

medartis®

PRECISION IN FIXATION

SURGICAL TECHNIQUE

# Proximal Humerus System 3.5



# APTUS® Shoulder





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# Proximal Humerus System 3.5

## Indications

The APTUS Proximal Humerus System is indicated for fractures, osteotomies and non-unions of the proximal humerus.

## Contraindications

- Pre-existing or suspected infection at or near the implantation site
- Known allergies and / or hypersensitivity to foreign bodies
- Inferior or insufficient bone quality to securely anchor the implant
- Patients who are incapacitated and/or uncooperative during the treatment phase
- The treatment of at-risk groups is inadvisable



# Surgical Technique

## Proximal Humerus Fracture Fixation with Plate and Spiral Blade

### Example and Technique by Mohammad Waseem, Macclesfield, England

This surgical technique is not meant to be exhaustive, nor to be the only approach to this indication. It does not replace appropriate training for this type of surgery.

The type of treatment depends mainly on:

- Age and general health of the patient
- Number and displacement of fragments
- Possible development of avascular necrosis
- Condition of the rotator cuff

For difficult fractures, alternative solutions (hemiarthroplasty, reverse total shoulder arthroplasty) should be available intraoperatively.

## Preoperative Imaging

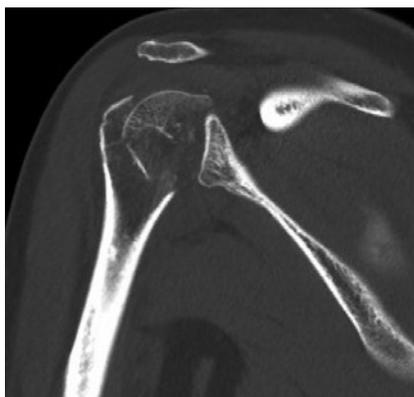
The fracture is classified by means of a CT scan using the Neer Classification and the Lego System\*.

The case presented is a posterior fracture dislocation in a young patient.

To determine the exact level of dislocation, a 3D reconstruction can be helpful.

The length of the plate is determined by the level of the fracture and bone quality. In the case presented, a short plate will be sufficient.

The medial inferior corner fracture is an indication for the use of the spiral blade.



\* Neer Classification:  
Neer II CS, Displaced proximal humeral fractures. I. Classification and evaluation. J. Bone Joint Surg. Am. 1970, 52(6): 1077-89

Lego System:  
Hertel R, Hempfing A, Stiehler M, Leunig M. Predictors of humeral head ischemia after intracapsular fracture of the proximal humerus. JSES 2004, 13: 427-33

## Step 1 – OR Setup

A general anaesthesia is administered and an antibiotic prophylaxis is given.

The patient is placed in a beach-chair position, with the arm unsupported.



## Step 2 – Surgical Approach

For displaced multifragmentary fractures, a deltopectoral approach is used which allows good reduction and visualization.

The deltoid splitting approach is reserved for 2-part fractures only.

For the deltopectoral approach, the incision is placed along the medial border of the deltoid. The length of the incision is determined by the plate used.



### Step 3 – Fracture Reduction

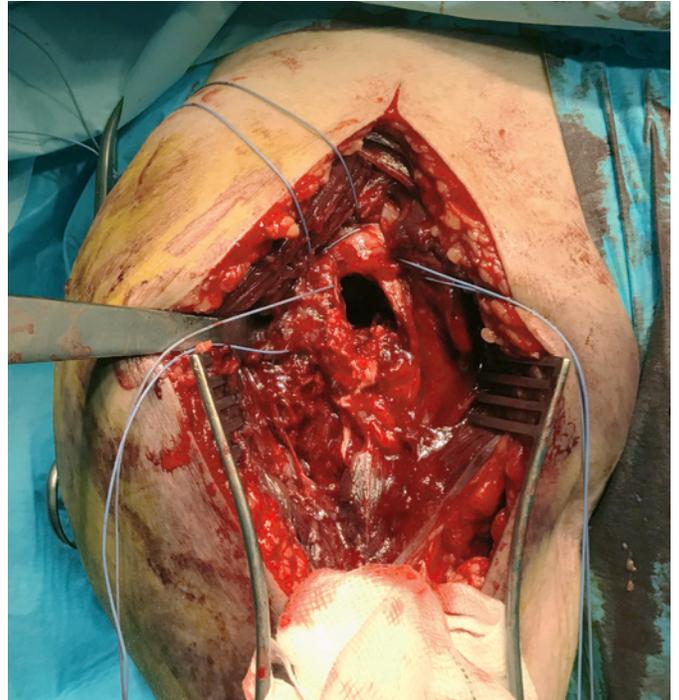
Confirm the position of all fragments with an image intensifier.

Use a laminar spreader to enhance visibility of the fracture.

Identify the long head of the biceps and the deltoid insertion point.

Once all four fragments are identified physically, reduce the fracture with manipulation of the fragments. Especially the fragment of the greater tuberosity might be in the back, not visible directly.

Suture greater tuberosity, lesser tuberosity and body fragment with the rotator cuff.



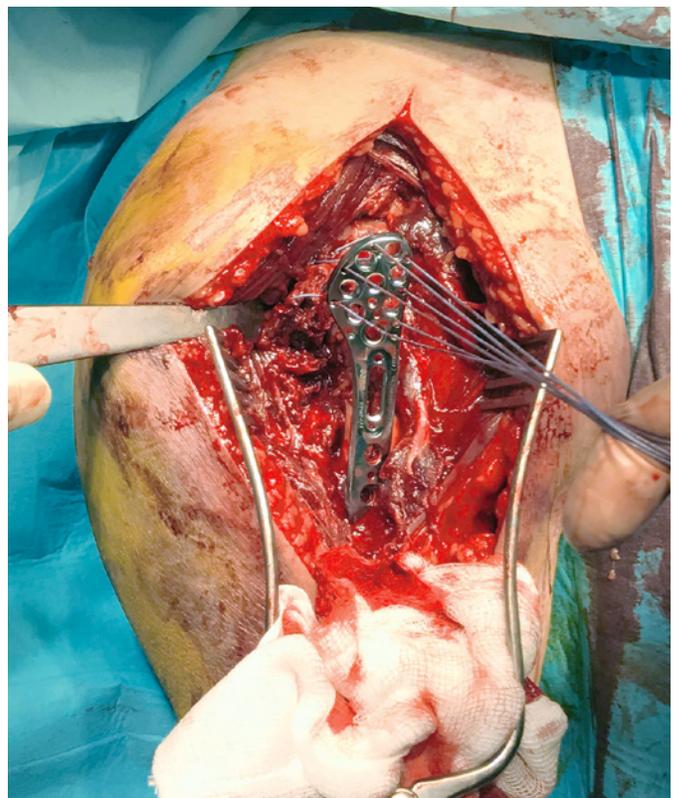
### Step 4 – Plate Positioning and Initial Fixation

Insert the sutures in the suture holes of the plate and place the plate by means of the sutures.

**Notice**

After you have passed the sutures through, do not tie knots yet. Otherwise the drill guide block cannot be positioned properly.

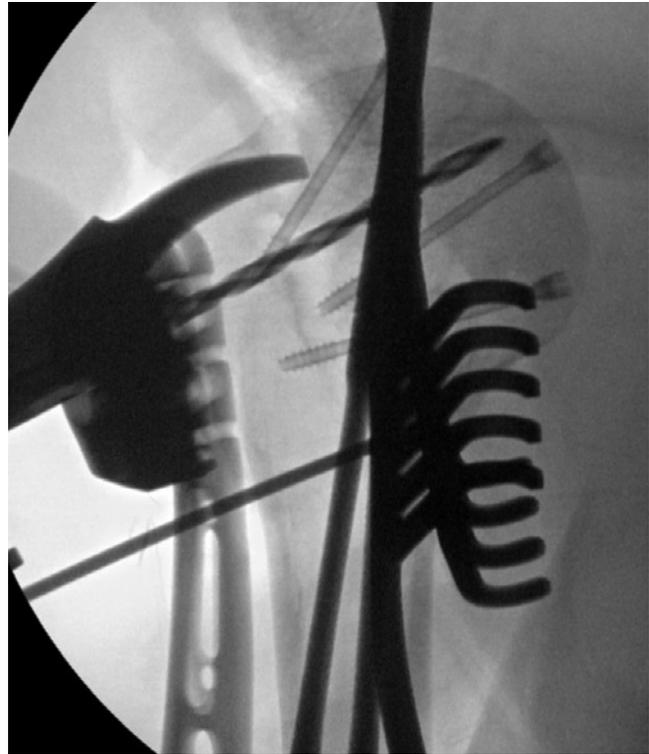
Fix this initial plate position with K-wires. Place a non-locking screw through the oblong hole of the plate to gently press the plate onto the bone.



Then place two TriLock screws distally and the two most proximal screws. Use the drill guide block for the proximal plate area at this stage.

As the use of a spiral blade is planned, the two plate holes marked with rings on the plate and on the drill block are not to be used at this point.

Use image intensifier from different angles to make sure that none of the proximal screws penetrates the joint. The body fragment was reduced and reattached with cannulated compression screws (APTUS CCS).



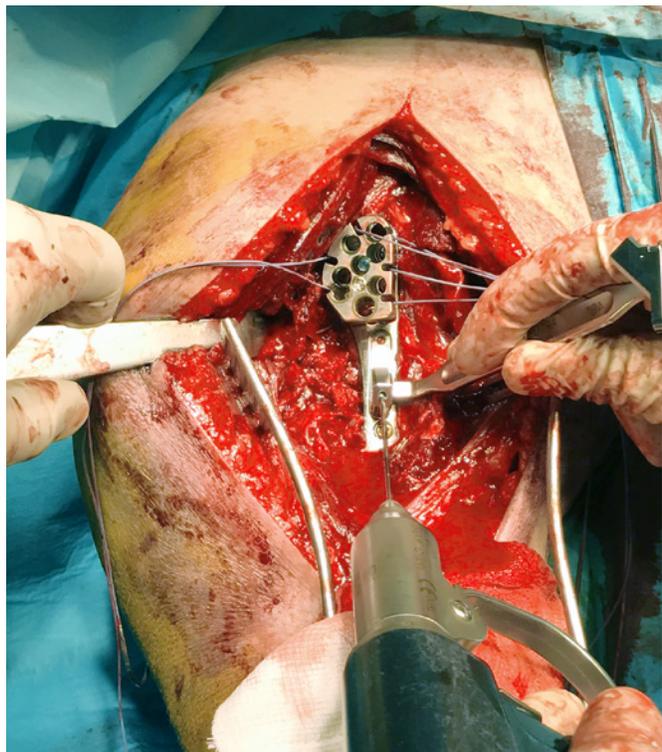
### Step 5 – Selection of the Spiral Blade

Preoperative planning on X-rays gives a first impression on which spiral blade angle would fit best. The spiral blade type that supports the medial inferior corner of the humeral head best should be chosen.

The planned spiral blade angle is tested with the help of the K-wire guide (A-2000) and verified with the K-wire in position in both planes.

Reasons to not use the spiral blade at this point could be:

- Angle too steep or plate position is too low
- 2-part fracture
- If the spiral blade distracts the fracture

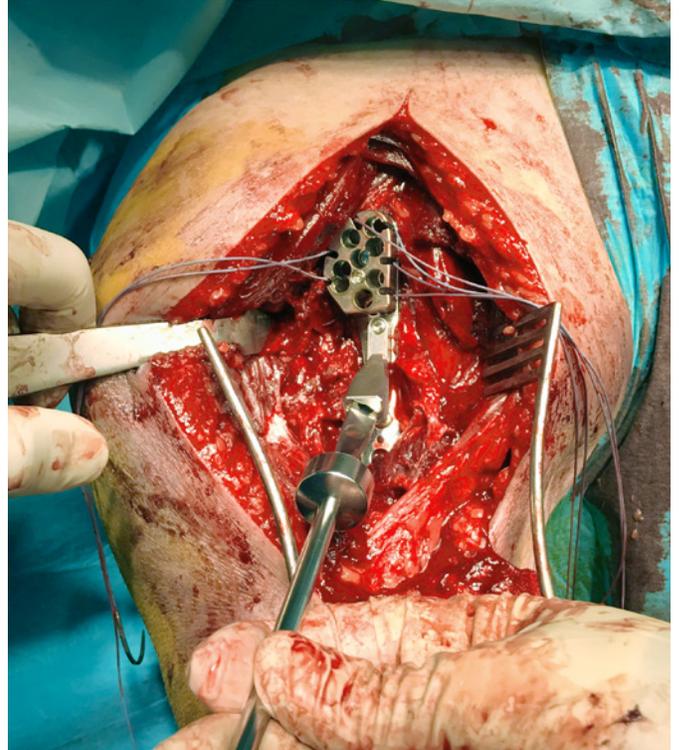


## Step 6 – Insertion of the Spiral Blade

Make two large drill holes with the 3.6 mm twist drill and the corresponding drill guide (A-2924) to open the cortex. Turn the guide upside down and repeat the step.

Mount the guide for the spiral cutter for the chosen spiral blade angle and fully insert the spiral cutter. Use the spiral cutter as a trial: if it sits, so will the implant.

Remove the guide for the spiral cutter along with the spiral cutter.



Pick up the chosen spiral blade with the corresponding handle. To insert the spiral blade, gently push it in by hand first, then carefully tap it with the mallet if necessary.

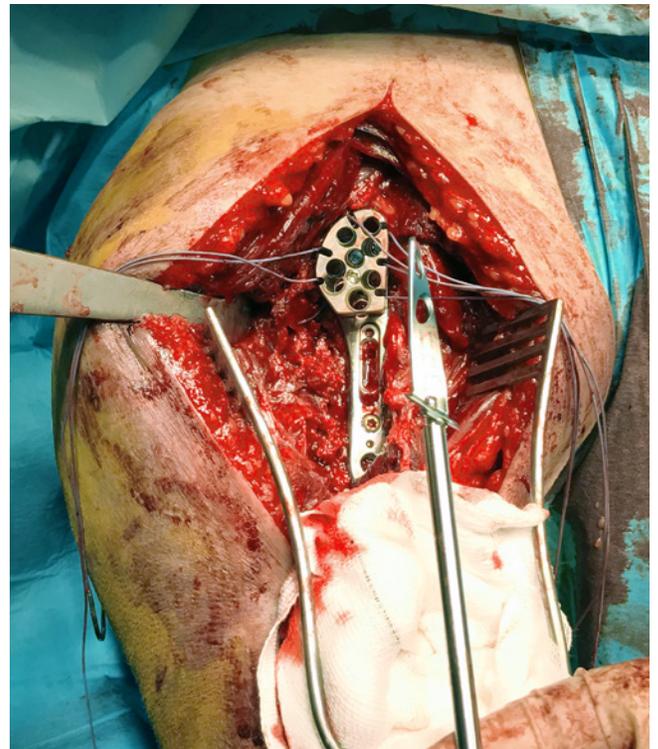
### Notice

Not much force should be used at this step. Using too much force will cause the spiral blade to bend and therefore the next surgical steps will be affected.

Place the spiral blade flush into the oblong hole and fix it finger-tight with the two small screws (A-4951.30). Do not try to push it down with the screws.

### Notice

Do not overtighten the small screws or the threads will strip.

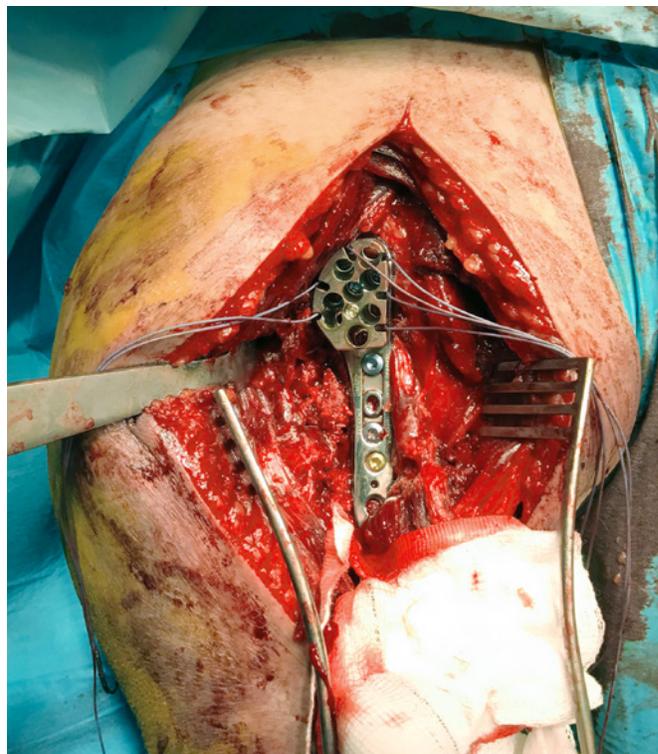


## Step 7 – Placement of the Remaining Screws

Place the two screws passing through the spiral blade (marked with rings on the plate and the drill guide block). Always determine the screw length to avoid joint penetration. Let the drill guide guide you. If any force is used, you will miss the target.

Place the remaining screws. There is a potential conflict of screws with the 40° spiral blade if you are not using the drill guide block. Therefore, try using it where possible. Once you are familiar with the implant, you may lock them free hand, but you need two views to confirm their position.

Make sure, by means of intensified imaging, that all the fragments are addressed and that there is no joint penetration.



## Step 8 – Reattachment of Soft Tissue and Wound Closure

Tie the anchored sutures above the plate.

Reattach the deltoid tip if it has been partially removed. The pectoralis major should be allowed to just fall back in position.

The incision is closed in layers with Vicryl and subcuticular Monocryl. Finalize with Steri-Strips and a silicon based dressing.



### Step 9 – Postoperative Imaging

Use postoperative imaging to verify that no screws are penetrating the joint surface and all tuberosity fragments are still attached.



## Aftercare

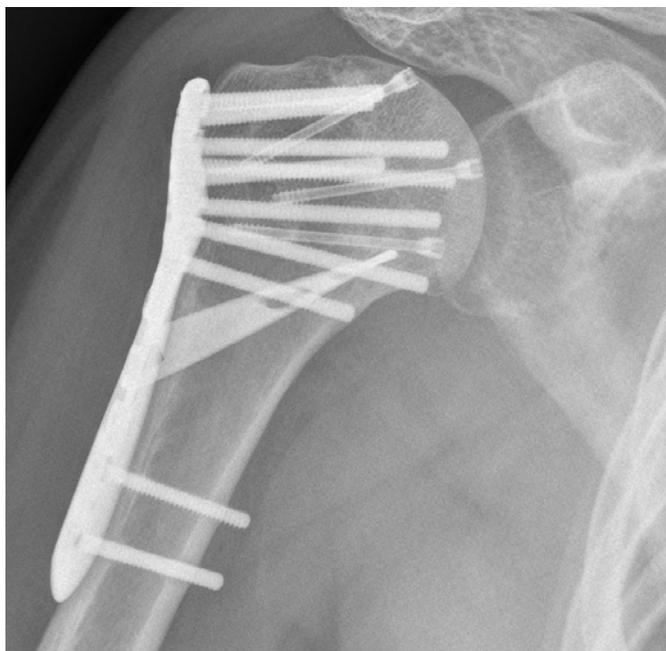
The patient is mobilized with physiotherapy 24 hours after surgery.

We use a CryoCuff and a Polysling.

- Day 2: Start active assisted external rotation. Full range of motion is allowed if the minor tubercle was intact, and full minus 20° if not. Add active assisted elevation up to 90° and Pendulum exercises.

- Day 3 to 21: Increase the active assisted elevation up to 150°.

Reviews are performed after 2 weeks, 6 weeks, 3 months, 6 months and 12 months. On these occasions, AP, axillary lateral and lateral views are taken with watching out for collapse of the humeral head and avascular necrosis.



Healed scar 36 months after surgery.



# Surgical Technique

## Proximal Humerus Fracture Fixation with Plate

Example and Technique by Georges Kohut, Fribourg, Switzerland

This surgical technique is not meant to be exhaustive, nor to be the only approach to this pathology. It does not replace appropriate training for this type of surgery.

The type of treatment depends mainly on:

- Age and general health of the patient
- Number and displacement of fragments
- Possible development of avascular necrosis
- Condition of the rotator cuff

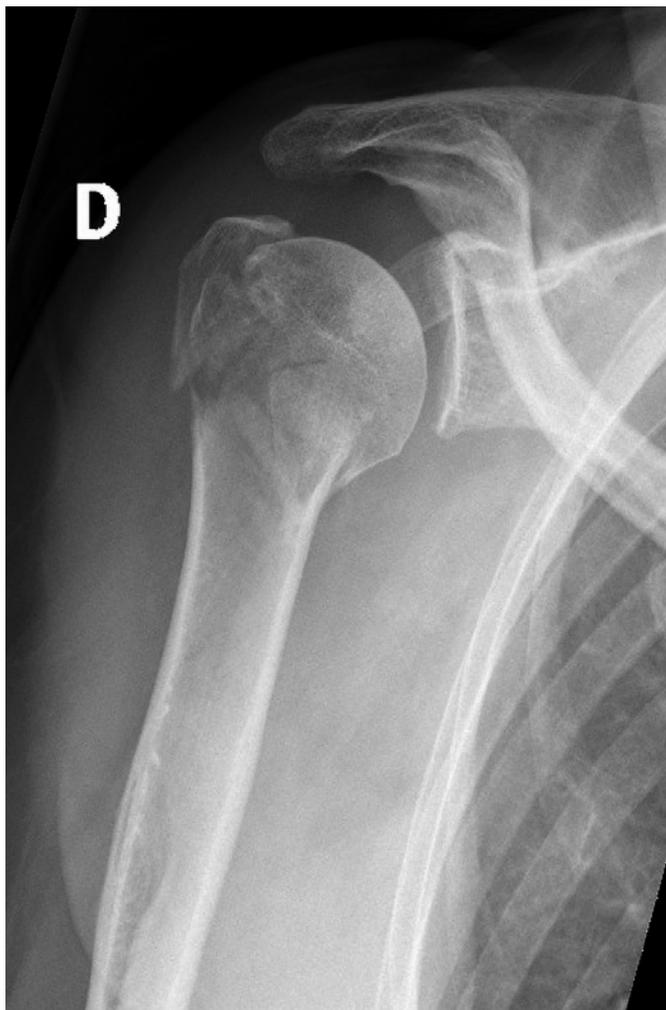
For difficult fractures, alternative solutions (hemiarthroplasty, reverse total shoulder arthroplasty) should be available intraoperatively.

## Preoperative Imaging

At least two good quality radiographs are needed. Additional CT is sometimes required

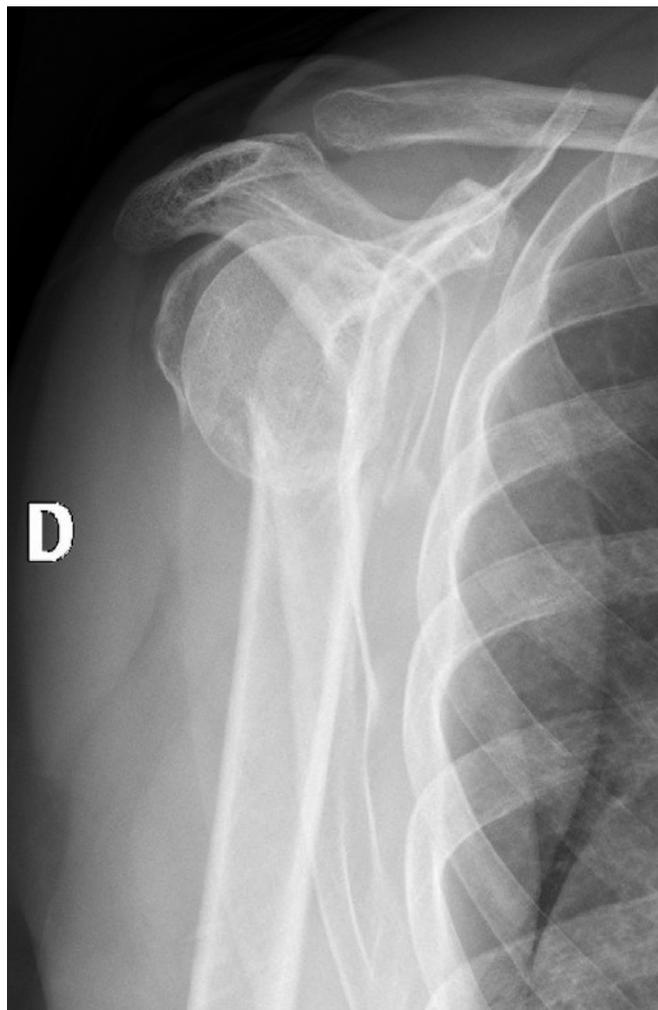
### 1) AP view of the shoulder

The beam must be 30° oblique in order to be parallel to the glenoid. Since the fractured arm is almost always held against the body, the proximal humerus will be accordingly internally rotated on the AP view. This has to be taken into account for the analysis, since it would tend to underestimate the amount of varus/valgus.



### 2) Neer view, orthogonal to the previous view

The presented case shows a fracture, probably 3-part. The possibility of a 4-part fracture cannot be excluded. The head fragment is displaced in varus and in extension. The greater tubercle is displaced posteriorly.



## Step 1 – OR Setup and Surgical Approach

An interscalene block or general anesthesia is administered.

The patient is placed in a beach-chair position. The arm is freely mobile, but can be placed on an arm-rest.

The shoulder should be sufficiently exposed to allow for easy use of a C-arm. Axial view, however, is not necessary.

A standard deltopectoral approach is performed.

The cephalic vein is retracted laterally.

The long head of the biceps is identified in its sulcus. This will help to control the rotation.

The tuberculi are identified. Place No. 2 non-resorbable sutures through the supraspinatus and infraspinatus tendons. In case of a 4-part fracture, place one or two additional sutures through the insertion of the subscapularis.

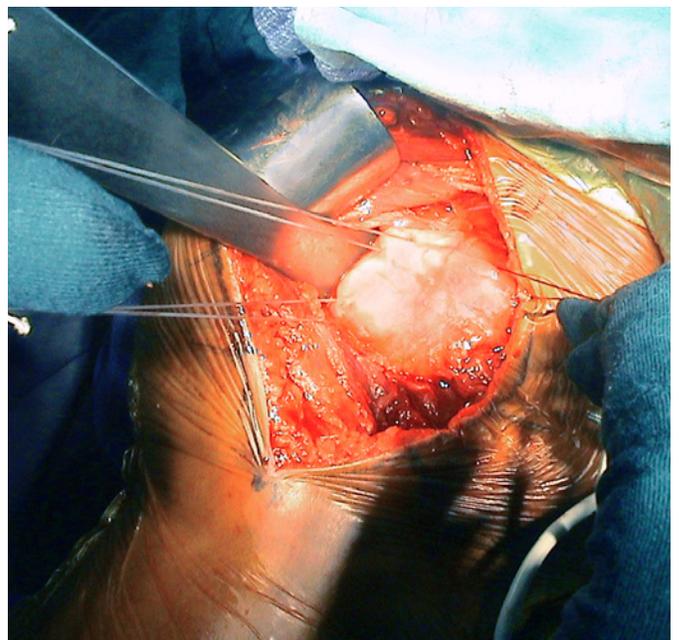


## Step 2 – Fracture Reduction

Traction on the sutures will help to mobilize and reposition the tuberculi.

Do not pull on the arm. There is a risk of producing a lesion of the brachial plexus. The head fragment must be treated with care, in order not to disrupt the remaining blood supply. A small rasp or elevator has proven useful to gently lift the head fragment, if needed.

Use pointed bone clamps and/or K-wires to achieve temporary provisional reposition.



### Step 3 – Plate Positioning

In general, the plate is positioned along the intertubercular sulcus. It should fit about 5 mm posterior to the posterior edge of it. The proximal end of the plate should be at least 5 mm distal to the tip of the greater tubercle.

Choose a plate of appropriate length. Pass the sutures through the holes on the edge of the plate.

Position the plate in the approximate location and insert a 3.5 mm cortical screw through the middle of the oblong hole.

At this time, a fairly accurate reposition of the tuberculi can be achieved, using the lateral cortex as a reference. Flexion/extension of the head can be checked by palpation. Any varus/valgus malposition, however, may be hidden by the rotator cuff.

Have a first AP view with the C-arm.

#### **Notice**

Do not attempt to have an axial or lateral view at this point. The instability of the fracture does not permit motion yet.



#### Step 4 – Fine Tuning of the Plate Position

The position of the plate may be adjusted longitudinally by slightly loosening the screw and gliding the plate on its axis.

Any remaining varus/valgus malposition of the head may be corrected by K-wires used as levers. In the example shown, two 2 mm K-wires are used to correct the varus tilt of the humeral head.



#### Step 5 – Insertion of the Screws

Insert at least two locking screws, preferably the proximal ones in the head fragment, and one more in the diaphysis.



At this time, the humerus may be gently rotated in order to have two views on the C-arm, 90° to each other.



Insert sufficient locking screws in the head/tuberculi in order to have a secure fixation of these fragments to the plate. These screws may be inserted through the drill guide block or freehand.

Tighten the sutures against the plate.

Insert at least one more screw in the diaphysis.



Check again with the C-arm in two planes. Make sure that no screw protrudes the joint surface. If the bone quality is sufficient, the screw tips can be 1 cm short from the joint surface.



## Step 6 – Wound Closure

Check the cephalic vein. If it is intact at the end of the procedure, this means that the retraction of the deltoid was gentle enough.

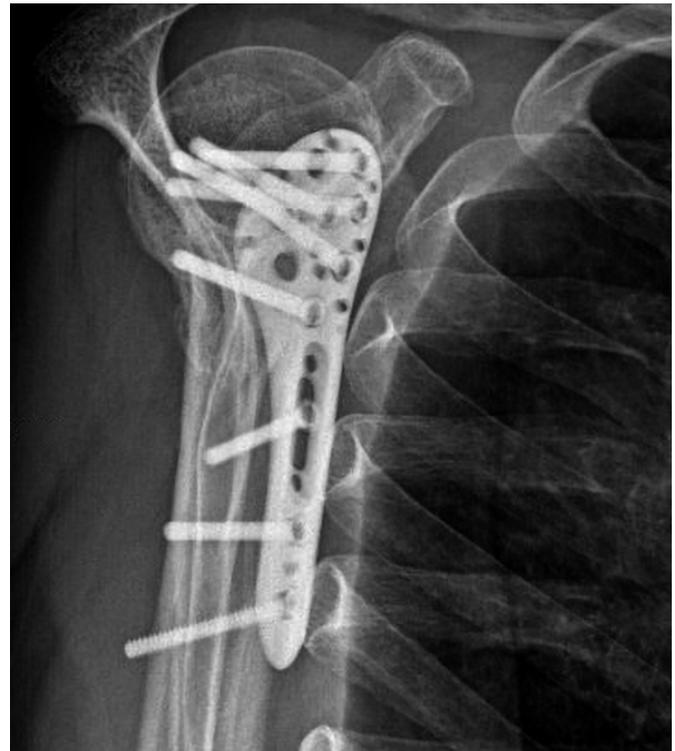
Close the wound in layers. Use a suction drain if there is some anticipated bleeding.

## Aftercare

As a general rule, the stability of the construct should be sufficient to allow for early active assisted range of motion exercises.

My usual protocol is:

- Immobilization of the arm against the chest for the first night.
- Day 1: Active assisted full flexion/extension of the hand, unlimited use of the hand. Have the arm in a sling during the day, and immobilized at night.
- Day 2: Add active assisted external rotation. Full range of motion if the minor tubercle was intact, and full minus 20° if not. Add active assisted elevation up to 90°. Pendulum exercises.
- Day 3 to 21 increase active assisted elevation up to 150°.
- Day 21: Control radiograph. Go on to unrestricted active mobilization if positive. Discard night immobilization.
- After 6 weeks: Control radiograph. Add strengthening exercises.







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