Technical Note

Arthroscopic Treatment for Greater Tuberosity Fractures: Rationale and Surgical Technique

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Abstract: A description of a new technique for arthroscopic treatment of minimally displaced greater tuberosity fractures of the humerus and associated soft tissue lesions is presented. This kind of fracture is usually treated nonsurgically. However, recent evidence suggests that even a small amount of superior displacement may produce shoulder dysfunction and require a perfect surgical reduction and fixation. Moreover, any displaced fracture of the greater tuberosity presents a high rate of associated and largely undetected soft tissue lesions. To avoid underestimating accompanying soft tissue pathology, arthroscopic assessment before open treatment of greater tuberosity fractures has been suggested. In 2 earlier case reports, we described the use of an arthroscope not only to diagnose and treat a rotator cuff tear and a Bankart lesion associated with a minimally displaced greater tuberosity fracture but also to arthroscopically reduce and treat the fracture. With advancements in arthroscopy and equipment, we refined and systematized the original arthroscopic technique that we have routinely used since 1997. This article presents the new technique. **Key Words:** Fracture—Greater tuberosity of the humerus—Arthroscopy—Surgical technique—Associated lesions.

Nonsurgical treatment is the mainstay for minimally displaced greater tuberosity fractures (less than 10 mm of displacement).[1,2] The rationale for surgical treatment, consisting of reduction and fixation of a greater tuberosity fracture,[3,4] is prevention of nonunion, impingement of the greater tuberosity beneath the acromion, or mechanical blockage of abduction of the shoulder by a superiorly displaced tuberosity[1,2,5] or reduction of external rotation because of a posterior displacement. Moreover, the healing of a greater tuberosity fracture in slight displacement may provoke disability, altering the point of the attachment of the rotator cuff.

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The exact amount of displacement acceptable for conservative treatment varies in different reports. Although almost all authors recommend open reduction for 1 cm or more of displacement, more recently, Bigliani et al.[6] reported that displacement greater than 5 mm should be reduced surgically. According to others authors, even for smaller displacements (3 mm), surgical treatment should be considered for athletes or people engaged in heavy labor who perform overhead activities.[7]

Furthermore, any displaced fracture of the greater tuberosity, whether associated with dislocation or not, presents a high percentage of accompanying soft tissue lesions.[7] Persistent late pain after a greater tuberosity fracture treated conservatively is a relatively common clinical finding, and this may be due to a rotator cuff tear.[8]

Moreover, greater tuberosity fractures associated with glenohumeral dislocation show a much higher frequency of labral lesions than those with verified nondislocation.[9]

Conventional imaging methods are limited in detecting soft tissue involvement. Therefore, arthroscopic assessment before open treatment of greater

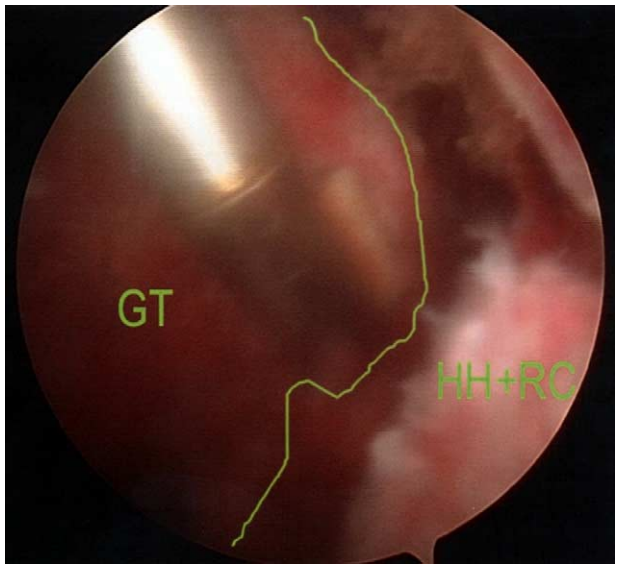

Figure 1. After a long washing of the subacromial space the fracture is identified and the humeral fracture bed is cleaned of fibrous tissue. GT, greater tuberosity; HH, humeral head; RC, rotator cuff.

tuberosity fractures has been advocated.[7] Although shoulder arthroscopy in a fracture situation is more difficult than usual, it allows the surgeon to identify, clarify, and treat lesions otherwise missed, thus explaining residual complaints in patients with greater tuberosity fractures that appear healed on radiographs.[8]

With recent advancements in arthroscopy, the concomitant arthroscopic treatment of the greater tuberosity fracture appeared to be a feasible and attractive challenge, and we reported on 2 cases of fractures with associated soft tissue lesions (respectively, a rotator cuff tear and a Bankart lesion) treated using an all-arthroscopic technique.[10,11] However, these case reports referred to isolated and occasional cases.

From 1997 on, we have routinely treated minimally displaced greater tuberosity fractures and associated soft tissue lesions arthroscopically, with remarkable clinical results. We present our original arthroscopic technique for the treatment of minimally displaced greater tuberosity fractures of the humerus.

SURGICAL TECHNIQUE

As for every shoulder procedure, our preferred anesthesia is general with interscalene block supplementation. We place the patient in the sitting position and the arm is prepared and draped routinely. At this point, fluoroscopic imaging is performed to ensure the position of the greater tuberosity. In some cases, a Kirschner wire is inserted through the tuberosity and the humeral head to fix the fragment in that position.

The incision for the scope is made more superior and lateral of the classical soft spot, allowing a better vision of the greater tuberosity and the rotator cuff during the subacromial time, and is placed 0.5 cm inferior and 0.5 cm medial to the posterolateral corner of the acromion. This position also allows a comprehensive glenohumeral inspection. A blunt obturator and trocar are inserted into the glenohumeral joint.

The arthroscopic pump is connected, and a diagnostic examination of the joint is performed. Any significant capsulolabral lesions detected are repaired.[11] The arthroscope is then removed, and attention is turned to the subacromial space. After a long washing of the subacromial space, a lateral portal site is identified with a spinal needle. A 7-mm diameter self-sealing cannula is inserted, followed by an arthroscopic probe. The fracture should be identified, the humeral fracture bed must be cleaned of fibrous tissue (Fig 1), and it should be abraded with a power bur.

Usually, an anterior portal is created, and a 5.5-mm diameter self-sealing cannula is inserted. The greater tuberosity is then reduced using a metallic blunt trocar passing through the lateral cannula (Fig 2) or percutaneously through a more posterior access. The trocar generally is used for pushing the tuberosity anteriorly and inferiorly. The tuberosity is also pulled in the same direction using 1 or 2 arthroscopic graspers that grasp the

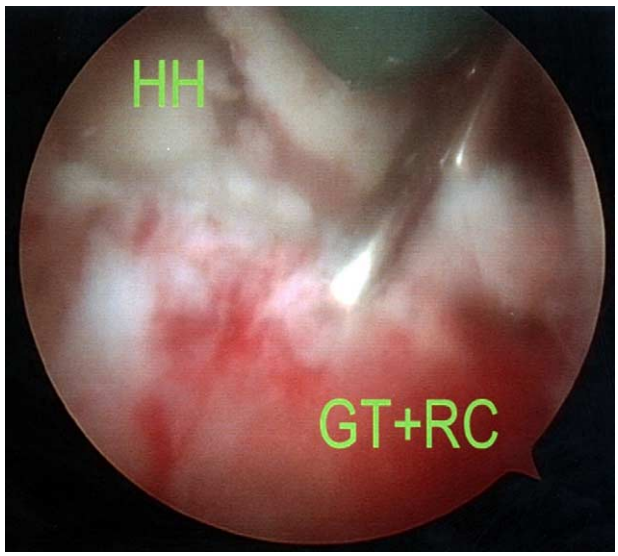

Figure 2. The greater tuberosity is reduced using a grasper passing through the lateral cannula. GT, greater tuberosity; HH, humeral head; RC, rotator cuff.

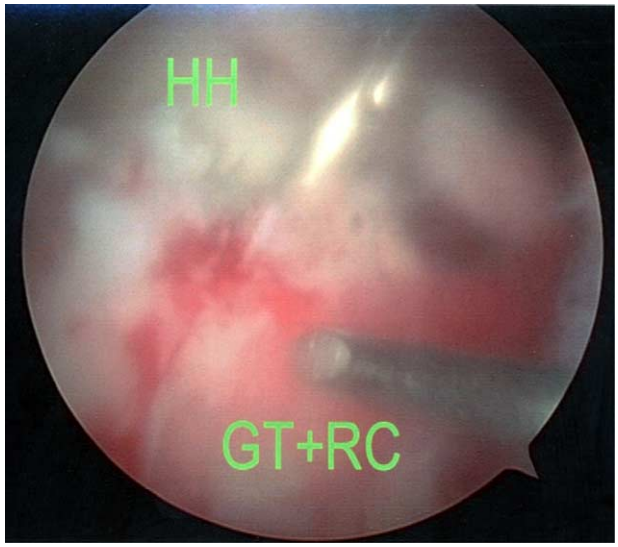

FIGURE 3. Arthroscopic picture showing a Kirschner wire placed percutaneously through the tuberosity fragment into the humeral head under arthroscopic guidance. GT, greater tuberosity; HH, humeral head; RC, rotator cuff.

rotator cuff just laterally and anteriorly from the greater tuberosity. The grasper most frequently is used passing through the anterior cannula.

When the fracture is reduced, 2 or more Kirschner wires are placed percutaneously through the tuberosity fragment into the humeral head under arthroscopic guidance (Figs 3 and 4). The wires must all be the same length. Fluoroscopic imaging is then performed to check the placement of the wires to ensure appropriate screw position. At this point, 1 or 2 partially threaded cannulated screws are inserted over the guidewires, which should result in firm, compressive fixation of the tuberosity (Figs 5 and 6).

The diameter and the length of the screw vary, depending on the bone stock of the fragment and on the dimension of the humeral head. After the insertion of the screw, the scope is reinserted into the glenohumeral joint to note possible cartilage penetration. Intraoperative radiographs are also suggested to control the fracture reduction and screw placement. Only then, after the greater tuberosity is stabilized, can any full-thickness rotator cuff tear present be fixed.[10]

Postoperative Care

We recommend that the patient's arm be kept in a sling for 6 weeks. Gentle passive motion can begin on the first postoperative day to minimize adhesion for-

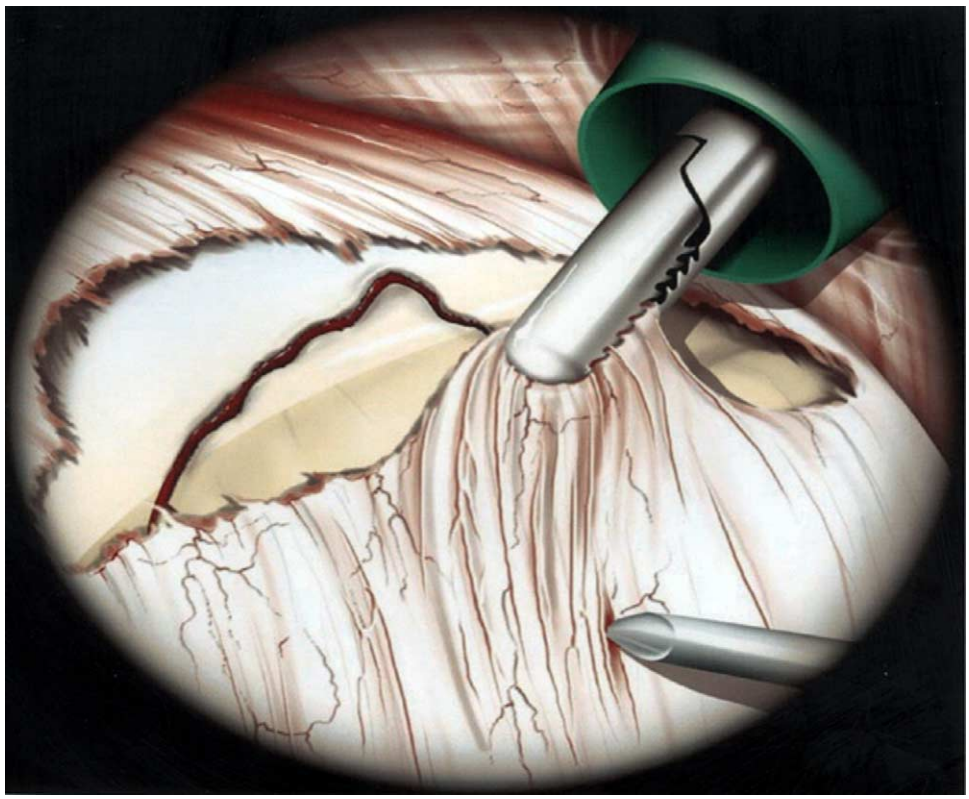

FIGURE 4. Drawing showing a Kirschner wire placed percutaneously through the tuberosity fragment into the humeral head under arthroscopic guidance.

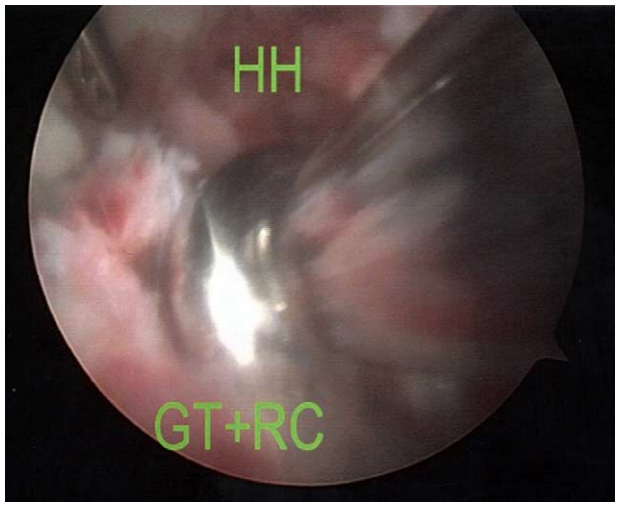

FIGURE 5. Arthroscopic picture showing partially threaded cannulated screw inserted over the guidewire resulting in firm compressive fixation of the tuberosity. GT, greater tuberosity; HH, humeral head; RC, rotator cuff.

mation. At 6 weeks, full active motion is generally allowed, and surgical tubing is recommended to strengthen all shoulder muscles, except the supraspinatus and the infraspinatus. Radiographs performed 3 months after surgery usually show healing of the fracture, and the mobility of the shoulder is restored to normal.

DISCUSSION

As mentioned in our previous reports,[10,11] we recognize that reduction and fixation of a greater tuberosity fragment cannot always be performed using arthroscopic technique because of insufficient bone stock, relevant displacement, or fixed retraction. We also recognize that even when it is possible, the arthroscopic technique can present disadvantages compared with open[3] or percutaneous[4] techniques. These disadvantages include higher costs, greater difficulty in achieving good results, the need to pass intraoperatively from arthroscopy to an open technique, longer surgical times, and a steeper learning curve.

Conversely, the open technique uses a separate incision, which probably increases postoperative pain and is cosmetically less appealing. However, it produces excellent outcomes,[3] and any new arthroscopic

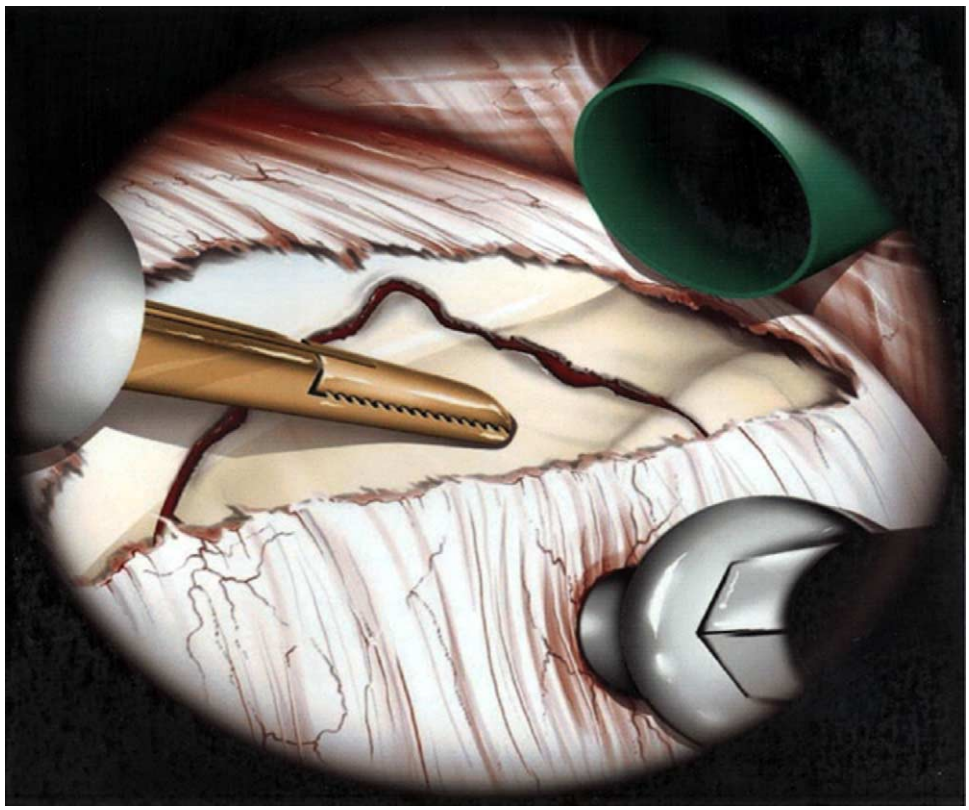

FIGURE 6. Drawing showing partially threaded cannulated screw inserted over the guidewire resulting in firm compressive fixation of the tuberosity.

technique should not sacrifice reduction and fixation while creating a procedure with potentially less perioperative morbidity.

Nevertheless, we believe that the arthroscopic evaluation of the shoulder in greater tuberosity fractures can advocate several advantages and, for experienced shoulder arthroscopists, the concomitant arthroscopic surgical treatment of the fracture is a viable and effective alternative to other methods. In fact, it benefits from the comprehensive access to all areas of the shoulder, allowing the detection and treatment of bony and soft tissue lesions at the same time.[8-12] Furthermore arthroscopic technique may be expected to minimize surgical morbidity associated with an open approach, as well as to avoid the occurrence, described with open techniques,[3,4,8,9] of missing the diagnosis and treatment of frequently accompanying soft tissue lesions.

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