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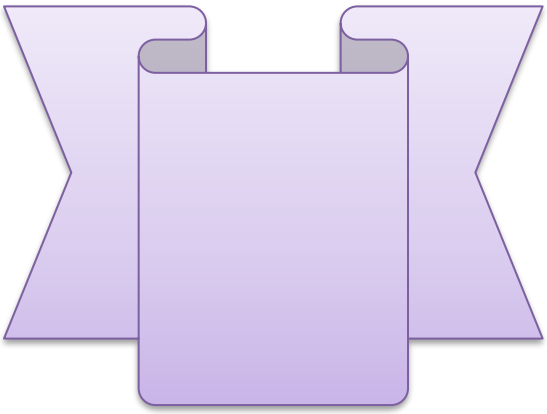

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Original Article

Comparative Study Between Operative and Conservative Treatment of Un-Displaced Isolated Greater Tuberosity Fracture of The Humerus

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ABSTRACT

Background: Fractures of the greater tuberosity of humerus account for one fifth of all fractures affecting the proximal ⅓ of humerus. Although a displacement of 3-5 mm in fractured greater tuberosity indicates surgical intervention, less displaced tuberosities can be managed nonoperatively in young athletes as well as more displacement in older groups. Surgical modalities include open reduction and internal fixation (ORIF) using plate and screws, fragment excision, and percutaneous fixation.

Aim of the Work: This study aims to compare between the operative and conservative treatment of un-displaced isolated greater tuberosity fracture of the humerus

Patients and Methods: We performed a prospective interventional study involved 20 patients with isolated greater tuberosity fractures. Divided equally into 10 patients in each group (conservative group and operative group). Radiographic healing was evaluated in the follow-up images. For the objective evaluation, the DASH score was used.

Results: The mean age in conservative group was 37.7 years and in operative was 36.9 years. Male patients represented 60% and 70% within conservative and operative groups respectively. Four patient (40%) had anterior shoulder dislocation within operative group. The two groups were not different statistically regarding range of motion. The median DASH score of operative group 13.49, while it was 20.83 within the conservative group.

Conclusion: Un-displaced greater tuberosity fractures can be treated without surgery with good outcome; however, there are indications for surgical interventional with benefit of provides early return to life activity as it enhances early union.

Keywords: Greater tuberosity; Fractures; Humerus; DASH score.

INTRODUCTION

Fractures of the greater tuberosity are common injuries observed in emergency settings, generally affecting older individuals with osteoporotic bone after low velocity trauma [(1)].

Management of greater tuberosity fractures depends on a number of clinical variables, including the existence of shoulder instability, other shoulder injuries, and the patient comorbidities, and functional demands [(2)]. Many mildly displaced fractures of the greater tuberosity can be treated conservatively by immobilization for 3 to 4 weeks of by pouch arm sling, followed by early passive movement [(3)].

If the fracture was displaced by the rotator cuff more than 5 mm posteriorly and superiorly, it will need reduction and internal fixation, and if not reduced, it may heal with substantial superior displacement, which narrows the subacromial space and may cause impingement upon arm elevation [(4)].

Surgical treatment of greater tuberosity fractures includes, both open and arthroscopic surgical procedures, depending on the nature, pattern, and surgeon's preference of the fracture [(5, 6)].

In this study, we aimed to compare between the operative and conservative treatment of un-displaced isolated greater tuberosity fracture of the humerus.

PATIENTS AND METHODS

This prospective interventional study involved 20 patients with isolated greater tuberosity fractures of the humerus; divided into two groups, **Group A:** Ten patients that were managed conservatively and immobilized in arm slings for 2-3 weeks followed by gradual range of motion, and **Group B:** Ten patients were managed surgically and immobilized in arm slings temporarily till they can be operated upon as soon as possible. Our study followed the Helsinki declaration principals, and it was approved from the ethical committee of Faculty of Medicine (Al-Azar university). Written informed consent was obtained from each patient. We recruited the patients according to the following criteria:

The inclusion criteria: 1) Skeletal maturity, 2) Age between 18 and 70 years old, 3) Bilateral or unilateral isolated greater tuberosity traumatic fracture (less than 5 mm displacement).

The exclusion criteria: 1) Proximal humeral fractures, 3 parts and 4 parts fractures. 3) bone deformity or diseases. 4) Unfit for surgery patients. 5) patients with pathological fractures.

Data collection: All study patients were subjected to complete medical history taking, general examination, shoulder examination, neurovascular examination, and routine laboratory investigations. General shoulder functions and rotator cuff function were determined clinically using routine tests and goniometer motion measures. Neer's clinical test were used to diagnose impingement syndrome. For the objective evaluation, the DASH score was utilized. The DASH score was categorized as outstanding (0–24), good (25–49), moderate (50–74), or poor (75–100). Plain X - ray (anteroposterior and trans-scapular lateral view) of the shoulder was done. CT scan (figure 1, 2), or MRI were interpreted in case of subtle fractures on plain radiograph.

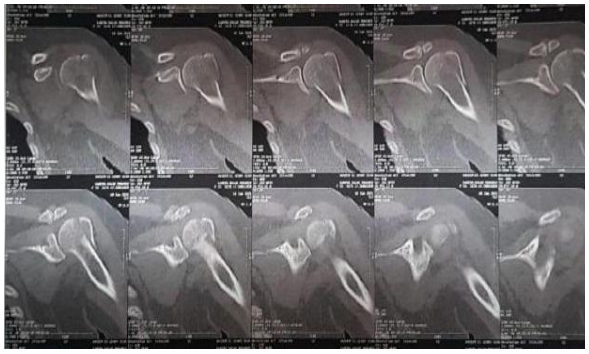

Figure (1): CT of shoulder: Coronal view

Figure (2): CT of shoulder

Techniques

Operative group: Patients were immobilized in arm slings temporarily till they can be operated. Six patients treated with screw fixation and four with plate.

Treatment using plate

All patients were placed in a beach-chair position under general anesthesia, which may have included a regional block. Utilizing a deltopectoral approach, the necessary surgical procedures were performed. Starting from the coracoid process, an 8 cm to 10 cm incision was made along the deltopectoral groove, the inter nervous plane was identified and separated, the fracture fragments were identified, and the hematoma was completely drained. For future healing, tag sutures were placed through the rotator cuff muscles.

In both orthogonal views, K wires were used to do preliminary reduction, which was then examined. Plate was placed 5 to 8 millimeters distal to the greater tuberosity and 2 to 4 millimeters posterior to the bicipital groove. All of the cases were meticulously sealed. All patients were kept in arm pouches following surgery. The mobilization process began on postoperative day one. In each case, identical pain management protocols were implemented.

Screw fixation

This operation is usually performed while the patient is seated in a beach chair. Percutaneous instrumentation was done through the safe zones to minimize the chance of neurovascular structure injury. Reduction of the greater tuberosity was done followed by fixation of the greater tuberosity temporarily (figure 3). Then, fixation of the larger tuberosity was done through 3.5 mm cannulated lag screws or small fragment screws (figure 4). Washers may be recommended for patients with osteoporosis or fractures. Once osteosynthesis has been performed, all K-wires was removed.

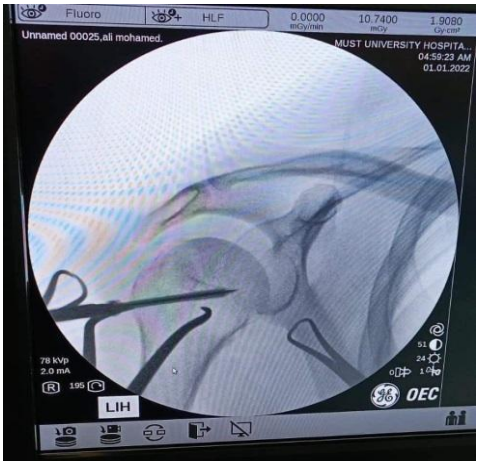

Figure (3): Fixation of the greater tuberosity

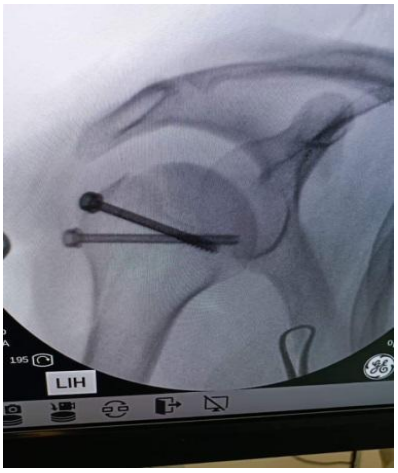

Figure (4): Completed osteosynthesis

Postoperative care

A six-month postoperative follow-up plan was adopted starting at day zero postoperatively, then in 3 weeks. 6 weeks, 3 months, and lastly 6 months. Each visit included clinical and radiological evaluations of the pain, function, and range of motion. At each follow-up, anteroposterior and axial X-rays were performed on all patients in order to determine if the fracture unions were complete and to remove all K-wires. Examine fixation through image intensification.

In conservative group: the immobilization was done for 3-4 weeks, followed by gentle range of motion exercises. Depending on the damage and its rehabilitation, isometric workouts may begin earl

Follow up

General health, physical examination, skin and wound conditions, radiological evaluation to determine the rate of union, clinical assessment of the muscle bulk and tone, and finally the functional assessment using The DASH score could be good (25-49), moderate (50-74), or bad (0-24). (75-100). True antero-posterior radiographs of the glenohumeral joint were assessed to determine union and the relation between the tuberosity and the head.

RESULTS

The mean age in conservative group was 37.7 years and in operative group was 36.9 with a statistically non-significant difference. Male patients represented 60% and 70% within conservative and operative groups respectively. There is statistically non-significant difference between the studied groups regarding range of motion. Four patient (40%) had anterior shoulder dislocation within operative group. The median DASH score of operative groups was 13.49, while it was 20.83 within the conservative group. The mean DASH score of complicated cases was 39.3. One patient in conservative group needs MRI that has been shown impingement syndrome, while two patients (20%) within the operative group needs MRI, and one of them has been shown rotator cuff tear.

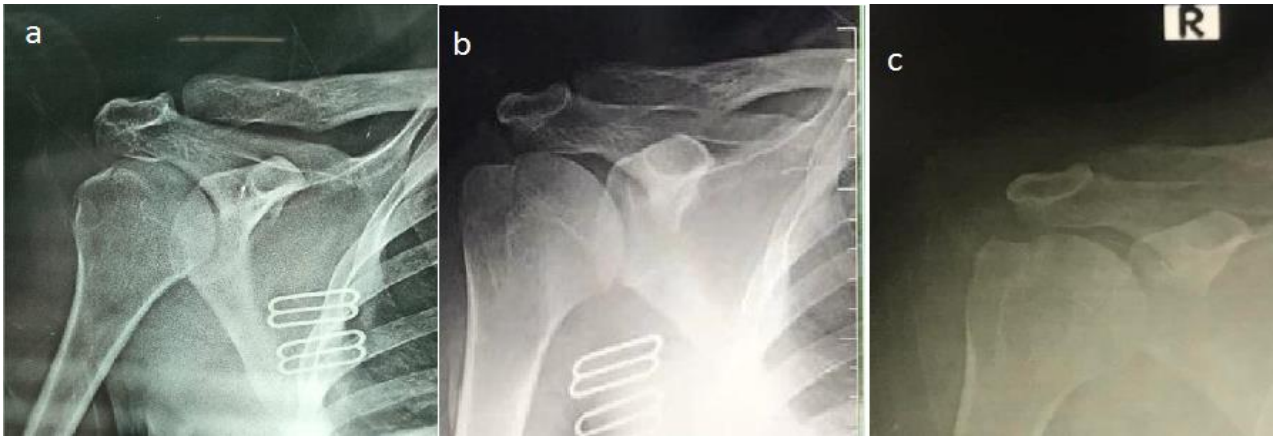

Figure (5): A 40-year-old woman presenting after a fall on the right shoulder, plain x-ray AP shows greater tuberosity un-displaced fracture **(a)** at presentation and **(b)** after 3 weeks of follow up and **(c)** with complete healing of the fracture

Figure (6): Patient examination on the follow up for the range of motion for right shoulder

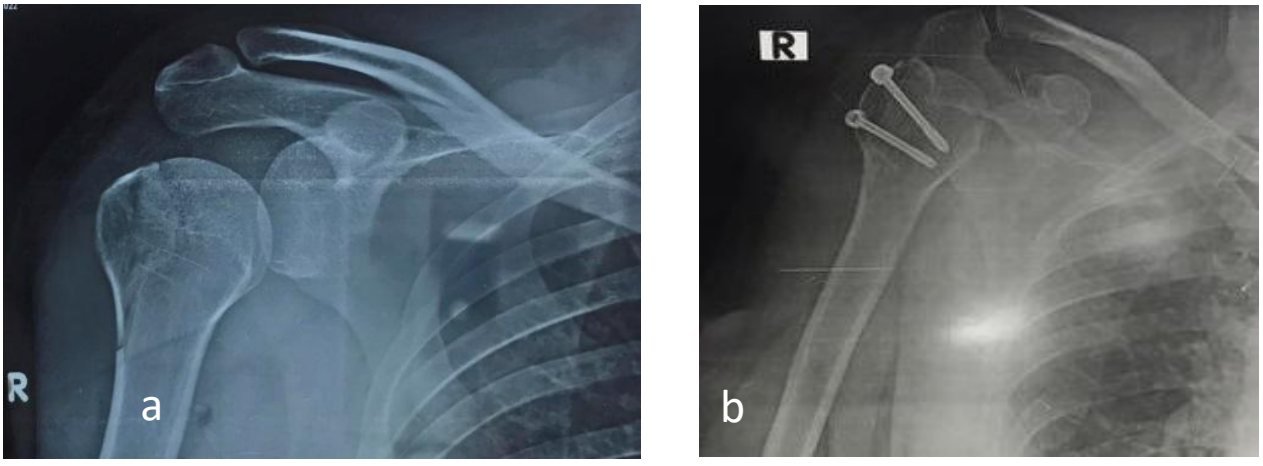

Figure (7): A 41-year-old male porter presenting after a fall on right hand with hyper abduction of the right shoulder, plain x-ray AP shows greater tuberosity un- displaced fracture **(a)** at presentation and **(b)** after 3 weeks of operation with fixation by 2 cannulated screws (**c)** with complete healing of the fracture after 4 months

Figure (8): Patient examined for range of motion of the shoulder.

DISCUSSION

Proximal humeral fractures (PHFs) are the third most common type of fracture in older people, after proximal femur fractures and distal radius fractures. They make up 5% of all fractures in the body [(7)]. Non-surgical treatment of greater tuberosity fractures doesn't work well, and even a small shift in the greater tuberosity can cause disability [(8)].

In our study there is four patients (20%) with anterior shoulder dislocation underwent operative management. The greater tuberosity fracture after glenohumeral dislocation, even if it is anatomically reduced, should be thought of as highly unstable and at risk of secondary displacement. Recent studies have shown that these fractures must be treated surgically when they are caused by glenohumeral dislocation [(9)].

Schliemann et al. [(10)] evaluated 102 patients with isolated greater tuberosity fracture un-displaced, 76.5 % of the patient underwent surgery either due to secondary displacement on the follow up. the concomitant soft tissue lesions were found frequently after shoulder dislocation which cause recurrent dislocation in patient with greater tuberosity fractures need to surgical intervention.

Since the greater tuberosity is an important component of subacromial gliding mechanism and serves a major insertion of rotator cuff which is a dynamic stabilizer of the joint is should be addressed if present [(11)]. Furthermore, The Rotator cuff tear leave avascularized area affect the bone healing [(12)].

Comminuted fractures of the greater tuberosity are rotator cuff tears with an associated fragment of bone, so recent studies recommending sutures as part of the fixation technique [(13)]. We have two patients with rotator cuff tear interfere with the improvement of the patient with limited range of motion underwent operative management.

The recommendation of Neer [14] to treat the tuberosity of less than 1 cm non operatively has been revised, and in current literature it is recommended that surgical fixation be used regardless Neer recommendation for fractures in active patient with frequent overhead activity.

Although it is frequently reported in the literature that 60% to 80% of nondisplaced or mildly displaced fractures can be treated conservatively, the vast majority of such fractures are now treated surgically, and the threshold values for a surgical indication have been lowered [15].

We have four young active patients underwent operative management by screws. These fractures in young patient better to treat operatively with better outcome and early return to activities [10].

Most current literature have lower set the criteria for surgical management of isolated greater tuberosity in active patient who involved in an overhead activity [9].

One patient in our study had previous proximal femur with DEXA showing osteoporosis, the most affected site by decrease bone mass and osteoporosis of proximal humerus is the greater tuberosity, which affect the outcome with poor healing [16].Similarly, **Schliemann et al.** [10] found that 50 to 60 % of un-displaced isolated greater tuberosity fractures show further displacement over the time. our study had displacement on the follow up which need for reduction and fixation.

The extremely limited number of patients in this study is one of its drawbacks; hence, it was unable to entirely eliminate evaluation bias.

Conclusions: Fractures of the isolated, non-displaced greater tuberosity may show mild imaging findings and may not be noticed on radiographs, so additional views are needed and should be performed. Conservative treatment for un-displaced greater tuberosity fractures is the best choice, however surgical interventional necessary in Secondary displacement on the follow up to avoid malunion, osteoporotic patient, young active athletes, shoulder dislocation, epileptic patient, non-union at six weeks after trauma and Rotator cuff tear as it affects the healing. Complications such as intraoperative or post-operative like infection occur with operative treatment, while nonunion and sub acromial impingement occurred with conservative-treatment.

Conflict of Interest and Financial Disclosure: None.

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