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Proximal Humeral Fractures

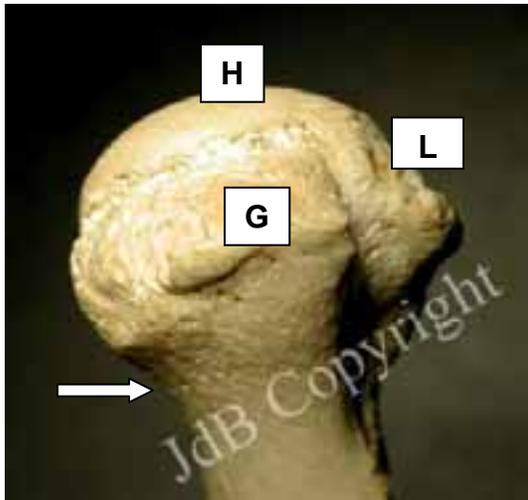
Introduction:

Fractures of the proximal humerus (ball) account for 5-15 % of all fractures. Majority of these occur in elderly individuals with osteoporosis, and are a cause of major morbidity. In younger individuals, these fractures occur after high-velocity trauma.

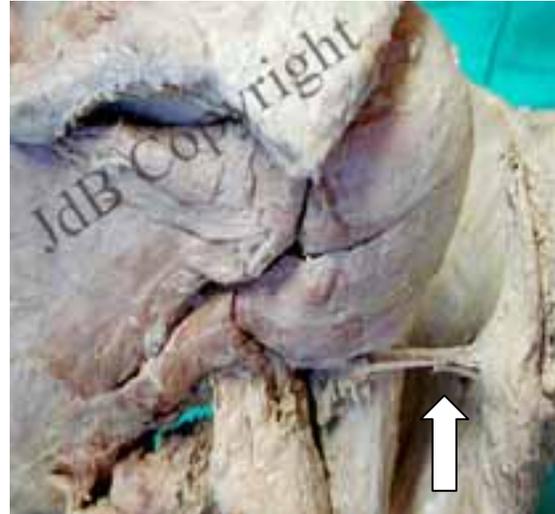
Mechanism of injury:

Indirect injury to the shoulder occurs during a fall on outstretched hand from standing position. Direct blow to the shoulder may also cause these fractures. In motor vehicular accidents, these injuries may coexist with several other fractures. Electric shocks and convulsions are other mechanisms.

Anatomy of the proximal humerus:



The proximal humerus (ball) consists of three parts:
 L=lesser tuberosity, G=Greater tuberosity, H=humeral head.
 Arrow shows the junction between the ball and the shaft, called the surgical neck. The neck is a frequent site of fracture.



Arrow shows the axillary nerve that is frequently damaged when a fracture in this region occurs.

Classification:

These fractures can be simply classified into four groups. Various combinations of these groups may occur.

- (1) Fractures of the greater tuberosity.
- (2) Fractures of the lesser tuberosity.
- (3) Fractures of the surgical neck.
- (4) Fractures of the humeral head.

(1) Greater tuberosity fractures:

- These account for a small number of proximal humeral fractures, and are associated with shoulder dislocations and osteoporosis.
- Attachment of the rotator cuff to this region adds to the significance of this fracture.
- Violent eccentric contraction of the cuff muscles, or anterior (frontal) shoulder dislocations can result in pull-off of the greater tuberosity.

- Direct injury to the shoulder can break the tuberosity into several fragments (comminuted fracture)



Arrow shows a fracture of the greater tuberosity.

In some fractures, the fracture remains undisplaced; these fractures are associated with partial cuff tears and this should be investigated with an MRI or diagnostic arthroscopy



MRI shows an undisplaced fracture of the greater tuberosity, with a partial tear of the supraspinatus.

Treatment:

(a) Most fractures are treated with open surgery. Screws or metal wires are used to hold the fragment in place. At the Cape Shoulder Institute, a new technique has been developed that uses tiny metal anchors and sutures to tie the fractured fragment to the avulsion site.



Double-row fixation technique.



Operative treatment of a greater
Tuberosity fracture with suture-anchors.

Some of these fractures can be treated by arthroscopic surgery using a technique developed at the Cape Shoulder Institute. Partial cuff tears can also be treated by arthroscopy.



Arthroscopic fixation of a fractured greater tuberosity is demonstrated.



Diagnostic arthroscopy reveals a partial tear of the rotator cuff.

(2) Lesser tuberosity fractures:

These usually result from posterior shoulder dislocations, or from violent muscle contraction due to electric shock or convulsions.



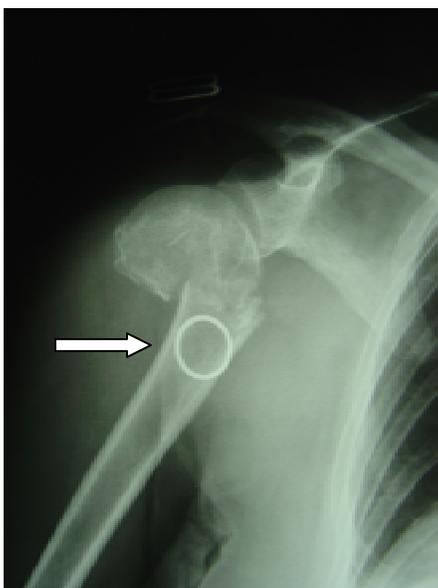
Arrow shows a lesser tuberosity fracture on a 3D ct scan.

Treatment consists of open surgical fixation of the fractured fragment using sutures through bone and anchors, similar to greater tuberosity fractures.

Neglect of these fractures leads to deficiency of the subscapularis muscle, an important shoulder stabilizer and mobilizer. Long term deficiency of this muscle may necessitate a major muscle transfer procedure.

(3) Surgical neck fractures:

These are common in osteoporotic bone. These fractures can result in damage to the axillary nerve that runs along the surgical neck.



Arrow shows a fracture of the surgical neck of the humerus.



CT scan shows a fracture of the surgical neck of the proximal humerus. This is important to rule out undisplaced fractures of other fragments.

Treatment:

- These fractures may be treated conservatively by closed reduction. Angulation of the head should be corrected to prevent malunion.
- Open surgical fixation can be performed using plate and screws.
- In some cases, especially in osteoporotic bone, allograft bone is necessary to supplement fixation.



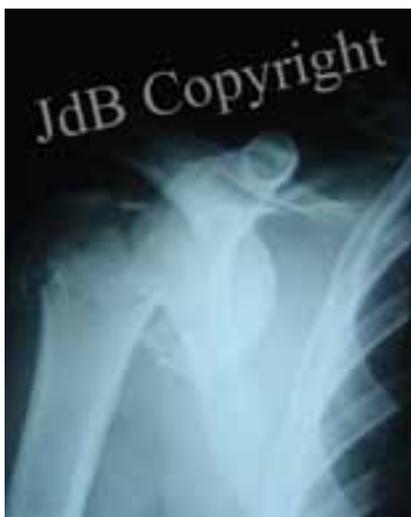
Use of allograft bone in augmentation of surgical fixation.



Use of plate and screws to fix proximal humerus fractures.

Two, three, and four part fractures:

- The proximal humerus may break into multiple parts resulting in 2,3 or 4 part fractures.
- In normal bone, these fragments may be surgically reconstructed using sutures, plates and screws.
- In osteoporotic bone, fixation is difficult and often impossible. In such cases, a fracture prosthesis/ hemireplacement may be used to restore function. The reverse shoulder prosthesis has been shown to have a better functional result in age group of 70 years and above.



Multi-part fracture of the proximal humerus.



The reverse shoulder prosthesis may be used to treat multi-part fractures of osteoporotic shoulders especially in old individuals.

References:

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2. The Bony-PASTA lesion: An arthroscopic technique of fixation of the partially avulsed greater tuberosity fracture. Bhatia DN, vanRooyen KS, deBeer JF. *Arthroscopy* In press.
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