shoulder joint due to deformities or previous surgery [53].

OPEN SOFT TISSUE SURGERY FOR THE TREATMENT OF ANTERIOR SHOULDER INSTABILITY

Among the large number of techniques and types of surgery that have been described for the treatment of patients with anterior shoulder instability, open Bankart surgery is perhaps the most frequently performed [56]. In this operation, the defect of the articular lip is first determined, then the latter is mobilized and attached to the place of its anatomical location in the region of the anterior lower part of the glenoid edge. Various methods are used to attach it to the edge of the glenoid. According to the original method described by Bankart, holes were drilled in the articular process of the scapula. In his works, he reported the absence of recurrent dislocations in 27 patients who were treated with this method [57]. Other surgeons using the same technique were able to reproduce this result. After Bankart surgery, a recurrence rate of dislocation of no more than 2% has been reported, with good and excellent results in the majority of patients [58, 59]. Currently, instead of drilling holes in the articular process, surgeons use anchors with threads inserted into them to attach the capsule to the edge of the glenoid. When using this technique, good and excellent results are observed in 88–94% of patients with an average follow-up [60]. The recurrence rate of dislocation ranges from 0 to 8% [61]. With long-term (29-year) follow-up described in one of the studies, relapses were also noted with a frequency of less than 10%. Arthrosis of the shoulder joint develops in 40% of patients after this intervention, but clinically manifests itself in only 16.6% of them. In general, despite the development of arthrosis of the shoulder joint, 100% of patients are satisfied with the outcome of the operation [62].

In addition to restoring the lip, some surgeons recommend reducing the capsule itself when it is overstretched. This intervention has received the term "capsule and lip reconstruction". With this technique, one surgical approach is used to correct pathological changes both in the articular lip and in the capsule [63]. After a standard anterior approach, the subscapularis tendon is removed from the joint capsule. After that, a T-shaped cut of the capsule is made, which includes a horizontal and a vertical part. The vertical section of the incision can be displaced laterally, closer to the head of the humerus, or medially, closer to the edge of the glenoid, depending on the technique that will be used or what structures will be repaired. When a horizontal incision is added, two separate capsule flaps are formed, one upper and the other lower. If there is a defect in the articular lip, its restoration is carried out as described above. Then two capsule flaps are placed on top of each other, shifting the lower flap up and the upper flap down. Thus, parts of the capsule overlap, and the total joint volume (capsular volume) is significantly reduced [63]. It should be noted that capsule plication is used only to reduce tissue hyperextension. Excessive anterior plication and capsule tension can alter the biomechanical characteristics of the joint, including a decrease in posterior displacement of the humeral head and an increase in the amount of contact between the articular surfaces when the arm is raised, which in turn leads to the premature development of arthrosis [64]. Using this surgical technique, many authors report good and excellent results with a very low recurrence rate of dislocation. Even in patients with high demands on the function of the shoulder joint, this operation leads to good and excellent results in 92–96% of cases with relapses, according to the literature, only in 0–4% of cases [65, 66].

When reconstructing the capsule and articular lip, the restoration of anatomy and anatomical relationships is of primary importance. The subscapularis tendon is not shortened during surgery, since it is not the cause of pathological changes. On the contrary, it is usually restored to its original length. However, during the Putti-Platt operation, restoration of capsule defects is not

performed. The main procedure performed is the subscapularis tendon transfer. The tendon is divided, crossed in the middle part, placed on its capsule part and sutured. After a vertical incision 2–3 cm long medial to the lesser tubercle, the lateral part of the tendon is fixed to the edge of the articular process of the scapula with sutures through the capsule and the articular lip. The medial part of the tendon is placed on top and fixed to its lateral part. Thus, the tendon of the subscapularis muscle is significantly shortened and the amplitude of external rotation is significantly reduced [67]. Compared to the Bankart operation and the restoration of the lip capsule, the results after the Putti-Platt operation are rather poor. Good and excellent results after such operations are found in 55–85% of patients, and recurrent dislocation is observed in 9–35% of cases [68]. This surgery is also associated with a loss of shoulder strength and decreased range of motion. Although the loss of external rotation can be as high as 40 degrees in some patients, most studies report an average decrease in rotation of 9 to 23 degrees [68, 69]. In addition, long-term follow-up of patients after the Putti-Platt operation revealed a high incidence of clinically manifested arthritis of the shoulder joint. According to several studies, moderate to mild osteoarthritis was found in 26–30% of patients, and the severity of arthritis was directly correlated with the duration of follow-up. It has been suggested that the development of arthritis is associated with the loss of external rotation and posterior subluxation of the shoulder as a result of overstretching of the structures of the anterior sections of the shoulder joint. Moreover, in one of the studies in patients who underwent the Putti-Platt operation, it was shown that even in the absence of a significant loss of range of motion, symptomatic arthritic changes still develop in the joint [69].

Another surgical treatment that disrupts the normal anatomy of the subscapularis tendon is the Magnuson-Stack operation. During this intervention, the attachment site of the subscapularis tendon is transferred from the lesser tubercle to a site that is located lateral to the bicipital sulcus. The main goal of this surgical treatment is to create a rigid anterior soft tissue loop that will hold the head and prevent it from moving anteriorly [70]. Surgeons proficient in this technique achieve good and excellent results in 90–97% of patients with a low relapse rate [71]. Even with long-term follow-up after surgery, a recurrence rate of less than 5% is reported. As would be expected, Magnuson-Stack surgery is associated with limiting the external rotation of the shoulder and its anterior flexion. Compared with patients who underwent Putti-Platt surgery, the loss of movement is minimal and limited to 5–10 degrees [72]. However, there are data in the literature on complications such as posterior subluxation of the shoulder as a result of excessive tension in the anterior part of the joint capsule, as well as damage to the tendon and biceps and early development of arthrosis [73].

OPEN SURGERIES FOR TREATMENT OF ANTERIOR INSTABILITY

In addition to soft tissue techniques, there are a number of different bone surgeries to treat patients with anterior shoulder instability [72, 74]. Defects of the glenoid surface of more than 30% may be associated with persistent instability of the shoulder joint [75]. Thus, if defects of this size are present, they must be filled with bone grafts that fit into the scapula neck region in order to increase the contact area of the humeral head and prevent its anterior dislocation. However, even in the absence of a bone defect in the region of the articular process of the scapula, surgeons perform various operations using bone tissue to stabilize the joint with varying degrees of success [72, 74].

Because of its proximity, the coracoid process is used in the two most commonly performed surgeries to treat anterior shoulder instability. The first intervention is called the Bristow operation, in which the medial part of the coracoid process, while retaining the attachment of the tendons, is transferred through the fibers of the subscapularis muscle and fixed to the anterior lower part of the edge of the articular process of the scapula outside the capsule [76]. Another modification of this operation is the transfer of the coracoid process over the upper border of the subscapularis tendon, rather than through the muscle fibers. At the same time, the edge of the glenoid is cleaned, its decortication is performed in order to improve the fusion between the bone structures. However, due to the remaining soft tissue elements of the joint capsule, the transposed bone will not be in contact with the edge of the articular process of the scapula throughout its entire length. Patient satisfaction with short and medium follow-up after surgery ranges from 82 to 97% [77]. Recurrences of dislocations after such operations are extremely rare, with a reported incidence of 0–6%, but when episodes of subluxation are taken into account, the incidence of instability is much higher, ranging from 8.5–21% [77, 78]. With an increase in the follow-up period after surgery to 26 years, demonstrated in one study, both patient satisfaction with the operation and joint stability decreased to 70% and 85%, respectively [78]. In addition, Bristow surgery is associated with a high incidence of complications, which include loss of external rotation and problems with screw fixation, persistent shoulder pain, and non-union of the bone block. In fact, the incidence of complications associated with screw fixation reaches 24% [77]. In connection with the above, many authors do not recommend Bristow operation as a routine one for stabilizing the shoulder joint [77, 78].

Another operation using the coracoid process is the Latarjet operation. Compared to the Bristow operation, a much larger part of the coracoid process is transferred to the scapula neck. The bone is placed outside the joint capsule and fixed to the scapula with screws [72]. Long-term results are assessed as good and excellent in 88–93% of cases [79]. The recurrence rate of dislocation, including subluxation, ranges from 2 to 10% [79, 80]. With 15-year follow-up, 98% of patients are satisfied with the outcome of the operation. Despite such good clinical results, this intervention is also associated with the development of arthrosis of the shoulder joint. Although most changes are classified as mild arthrosis, the incidence reaches 30–71%. In one study, moderate to severe arthrosis was described in 14% of patients within 15 years after Latarjet surgery [80, 81].

The other most frequently performed bone block manipulation procedure is the Eden-Hybbinette procedure. The first description of the operation, like all its modifications, includes the use of an iliac crest graft and its fixation on the anterior part of the glenoid [82]. Thus, the head of the humerus needs much more displacement in order for a dislocation to occur. Long-term results after this surgery are assessed as good and excellent in 75–85% of patients [83]. However, the evidence for relapse is mixed. Some authors report repeated dislocations in only 4% of cases, others in 33%. Unfortunately, when observing patients for 15 years

after surgery, several researchers found the development of arthrosis in 47–89% of patients [84]. Thus, the Eden-Hybbinette surgery has lost its popularity as the primary surgery for the routine management of anterior shoulder instability.

In contrast to interventions in which the bone block is placed outside the joint, there are techniques in which the bone graft is placed inside the joint. An intra-articular bone graft is usually used to repair rather than augment the glenoid surface. Although the technique of such operations may vary, most surgeons place the bone block in the region of the decorticated neck of the glenoid and fix the graft with several metal screws. The anchored graft is then shaped to fit the surface of the glenoid. Further, the anterior part of the capsule and the tendon of the subscapularis muscle are fixed in their anatomical position. A small number of patients treated in this way demonstrated good results with no threat of dislocation and a return to the previous level of activity, even in athletes. The authors note that the intra-articular positioning of the bone block improves the degree of bone graft fusion, and also allows achieving accurate restoration of the glenoid surface [85]. Thus, although there are insufficient long-term clinical studies, this technique represents a promising alternative to the treatment of glenoid bone defects.

ARTHROSCOPIC METHOD OF SURGICAL TREATMENT FOR ANTERIOR SHOULDER INSTABILITY

The surgical technique for shoulder arthroscopy differs from surgeon to surgeon. Most tend to use the posterior port for the arthroscope and the anterior port for the insertion of instruments. If an examination of the joint reveals Bankart damage, that is, damage to the anterior lower part of the capsule and the lip of the articular process of the scapula, such damage must be repaired. The medially displaced articular lip must be mobilized and attached to the edge of the bean in its anatomical position. This surgery is often referred to as Bankart arthroscopic surgery [86].

At the beginning of the development of arthroscopic technique, metal braces were used to fix the articular lip. Unfortunately, this technique was associated with a fairly large number of complications (12%) and recurrent dislocations (33%) [87]. Several authors have described the application of transosseous sutures under arthroscopic imaging through the glenoid to reattach the detached portion of the articular lip. Although short-term follow-up results after such operations were excellent in the majority of patients, medium-term results deteriorated dramatically over the period from 2 to 8 years: recurrent dislocations were reported in 17% of patients [88]. At present, special anchors with threads inserted into them are used for arthroscopic stabilization of the shoulder joint. These anchors can be inserted into the anterior part of the articular process of the scapula, humerus, etc. Anchors provide a stable base for the attachment of the capsule-lip complex. When using anchors for the treatment of isolated injuries of the anterior part of the articular lip and moderate capsule distension, most authors report good and excellent results, even in those patients who have high demands on shoulder function, such as athletes of intermediate and advanced professional level [89, 90]. With a fairly short follow-up period after surgery, these studies report a very low recurrence rate of dislocations (from 0 to 10% for undemanding patients and from 12.5 to 16.5% for athletes). In the medium-term results (2 to 6 years), the recurrence rate remains quite low: from 4 to 7% [91, 92]. Failures of arthroscopic surgeries are associated with factors such as the presence of a bone defect, lower instability or multidirectional instability, and the total number of anchors used for recovery is less than four [92].

In addition to repairing a torn articular lip, if concomitant capsule defects or ligament tears from their attachment to the humerus are detected, these lesions should also be repaired. Ruptures in the midsection of the joint capsule occur at a rate of about 4% and require anatomical repair for optimal treatment results. As with rupture of the midsection of the capsule, HAGL lesions can occur in 1–9% of cases with chronic instability and may be the reason for the persistence of shoulder instability after surgery [93].

For arthroscopic stabilization of the joint, in addition to the capsule and the articular lip, it is necessary to assess the window between the muscles of the rotator cuff of the shoulder. This is a triangular space bounded by the tendons of the subscapularis, supraspinatus muscles and the base of the coracoid process. Biomechanical studies have shown that these structures ensure stability of the humerus head and prevent posterior, downward displacement and excessive external rotation [94]. In addition, thermal compression of this gap, for example, when using coagulation, leads to a decrease in the displacement of the shoulder head anteriorly [95]. Thus, damage in the area of this window can lead to shoulder instability in several directions. Several surgeons describe arthroscopic techniques for evaluating and closing the interrotator window. In patients with the existing clinical picture or arthroscopic finding of lesions in the interrotator space, it should be closed. The procedure should be performed at a distance of at least one centimeter lateral to the surface of the glenoid in order to avoid tension and constriction of the coracohumeral ligament, which can lead to loss of external rotation. If the patient persists with symptoms of shoulder instability without prior dislocation, isolated closure of the rotator gap can lead to good and excellent results. However, in most patients, closing this window is an additional procedure, a stage of the operation, which is carried out together with the treatment of other injuries [96].

Arthroscopic capsulorrhaphy (capsule closure) can be a laborious and inconvenient task that requires a lot of surgical experience. In order to simplify this procedure, an arthroscopic technique has been developed, which is called "thermal capsulorrhaphy". The effect of contraction of the tissues of the capsule is achieved by thermal exposure to laser radiation or radiofrequency. The end result of the procedure is to reduce capsule stretching, joint volume and displacement of the shoulder head relative to the articular process. However, later it turned out that this operation was associated with unpredictable outcomes. Due to the large number of various complications, thermal capsulorrhaphy has lost its popularity [97].

OPEN SURGERIES THROUGH ANTERIOR ACCESS TO TREAT POSTERIOR INSTABILITY

For some patients with non-traumatic posterior shoulder joint instability, the use of an anterior access in surgical treatment has been described. This operation is similar to that performed for multidirectional instability, when the lower parts of the joint capsule are strengthened. Surgical intervention begins with deltopectoral access. After the release of the tendon of the subscapularis muscle and the release of the capsule, it is separated from the neck of the shoulder posteriorly as much as possible. Then the capsule of the

joint is shifted anteriorly and upward in order to reduce its hyperextension in the anterior, lower and posterior parts of the joint. In addition to manipulating the joint capsule, the anterior approach allows elimination of stretching in the area of the rotator window. Thus, the displacement of the shoulder head relative to the glenoid decreases in all directions. Using this technique, good and excellent results were achieved in 9 out of 10 patients with a follow-up period of up to 5 years [98].

Following traumatic posterior dislocation of the shoulder, a significant bony defect of the humeral head, known as Hill-Sachs reverse injury, may form. If the defect is large enough, then during internal rotation of the shoulder, it can reach the posterior edge of the glenoid. As a result, repeated episodes of instability and relapses of dislocation are possible. Even when anatomical elimination of the dislocation is achieved, it is not possible to maintain congruence and stable movement of the shoulder head. In such patients, the primary pathogenesis is the presence of a bone defect, which can be corrected by McLaughlin surgery. The original description of the operation included an anterior approach with excision of the subscapularis tendon from the lesser tubercle. The tendon was moved to the area of the bone defect in order to fill it and prevent the head from adhering to the posterior edge of the glenoid [99].

The modification of this operation, described by Neer, does not involve cutting off the subscapularis tendon. Instead, an osteotomy of a small tubercle is performed at the site of attachment of this tendon, and the formed bone block is moved to the area of the head defect [100]. This modification creates greater stability and improves the engraftment of the autograft. Although few studies have been published with the results of these operations, the authors note shoulder stabilization and congruence formation, and the presence of unimpeded shoulder movements in most patients [101].

OPEN SURGERIES THROUGH POSTERIOR ACCESS TO TREAT POSTERIOR INSTABILITY

Patients with unidirectional posterior instability or with multidirectional instability of the shoulder, in whom posterior instability is a consequence of the main clinical symptoms, can be operated on through the posterior surgical approach. After access to the joint, if the capsule and articular lip are torn off, these injuries must be repaired. In addition, if an overstretching of the posterior part of the joint capsule is detected, it is necessary to suture the capsule, capsulorrhaphy, in the same way as in the anterior approach. Since the posterior part of the joint capsule is very thin and fragile, the surgical technique when working in this area must be precise and meticulous.

Previously, some surgeons preferred to perform posterior capsulorrhaphy with metal staples. However, unsatisfactory results of such operations occurred in 45% of patients. The reason for this could be the general hyperelasticity of the ligamentous apparatus and undiagnosed multidirectional shoulder instability. Currently, the fixation of the capsule with staples has been abandoned in favor of suture material. The capsule suturing results are more promising. According to research, good and excellent results are observed in 80–92% of patients. The recurrence rate of dislocation ranges from 11 to 23% [97, 102].

There is an opinion that patients with recurrent posterior shoulder instability have excessive retroversion of the glenoid, and this is the reason for the failure of surgical treatment. If the patient has significant retroversion (more than 30 degrees), it is possible to restore the normal position of the articular process by posterior osteotomy of the glenoid. In this case, a posterior surgical approach is used. The joint is reached in a blunt and sharp way, a wedge-shaped osteotomy is performed at the level of the posterior part of the scapula neck. The open wedge can be filled with a bone graft from the iliac crest or the posterior part of the acromial process. The access to the scapula neck must be performed carefully so as not to damage the suprascapular nerve that runs in this area [7, 101].

The results of osteotomy of the glenoid, according to the literature, are satisfactory. In one study, out of 32 osteotomized patients, 82% had good and excellent results. The recurrence rate ranged from 12 to 17%. Unfortunately, after these operations, various complications also develop, such as anterior subluxation of the shoulder, coracoid impingement, arthrosis of the shoulder joint and intra-articular fractures of the glenoid. Therefore, these interventions are recommended only for those patients in whom the retroversion of the glenoid exceeds 30 degrees [103, 104].

ARTHROSCOPIC INTERVENTIONS FOR TREATMENT OF POSTERIOR SHOULDER INSTABILITY

When revealing the detachment of the posterior part of the capsule and the glenoid from the glenoid, the damaged structures are mobilized and attached to the posterior edge of the glenoid. Currently, anchors with threads are used for this. In contrast to the anterior instability of the shoulder, detachment of the capsule and glenoid lip from the glenoid is much less common here. For the development of posterior instability, the development of hyperextension of the joint capsule is the most significant. To eliminate overstretching of the joint capsule, its arthroscopic suturing is performed [105].

When using this technique, good and excellent results are noted in 86–96% of patients with short and medium follow-up periods. The recurrence rate of dislocation in such patients ranges from 0 to 12% [105, 106]. One study confirms that isolated posterior dislocations after surgery are very rare. Clinically significant subluxations are more common. In this study, 11% of patients had positive tests for shoulder instability and 8% of patients had to undergo revision procedures due to persisting pain, instability and decreased joint function [107].

As with anterior and multidirectional shoulder instability, some surgeons recommend the use of thermal capsulorrhaphy to reduce stretching of the posterior portion of the capsule. However, as mentioned above, this technique is associated with unacceptable risks and complications resulting in persistent pain, instability and damage to the joint capsule tissue. Therefore, the routine use of this method as a primary one is not recommended.

CONCLUSION

Thus, at the present time, with traumatic fresh dislocation of the shoulder, the classical approach is preserved, i.e. under local, regional or general anesthesia, the dislocation is eliminated, the limb is immobilized with a kerchief bandage. There is no unanimous view on the immobilization period, but the older the patient, the shorter the immobilization period. After the elimination of the dislocation, young active patients, especially athletes, should undergo magnetic resonance imaging of the damaged joint to identify the accompanying dislocation injuries. Particular attention should be paid to early detection of concomitant injuries of muscles, tendons, nerves in order to prescribe the correct treatment and improve clinical outcomes. There are no generally accepted indications for surgical treatment of such victims. It all depends on the preferences, experience of the surgeon and the equipment of the clinic. The operation is definitely necessary for irreducible dislocation, habitual dislocation and open shoulder dislocation. Preference is given to operations with the restoration of anatomy, whereas at the end of the last century, techniques were often used that limit the range of motion in the shoulder joint. Currently, non-physiological reconstructions are discouraged because they impair the normal biomechanics of the shoulder joint and do not directly affect the pathological substrate of damage. Gradually, the scale tips towards arthroscopic options for operations. By and large, there is not yet one operation or technique that is associated with the best results. Thus, the choice of a particular operation should be based on the patient's expectations, as well as on factors associated with the surgeon, such as proficiency in a particular technique, experience, and the availability of instruments and equipment.

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