

## Proximal Humerus Fractures

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Proximal humerus fractures are a very common injury that occurs in all populations but is certainly more prevalent in the patient population over the age of 65. It is the third most common fragility fracture after distal radius and hip fractures. The majority of proximal humerus fractures can be treated non-operatively, however there are some fractures that can benefit from operative intervention. The extent of operative intervention can include percutaneous pinning, open reduction internal fixation, and joint replacement depending on various fracture and patient characteristics.

### Anatomy

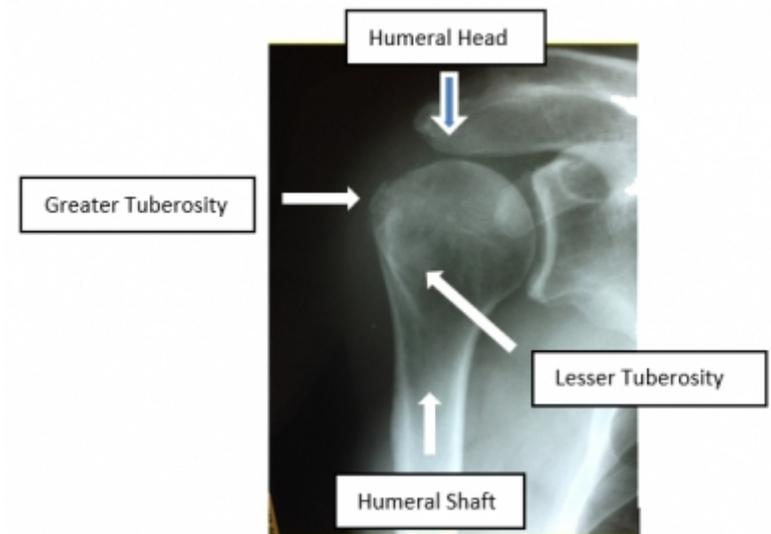
The proximal humeral anatomy consists of four main anatomic structures that are important in understanding xrays when you are interpreting the fracture configuration as well as how a given fracture will be treated.

The four parts include the humeral head, greater tuberosity, lesser tuberosity and humeral shaft. Fractures are classified according to which structures are fractured. The Neer classification is commonly used to describe these fractures and can be categorized into 2-part, 3-part, and 4-part fractures with further differentiation into head splitting fractures and fracture dislocations. The importance of this classification allows the selection of the optimum treatment and the ability to predict complications including fracture collapse, avascular necrosis and healing.

### Treatment

The vast majority of proximal humerus fractures can be successfully treated non-operatively particularly in older patients. The deformity can be well tolerated and the loss of function typically occurs with overhead activities. Most activities of daily living occur at waist level and therefore may be largely unaffected. There are a subset of fracture in younger patients and ones that have significant displacement that may be more amenable to surgery.

### Osteoporosis



The need for the diagnosis and treatment of osteoporosis is an important facet of complete musculoskeletal health. Testing for osteoporosis is important but particularly in females over the age of 65 and vitally important in patients that have sustained a fragility fracture. A fragility fracture includes a fracture of the hip, distal radius, humerus or vertebral compression fracture from a low energy injury such as falling from standing height

Testing involves examining the density of various bones in the body and is called a DEXA scan (Dual Emission X-Ray Absorptiometry). This test is usually ordered by your primary care physician and evaluates a patient's bone density. If you are tested and the bone density is greater than 2.5 standard deviations below normal than a patient is considered osteoporotic.

Treatment for osteoporosis should include the recommended daily doses of calcium and vitamin D but may also involve the need for additional pharmacologic intervention. These medications include bisphosphonates, hormone replacement therapy and calcitonin therapy and can be started in consultation with your primary medical care physician. The goal of these therapies is improve bone density and can reduce the incidence of fragility fracture by as much as 50%.

## **Physical therapy**

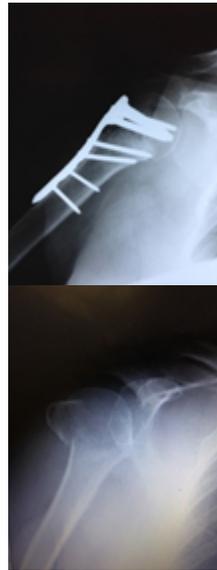
This step is very important to regaining functional use of the shoulder and arm and is used in conjunction with operative and non-operative intervention. I generally allow immediate elbow and wrist range of motion. Physical therapy in patients who are treated non-operatively is usually initiated within two weeks from the date of injury. Physical therapy will often begin with pendulum exercises and gentle passive range of motion. This slowly progresses to active and active assist range of motion. The length of time that physical therapy is performed, depend on many patient and fracture characteristics, but complete recovery usually takes 3-6 months.

## **Surgical intervention**

For severely displaced fractures, surgery may be the most reliable way to restore anatomic relationships and allow optimal function of the shoulder. There are a myriad of different techniques for fixing proximal humerus fractures and can vary from percutaneous techniques involving wires to the other extreme involving the total replacement of the shoulder joint. This decision involves many patient factors including the severity of the fracture, age and function of the patient.

Isolated greater tuberosity fractures often occur in younger individuals after a traumatic injury. These fractures need to be closely monitored due to the involvement of the rotator cuff. While many fractures involving the proximal humerus can tolerate displacement, the greater tuberosity, due to the attachment of the rotator cuff, cannot. Displacement more than 5 mm is usually an indication for surgery and often can be accomplished arthroscopically with percutaneous techniques.

Many innovations over the past decade have allowed superior fixation of peri-articular fractures in osteoporotic bone involving the proximal humerus. One of the most important innovations involves the use of locking plate technology. This technology allows the use of a fixed angle construct to help support osteoporotic bone which has a tendency to collapse into a varus deformity. These implants are far superior to older implants that rely on an interference fit between the bone and screw. In patients with osteoporotic bone this interference fit is significantly effected and can lead to early failure of the construct.



## New Techniques

Several new techniques have been available over the past few years that can really help patients that have severe fractures. These two techniques include the reverse total shoulder arthroplasty and the use of fibular strut allografts with locking plate technology for patients with severe fractures and osteoporotic bone.

### Fibular Strut Allografts

The use of a fibular allograft allows immediate structural augmentation of a patient's bone stock to allow a more robust and anatomic reconstruction of the proximal humerus. Many patients who have sustained a proximal humerus fracture have osteoporotic bone. When fractures occur in this type of bone even the use of locked plating devices can fail due to the lack of underlying bone support. The use of these allografts provides an immediate structural support and helps to prevent loss of fixation.

This is an example of a four part proximal humerus fracture in a patient with osteoporosis the pre-operative x-ray demonstrates a very typical fracture pattern with the articular surface of the humeral head pointing straight up.

Post-Operative x-rays demonstrate an anatomic reduction with the use of an intra-medullary fibular allograft.

### Reverse Total Shoulder Replacement

The reverse total shoulder replacement is performed on severe fractures in patients generally over the age of 65. This has shown in several studies to be superior to reconstruction with a hemiarthroplasty particularly in older patients. Hemiarthroplasty has historically demonstrated good results in terms of pain relief but has been somewhat less predictable in terms of improving function. Most

historical studies have only shown forward flexion to about 90 degrees. With newer ingrowth surfaces and attention to the repair and reconstruction of the tuberosities, which control rotator cuff function, these results have shown improvement. The importance of these tuberosities to a good functional outcome is critical.

The reverse total shoulder allows a reconstruction that demonstrates superior functional results to hemiarthroplasty with additional excellent relief of pain.



In summary, proximal humerus fractures are very common and can result in significant morbidity. The vast majority of these fractures can be treated non-operatively and patients can expect a return to normal function usually with some residual stiffness. In patients that have more severe fractures there are many available techniques and implants that can allow reconstruction of the shoulder and allow a good return to function without pain.