



TREATMENT FRACTURES PROXIMAL PART OF THE HUMERUS BONES

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Annotation. The problem of treating patients with fractures of the proximal humerus is relevant due to the high frequency of this injury, which is 45% from the number of all fractures of skeletal bones in persons over 40 years of age is observed in 76.82% of cases. Injuries to the proximal part of the shoulder often lead to a pronounced violation of the function of the upper limb due to the development of contracture of the shoulder joint. Majority (80.85%) fractures of the proximal humerus are not accompanied by displacement of fragments or have minimal displacement and can be treated conservatively with a good and excellent functional outcome. However, in the treatment of unstable fractures with displacement of fragments, closed reposition or skeletal traction followed by fixation with a plaster cast is often (up to 50%) used. They lead to unsatisfactory results. Open reposition creates the necessary conditions for accurate anatomical comparison of fragments, but when using conventional access in this area, it is difficult to ensure a good view during surgery and stable osteosynthesis. Even technically correct fixation with a high-quality implant does not always allow you to avoid further screw migration or plate fracture; and consolidation in the correct position does not guarantee satisfactory function of the shoulder joint. The disadvantage of plate osteosynthesis is a large number of complications: plate instability, impingement syndrome, aseptic necrosis of the head of the humerus followed by its destruction in 12-35% of cases. When osteosynthesis is performed with a blocked rod, there is a high risk of damage to the radial and axillary nerves with screws. A common disadvantage of external fixation devices is that they do not always allow for effective reposition of fragments, especially in cases of long-standing, multi-comminuted fractures, in the presence of angular and rotational displacements. In addition, the application of a compression distraction device is a rather complex operation and in some cases presents serious inconvenience to the patient. Despite the large number of conservative and operative techniques used for this type of injury, there is still no single approach to choosing a treatment method depending on the patient's age, nature and duration of the injury. According to Professor S.E. Lvo, taking into account the mental state of the patient, professional features of the function, characteristics of biomechanics, blood circulation and innervation of the hand is crucial in the preparation of a rehabilitation complex. The least traumatic method, which provides good anatomical and functional results, is a closed reposition of splints with knitting needles under the control of EOP. However, all known methods of percutaneous fixation with knitting needles have common drawbacks: the difficulty of achieving anatomical reposition, insufficient stability of osteosynthesis is, and a high risk of vascular and nerve damage during knitting. The need to further improve existing and create new methods of osteosynthesis in fractures of the proximal humerus, as well as to evaluate the results of treatment by various methods, determined the relevance of the chosen topic and served as the basis for this work.

The relatively benign radiographic appearance of isolated tuberosity fractures of the proximal humerus belies the poor functional outcome that can result from inappropriately treated injuries. While patient functional outcomes following non-operative management of two-part surgical neck fractures have generally been good,^{34, 11} the outcomes of conservatively treated, displaced



fractures of the greater and lesser tuberosity have been disappointing. Despite the disparity in the literature regarding the magnitude of displacement of the greater tuberosity that warrants surgical intervention, most authors agree that even 5mm of posterior-upper displacement may lead to clinically significant impingement. Tuberosity fractures can occur either as part of a comminuted fracture of the proximal humerus, or in isolation. Isolated fractures of the large tubercle are associated with dislocation of the humerus in about 10-30% of cases. Because isolated small tuberosity fractures are rare, there is much less literature on the treatment and outcomes of this injury, and our current knowledge is based on a series of cases and individual reports. A systematic protocol for identifying these sometimes difficult-to-recognize fractures and solutions that require surgical intervention to optimize functional outcome will be essential for all orthopedic surgeons and physicians dealing with upper limb injuries. mm of posterosuperior displacement can lead to clinically significant impingement. Tuberosity fractures may occur either as a component of a comminuted proximal humerus fracture or in isolation. Isolated fractures of the greater tuberosity are associated with a glenohumeral dislocation in approximately 10–30% of cases. Because isolated lesser tuberosity fractures are uncommon, there exists far less literature on the management and outcomes of this injury, with the mainstay of our current knowledge based on case series and isolated reports. A systematic protocol for identifying these sometimes difficult to recognise fractures and deciding which require operative intervention to optimise functional outcome will be essential for all orthopaedic surgeons and physicians dealing with upper extremity trauma.

Epidemiology

Fractures of the proximal humerus account for approximately 5% of all fractures and almost half of all humerus fractures. Isolated fractures of the small hillock are extremely rare. Fewer than 100 cases are described in the literature, so isolated fractures of the small humerus account for approximately 2% of all fractures of the proximal humerus. In contrast, the incidence of isolated fractures of the greater tubercle is estimated at 20% of all fractures of the proximal humerus. In addition, isolated

Classification

The most frequently cited classification of proximal humerus fractures is the Neer which itself is a modification of the original Codman description, which consists of four well-defined parts of the fracture-the large and small tubercles, the head of the humerus, and the diaphysis. An offset of more than 1 cm or a tilt angle of more than 45° is required for classification as a part. Therefore, isolated tuberosity fractures with displacement, as well as surgical or anatomical neck fractures with displacement, are considered.

Muscle-deforming forces

The shoulder mounds serve as attachment points for the rotator cuff musculature. The most proximal part of the articular surface is located 6-8mm above the tubercles, which prevents the bumps from colliding with the acromial lower surface. The subscapular muscle is attached to the small tubercle, and the supraspinatus, subspinatus, and small round muscles are sequentially attached to the large tubercle. The tendon of the long head of the biceps muscle passes through the interbugular

Clinical assessment

As discussed earlier, isolated tuberosity fractures occur in younger and physically fit patients. Several mechanisms have been proposed. When falling on an elongated upper limb, the



breakage of the tuberosity and the spread of the fracture can occur secondary to the eccentric load applied to the corresponding hillock by the attached rotator cuff. 38, 19 In a recent review of 103 patients with isolated large tubercle fractures conducted by Bahrs et al., more than half of these injuries occurred in

Concomitant injuries

Most combined injuries are found in combination with fractures-dislocations of the tuberosity and involve adjacent neurovascular structures. Nerve damage occurs in about one-third of fractures-dislocations of the large tubercle, with recovery in most cases after a few months, indicating that most of them are low-grade neuropraxia or axonotmesis secondary to the sprain or external pressure during the initial injury. Axillary nerve damage is most often described in anterior

Treatment of tuberosity fracture

The exact surgical threshold for tuberosity displacement to maximize the patient's functional outcome remains controversial. Fractures of the large tubercle without displacement or with minimal displacement (<5 mm) are usually treated without surgery.⁴⁰ These fractures are usually stable, and early mobilization of the shoulder joint begins after a short period of immobilization. Platzer et al. examined 135 patients with isolated fractures of the large tubercle less than 5 mm.

Fractures of the large tubercle

Accesses to tuberosity include both open and arthroscopic techniques. Open techniques can be performed through a standard deltopectoral approach or through a split deltoid access. More recently, arthroscopic assistive techniques have been described that allow a more complete assessment of the rotator cuff of the shoulder and minimize soft tissue dissection. 8, 56, 6, 16, 48 Considering anatomical abnormalities in cases of fractures, these procedures require experienced arthroscopists.

Fractures of the small hillock

Surgical treatment of isolated fractures of the small tubercle is a unique problem. The integrity of the proximal humerus in patients with an immature skeleton should be maintained during fixation of the fracture. Fixation techniques using a thick seam and suture anchors can minimize physical injury.³¹ In adult patients, cannulated screws with or without washers were used, 38, 57, 43 a thick suture and cerclage wire 38, 20 . Removal of the subscapular muscle and bone fragment is often required.

Postoperative rehabilitation

Rehabilitation schemes are selected individually and adapted based on concomitant injuries, bone/soft tissue quality, strength of fixation, and the patient's expected compliance with the treatment regimen. Postoperative tuberosity fractures follow a patient-like protocol after rotator cuff repair. This is especially true for those patients with severe comminuted tuberosity fractures whose bone fragments have either been removed or incorporated into the suture material. Immediate pendulum exercises

Complications of surgical treatment

Complications after surgical fixation of tuberosity fractures include complications of other extra-articular metaphyseal fractures, namely infections, improper fusion, non-fusion, AVN, adhesive capsulitis, and iatrogenic neurovascular injuries. They can be minimized through careful surgical



techniques, early diagnosis, and intervention. No large series of tuberosity fractures specifically investigated these complications. Infection of the shoulder joint or subacromial space after open or arthroscopic access

Resume

Recent outcome studies have reported functional deficits in patients with missed or incorrectly treated isolated tuberosity fractures. This highlights the importance of timely diagnosis, which begins with a thorough medical history, elucidation of the mechanism of injury, and physical examination, which should include a secondary examination of the musculoskeletal system. Fractures of the large tubercle and displacement are best detected on the shoulder projection in a straight projection with external rotation.

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