

62 Elbow injury

62.1 Introduction

A normal function of the elbow joint is essential for the daily use of the whole arm. Mismanagement of displaced fractures, dislocations or ligament instability often leads to a stiff or painful, dysfunctional joint.

Injuries can occur to ligaments, bones or both. Severe complications may include nerve or vessel damage.

N.B. The typical elbow injuries of adults are quite different from those of children (73.7).

EXAMINATION

First check the radial pulse, and the sensory territories of the median nerve (flexor surface of thumb, index & middle fingers), ulnar nerve (flexor side of little finger) & radial nerve (extensor side of thumb, index & middle fingers).

LOOK

Check the contour of the posterior of the elbow. If is abnormal, a supracondylar fracture or dislocation is likely.

FEEL

Feel the 3 bony points, the medial & lateral epicondyles & the olecranon tip (62-1A). If the elbow is very swollen, they will not be palpable.

If the 3 bony points are displaced in relation to one another there may be a dislocation. If the olecranon is displaced, has it moved medially or laterally in relation to an imaginary line down the back of the arm? (You will need to know this when you come to reduce a supracondylar fracture or a dislocation).

Is there a gap in the olecranon?

Check where there is the greatest tenderness: above the elbow, over the medial or lateral epicondyle, the head of the radius, or the olecranon.

MOVE

Normal painless elbow movement excludes any severe injury; any limitation or pain suggests some pathology. If very little movement is possible, there is a dislocation, supracondylar fracture, or a T-shaped fracture. If the elbow is fixed in 45° of flexion with almost no movement, there is almost certainly a dislocation.

Check movement of the radial head. Bend the elbow to 90°; if the forearm can rotate, the head and radial neck are probably normal. Place your middle finger on the lateral epicondyle, and your index beside it over the radial head.

Pronate and supinate the forearm. If the radial head is intact, you will feel it moving under your index finger. Does the olecranon move in relation to the ulnar shaft?

Steady the arm with your other hand. Then very gently try to move the lower end of the humerus sideways, backwards & forwards on the shaft. Use your finger and thumb to feel the bony ridges running up from the medial and lateral epicondyles. This is very painful, so only do it if you have no X-ray machine.

If the elbow is obviously swollen, try to move one condyle in relation to the other, & check for crepitus.

If the patient can extend the elbow, its extensor mechanism is intact (62-23).

RADIOGRAPHS

Always get an AP & lateral radiograph of an injured elbow. Minor fractures such as small chips off the capitulum are difficult to diagnose without a radiograph.

In a severe elbow injury, the medial epicondyle is easily detached, so it is the 1st thing to look for. If you are still in doubt, X-ray the elbow again after 7days. The fracture, if there is one, will then be easier to see.

THE 3 BONY POINTS AT THE ELBOW

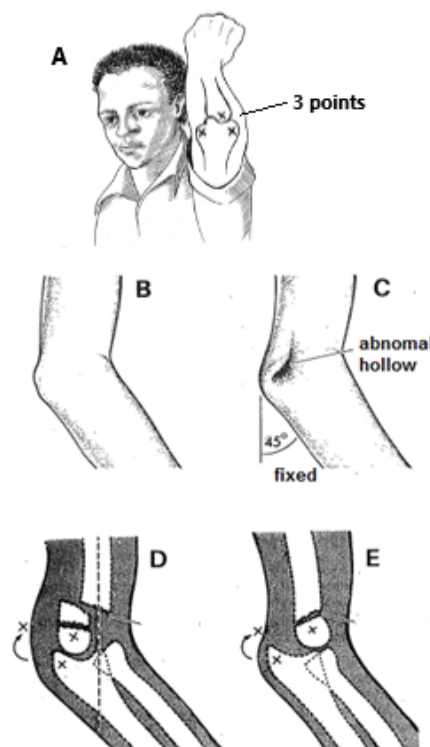


Fig. 62-1 THE 3 BONY POINTS AT THE BACK OF THE ELBOW. A, the medial & lateral humeral epicondyles & the olecranon tip of the ulna. B, normal contour of the elbow. C, contour of a dislocation. D, in a supracondylar fracture, the 3 bony points are correctly related to one another, but are posteriorly displaced in relation to the humeral shaft. E, in a dislocation the relationship of the 3 bony points to one another is disturbed. *Kindly contributed by John Stewart.*

SUMMARY OF MAJOR ELBOW INJURIES

FRACTURE	C	Sw	MOVEMENT	BONY POINTS	OTHER
Dislocation	N	++	fixed 45°	mal-aligned	
Supra-condylar	Ab	++	some	displaced relative to humerus	crepitus
T-shaped	Ab	++	some	mobile	crepitus
Medial epicondyle	N	+	some	tender medially	normal rotation
Capitulum	N	+	v. little flexion	N	
Radial head	N	+	little or no rotation	N	tender radial head
Olecranon	N	+	?some active extension	abnormal	tender olecranon

Ab = abnormal, C = Contour, N = normal, Sw = swelling

62.2 Elbow aspiration

ASPIRATING THE ELBOW (GRADE 1.2)

Clean the skin carefully with betadine, and taking the most careful aseptic precautions, aspirate at the summit of the swelling between the 3 bony points on the outer side of the elbow (62-2B)

An injured elbow rapidly swells, and makes reduction of a fracture difficult, especially comminuted supracondylar fractures in adults (62.4) and fractures of the head of the radius (62.7). As with the knee, aspirating the blood from a tensely distended elbow joint relieves pain, and allows the patient to move the elbow much earlier. Also, you can inject LA at the same time. This is however an invasive action, and you must only do it under aseptic conditions. Consider if the risk outweighs the advantage.

ELBOW ASPIRATION

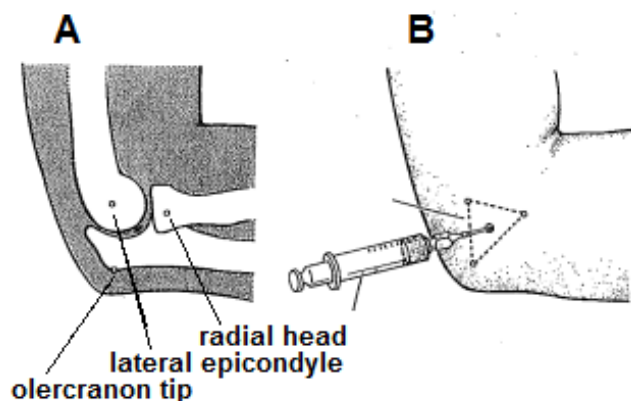


Fig. 62-2 ELBOW ASPIRATION. Strict aseptic technique is mandatory. *N.B.* These 3 bony landmarks are not the same as 62-1.

ELBOW DISLOCATION

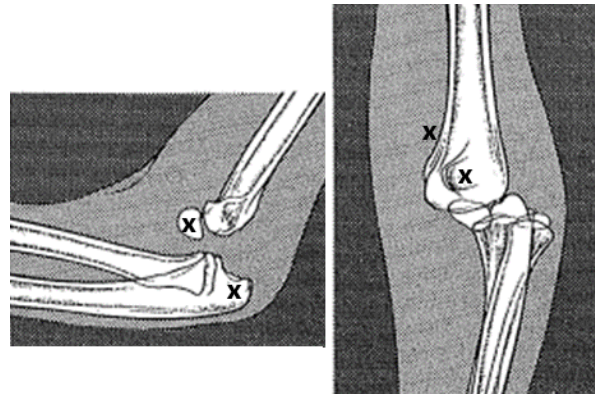


Fig. 62-3 RADIOGRAPHS OF ELBOW DISLOCATION showing mal-alignment of the 3 bony points.

62.3 Elbow dislocation

A fall on the outstretched hand may cause an elbow dislocation. In this common injury, the force travels up the forearm and pushes the radius and ulna posteriorly, or the humerus posteriorly and laterally. The elbow is immobile and held at c.45°. The posterior outline of the arm, instead of being normally rounded, or showing a slight prominence over the olecranon, bends abruptly backwards (62-1C,E). The 3 bony points of the elbow are not in their normal places.

N.B. There may also be a lateral condyle fracture, and severe soft tissue injuries. Occasionally the circulation of the forearm is obstructed, with development of a compartment syndrome (49.6).

REDUCE A DISLOCATED ELBOW IMMEDIATELY

ELBOW DISLOCATION REDUCTION (GRADE 1.3)

The sooner you do this, the easier it will be, and the fewer the complications. If it is very recent, the alternative method described below may work. If it is fractured and too swollen to reduce immediately, elevate the arm (63-11).

Good relaxation is essential.

Lie the patient on the back with the upper arm vertical, and the forearm flexed across the chest. Get an assistant to exert traction on the hand from the other side of the table (62-4A), and at the same time, to flex the elbow gradually (62-4B).

While this is being done, grasp the elbow in both hands, with your fingers round the front of the humerus, and your thumbs behind the olecranon, then push it forwards (62-4C).

The olecranon should lie in the centre of the arm midway between the two epicondyles (62-1A).

If it has shifted sideways, first move it into the midline with your thumbs as you reduce it, then push it forwards over the lower end of the humerus. The dislocation will reduce with a crunch.

When you are satisfied, move the elbow through its normal range. *Unless you can get full flexion, you have not reduced the dislocation, and the olecranon will not be properly in the trochlear groove.*

When you have achieved full flexion, slowly return to 30° of extension whilst supinating the forearm. If you feel the elbow wants to re-dislocate before reaching 30°, it is unstable.

REDUCING A DISLOCATED ELBOW

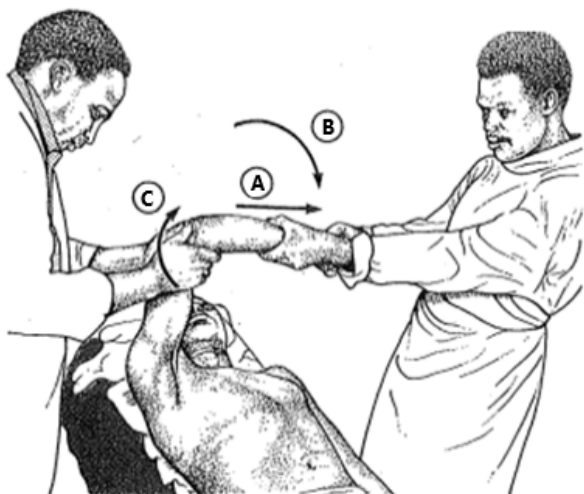


Fig. 62-4 REDUCING A DISLOCATED ELBOW
A, the assistant pulls on the wrist; B, flexes the elbow gradually; C, whilst you push the olecranon forwards.
Kindly contributed by John Stewart.

CHECK RADIOGRAPHS

Make sure that: (1) reduction is satisfactory, and (2) there is no bony fragment trapped in the joint. If there is, it needs removal by opening the joint.

CAUTION! If you fail to get a post-manipulation radiograph, you may miss an incomplete reduction. Reduction will then be possible only at open operation.

POST-OPERATIVE CARE

Check the radial pulse, and function of the median, ulnar, and radial nerves to make sure that they have not been injured during reduction.

If reduction is stable, rest the arm in a collar & cuff I flexion >90° for 3wks. After 1wk, gently exercise the elbow, starting with pronation-supination in 90° of flexion. Then continue with extension-flexion with the thumb in line with humerus (i.e. the forearm in neutral). Exercise also with the arm vertical over the head.

CAUTION! Never perform passive stretching exercises: these encourage post-traumatic ossification (*myositis ossificans*).

N.B. The only safe movements are those that are possible using the injured elbow's own muscles, without the help of the normal hand or an assistant.

COMPLICATED ELBOW DISLOCATIONS



Fig. 62-5 COMPLEX ELBOW DISLOCATIONS. A, with an olecranon fracture. B, the 'side-swipe' fracture-dislocation when a car driver's elbow protruding through the car window is hit by another car. After Apley AG, Solomon L. Apley's System of Orthopaedics and Fractures. Butterworth, 6th ed. 1982 with kind permission.

If reduction is very unstable in all directions:

- (1) there is a fracture of the radial head or olecranon, or there is a grossly comminuted fracture with an anterior dislocation (62-5),
- (2) the medial epicondyle is trapped inside the elbow joint, or
- (3) all the ligaments are torn.

Apply a temporary plaster backslab and organize an open/closed reduction.

Attempt fixing an elbow only if you are sure you have what it needs to achieve a joint stable enough for active mobilization on the 2nd day post op. *In desperate situations*, bridging with an ex fix on the lateral side may provide stability, *but at the expense of range of movement.*

DIFFICULTIES WITH A DISLOCATED ELBOW

If the patient presents >2wks late, but <6wks, try to reduce it by manipulation under GA, *but only once*. If you fail, arrange open reduction.

OPEN REDUCTION FOR CHRONICALLY DISLOCATED ELBOW (GRADE 3.2)

Use the Soddo method (after the hospital of this name in Ethiopia); apply a proximal tourniquet. Do this if you have the skills: *it is not for the occasional surgeon!*

Expose the elbow joint through separate lateral & medial incisions, avoiding the *triceps* extensor mechanism. On the lateral side, cut along the supracondylar ridge to the lateral epicondyle, and over the radial head (62-6A), identified by pronation & supination of the forearm.

Deepen this incision to make separate sleeves of anterior muscles (*brachialis*, *brachioradialis* & *extensor carpi radialis longus & brevis*) & posterior muscles (*triceps* & *anconeus*). Identify the ulnar nerve.

PROCEDURE FOR CHRONIC ELBOW DISLOCATION

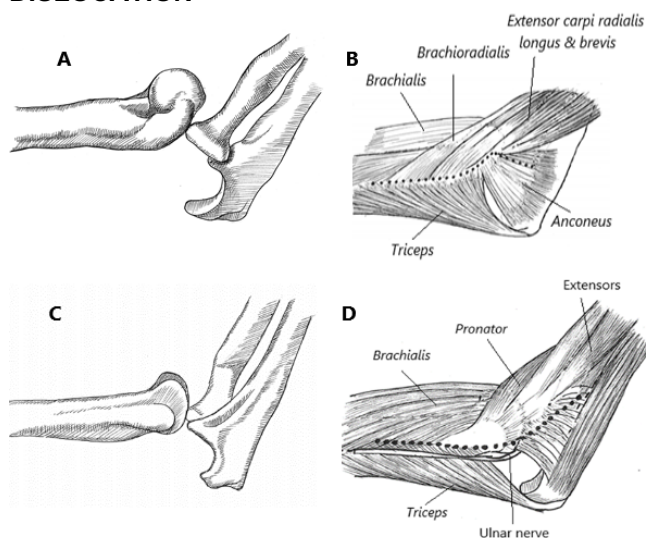


Fig. 62-6 SODDO PROCEDURE FOR NEGLECTED ELBOW DISLOCATION. A,B, the line of the lateral incision. C,D, that of the medial incision, taking care to dissect out the ulnar nerve. After Anderson DR, Haller JM, Anderson LA, Hailu S, Chala A, O'Driscoll SW. *Surgical Treatment of Chronic Elbow Dislocation*, J Ortho Trauma, Wolters Kluwer Health 2017.

Don't go posteriorly beyond the radial neck, and go around any heterotopic calcification to expose the capitellum posteriorly.

Now turn the elbow over, and cut on the medial side along the medial supracondylar ridge to the medial epicondyle, and distally 2cm. Then very carefully dissect out the ulnar nerve, which may be buried in scar tissue (62-6B).

Then mobilize *brachialis* anteriorly off the distal humerus extraperiosteally; *scar tissue is often very thick here*. Make sure the anterior muscle sleeve contains all the flexor pronators' insertion and the medial collateral ligament. The posterior sleeve should include the *triceps* expansion & most of the scar tissue.

Continue dissection anteriorly into the joint, taking care to stay close to the bone, till the trochlea. Use a finger or blade to release all the capsule and scar at the articular margin anteriorly from both medial epicondyle and condyle.

You should then see the articular surface of the anterior humerus.

Now start the posteromedial dissection, which is more difficult; flex and extend the elbow to delineate the contour of the dislocated olecranon in order to identify its articular surface.

Then mobilize the *triceps* off the posterior supracondylar ridge for 4–5 cm, and extend dissection to the tip of the olecranon, freeing it from the posterior humerus medially.

Flexing and extending the elbow allows you to feel the olecranon; cut the soft tissues in the contour of the olecranon, taking care not to injure its articular surface

Now turn the elbow over again; carry on the dissection anterior to the radial head towards the lateral olecranon. Repeatedly flex & extend the elbow in order to palpate the olecranon. Now carefully dissect the scar between it and the posterior humerus, till it separates completely. Now dislocate the 'naked' distal humerus out of the medial or lateral wound, aiming to disrupt the periosteum. At this stage, the radial head should also be free.

Now gently dissect scar tissue off. The olecranon articular cartilage; this should come off *en bloc*, so it makes a nice fit with the trochlea.

Make sure that there is adequate space between the anterior and posterior sleeves distally to allow full reduction of the humerus. This usually means further deep dissection into the flexor pronator mass in line with the ulnar nerve until its first motor branch becomes visible.

Beware of catching the ulnar nerve when you reduce the elbow! Check for impinging soft tissue around the olecranon so that the elbow remains well reduced in near-full extension. Check that the *triceps* is nicely taut with flexion of the reduced elbow; *avoid forceful manipulation!*

N.B. You may be able to stretch the *triceps* tendon by piercing it in a few (not too many) places with a Ch18 needle.

Finally, transpose the ulnar nerve anteriorly submuscularly.

Starting on the lateral side, fix the soft tissue sleeves with no.1 long-acting absorbable sutures through 2mm holes drilled anterior to posterior through both medial & lateral epicondyles.

Test stability again after reduction and close the wound.

Post-operatively, if reduction is stable intra-operatively, a sling is all that is needed. If there is some laxity, keep the elbow in a backslab with the forearm in neutral and elbow at 90°. After 2 days, take the cast off for exercises described above, & at 2wks, abandon the cast and start lifting gradually heavier bottles of water.

If the elbow remains incompletely reduced, there is probably soft tissue between the joint surfaces which needs removal.

If the elbow re-dislocates easily and is very unstable, make sure there are no fractures. Try to refer for ligament reconstruction, but if this is impossible, immobilize the elbow with a backslab for 3wks in 90° flexion and the forearm in neutral. Right after applying the cast, get a radiograph within the cast, and if it is still dislocated, apply an external fixator (62-8).

If the medial epicondyle is trapped inside the elbow, arrange an arthrotomy: a trapped medial epicondyle is easy to find because the flexor muscles are attached to it.

If there are other fractures, there may be a flake off the capitulum, a fracture of the coronoid, or a fracture of the radial head. First reduce the dislocation, and then treat the fracture as if the dislocation had never existed, but if you cannot fix the fragment securely, remove it.

If a nerve has been injured, it needs to be explored if it does not recover spontaneously in 3 months.

If 2-3wks after an injury the movement of the elbow diminishes, a firm mass forms near the joint, and the soft tissue starts to calcify, this is post-traumatic ossification. The periosteum is torn off the back of the humerus and *brachialis* is torn off the front. These injured tissues may calcify and ossify, particularly in children.

The same complication can follow a supracondylar fracture, and is made worse by:

- (1) repeated reduction attempts, or
- (2) subsequent forceful movements.

Don't try to remove any bony lumps. Don't intervene until at least a year after the injury.

Sometimes, in spite of everything, the elbow becomes permanently stiff. If this seems unavoidable, keep it in its most useful position, according to the patient's needs.

This is usually flexed to 45-60°, with the forearm in mid-pronation (63-1).

AVOID ANY FORCED ELBOW MOVEMENTS!

N.B. An elbow arthrodesis is only indicated in case of untreatable pain or to obtain stability demanded by the patient!

62.4 Humeral supracondylar fracture

The swollen and deformed elbow is impossible to move. The swelling obscures the bony landmarks but you may be able to feel crepitus.

These fractures are usually T-shaped or comminuted. Rarely, they are transverse as in children. The fragments cannot be reduced by closed manipulation, and they are difficult to fix at open operation. Even with accurate internal fixation, the late results are often disappointing, so better to institute *early* active movements. Much less osteoarthritis occurs than you might expect. Ultimately, function will depend on a good position of the 2 condyles. If they are widely apart or shifted onto one another, movement will be poor. If they are parallel, movement will be better. Displacement of the fragments at the transverse fracture is less important. Combine active movements with traction (62-7).

OLECRANON TRACTION

If the olecranon is intact, pass a K- wire through it from the ulnar to the radial side, and tension the wire with a Gissane stirrup (62-7A), or, less satisfactorily, use a thin (<4mm) Steinmann pin. *The direction matters to avoid damage to the ulnar nerve.* If the fragments are displaced, ask an assistant to exert traction on the stirrup while you press them back into place (62-7B). You may need anaesthesia to achieve this.

Apply enough traction to keep the upper arm under tension (62-7C) but not enough to lift the shoulder off the mattress. Apply a sling (62-7D) to keep the elbow at 90° and the wrist half-way between pronation and supination, with the hand over the opposite shoulder.

Apply 0.5-1kg of backward traction on the upper arm (62-7E), if necessary.

Feel the epicondyles and adjust the direction of traction so that their positions are at right angles to pull of the traction (62-7F). For this, you may have to adjust the pull of the stirrup (62-7G).

CAUTION! Check the radial pulse often. *Don't apply too much traction*, or you may obstruct the circulation to the arm, injure the nerves, or distract the fragments and so prevent union.

OLECRANON TRACTION

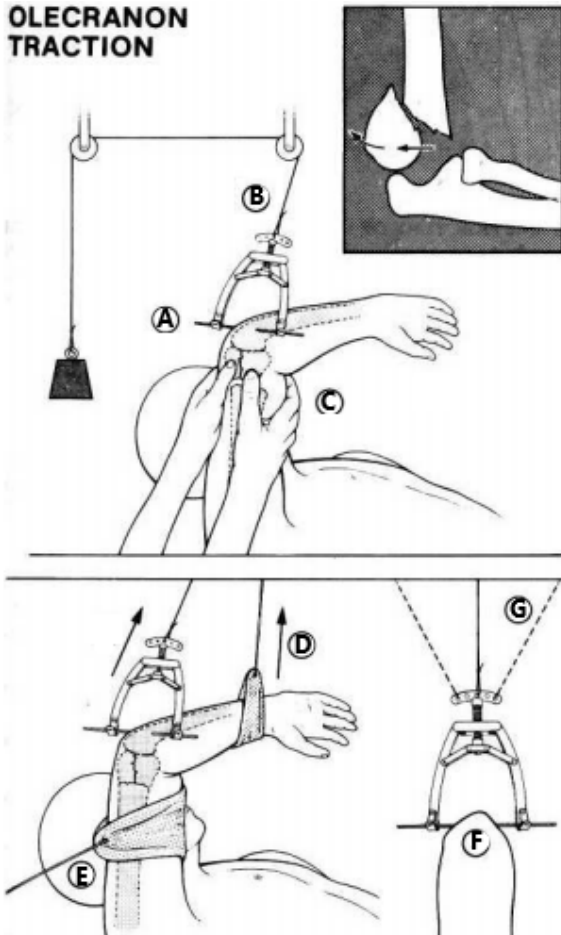


Fig. 62-7 OLECRANON TRACTION FOR A COMMINUTED SUPRACONDYLAR FRACTURE. A, if the olecranon is intact, pass a K-wire through it. B, tension the wire with a Gissane stirrup with 2-4kg, or, less satisfactorily, use a thin (<4mm) Steinmann pin. C, get an assistant to exert traction whilst you push any displaced fragments into place. D, apply a cuff to keep the elbow at 90° and the arm in neutral rotation. E, apply backward traction of 0.5-1kg if necessary. F, adjust the line of traction so that the epicondyles are at right angles. G, you may need a V-shaped pull to achieve this correction. After de Palma AF, *Management of Fractures and Dislocations, An Atlas*, WB Saunders, 2nd ed 1970 with kind permission.

Obtain a radiograph. Slight backward displacement is acceptable, *but there should be no angulation or lateral displacement.*

While in traction, encourage elbow movements. Let the patient take hold of the traction cord and assist in these movements.

Remove the traction at 2-3wks, put the arm in a sling with the elbow at 90° and the forearm in 45° of pronation. Start carefully graded active movements without using force. Recovery will take several months.

EARLY ACTIVE MOVEMENTS

If necessary, anaesthetize the patient and try to get the fragments into a better position. Try to start active movements as soon as possible. If the arm is very swollen keep it raised for a few days in straight traction (as for a child, 73-7).

Put the arm in a collar & cuff for ≤7days. During this time take it out several times a day and encourage movements.

CAUTION! Flexion & extension are subsequently likely to be limited, so make sure they are in the most useful range (62-7). For the same reason the forearm should be in mid-pronation.

Start pendulum exercises for the shoulder, and exercises for the wrist and fingers immediately after the injury.

Put the arm in a sling only if this relieves pain, and for as long as it is needed for analgesia. Encourage using the hand and moving the elbow as much as possible. No recovery of elbow movement will occur without severe determination.

INDICATIONS FOR REFERRAL

- (1) If you can refer to an experienced surgeon, especially if the patient is young.
- (2) Injuries to the median or ulnar nerves.
- (3) Open injuries.

TRANSVERSE SUPRACONDYLAR FRACTURE

If the lower fragment is in one piece, reduce it as in a child (73.7).

DIFFICULTIES WITH SUPRACONDYLAR FRACTURES IN ADULTS

If there is a complex open fracture, toilet the wound. If the elbow is dislocated, reduce it. Suspend the arm in the position of function, and get it moving. Dress it, but *don't close it by primary suture*. Look at it in 4-5 days, and either close it or graft it. Hang it up with metacarpal K-wire or use skin traction on the fingers *while watching the circulation carefully*. Hang the hand up in the same position as for forearm traction.

This is a good indication for an X-fix crossing the joint (62-8). Pay attention to a functional joint position (45-60° flexion). The external fixator has to remain for 4-8wks depending on fracture healing.

EXTERNAL FIXATION OF THE ELBOW (GRADE 3.2)

Make sure you avoid the radial nerve when placing the humeral pins (61-18). Dissect soft tissues bluntly, using small Langenbeck retractors to prevent damage to muscles, vessels and nerves to prepare a channel for pin insertion. If you have any doubt, drill at the insertion of the *deltoid*, or make the incision big enough so that the drill sleeve will have direct contact with the bone.

For more rigidity add a rod between the most proximal to the most distal pin.

EXTERNAL FIXATION OF THE ELBOW

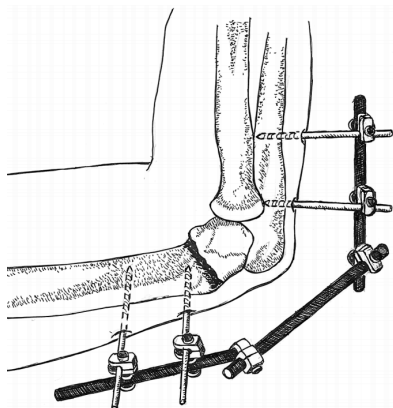


Fig. 62-8 EXTERNAL FIXATION OF THE ELBOW. Beware of the radial nerve which crosses from laterally across the cubital fossa.

62.5 Humeral medial epicondyle fracture

Up to the age 20yrs, the centre of ossification of the medial epicondyle may be a separate piece of bone, and may be pulled off by the flexor muscles of the forearm. The detached fragment may remain outside the elbow joint or enter it and lock it. Treatment is as for a child (73.7)

62.6 Capitulum fracture

A fall on the hand with the elbow straight may rarely cause a piece of the capitulum to break off, tilt, and shift anteriorly. The fragment may be small or include the whole of the anterior capitulum and part of the trochlea. The head of the radius may also be fractured.

The victim holds the elbow at 90°, the contour of the arm is normal, but fuller anteriorly, and tenderness is difficult to locate.

Some rotation is possible, but very little flexion. Small fragments consisting only of cartilage are difficult to see on a radiograph, so suspect this if there is intermittent locking of the joint.

REDUCTION OF CAPITULUM FRACTURE (GRADE 1.5)

If the fragment is large, & you have no opportunity for referral, ask an assistant to exert traction on the extended forearm, while you press the fragment down firmly with your thumbs. Then when the fragment is reduced, flex the elbow >90°. Check the distal circulation, and reduce the flexion if it is impaired. Apply a collar & cuff or a backslab for 4wks and start shoulder and finger exercises immediately.

If radiographs show that reduction has failed, try external fixation of the fragment.

CAPITULUM FRACTURE

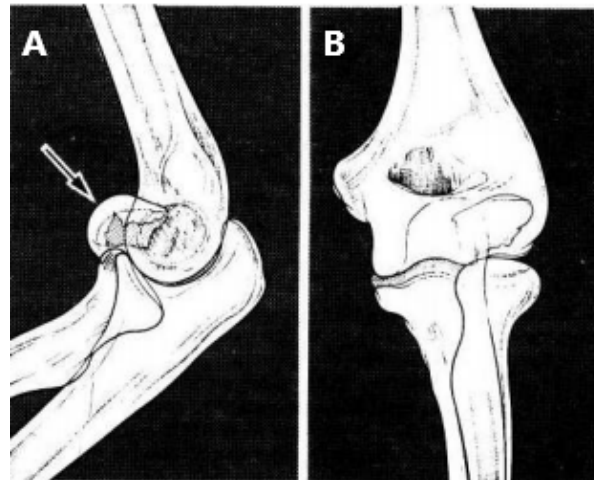


Fig. 62-9 FRACTURE OF THE CAPITULUM. A, lateral view showing a large piece of the capitulum displaced anteriorly. B, diagnosis on an AP view is much harder.

If the fragment is small and has entered the joint, it needs removal. Use the same approach as for a radial head fracture (62.7).

62.7 Radial head fracture

A fall on the outstretched hand forces the elbow into valgus and cracking the radial head against the capitulum. The important feature is the resultant incongruity of the articular surface.

RADIAL HEAD FRACTURE TYPES

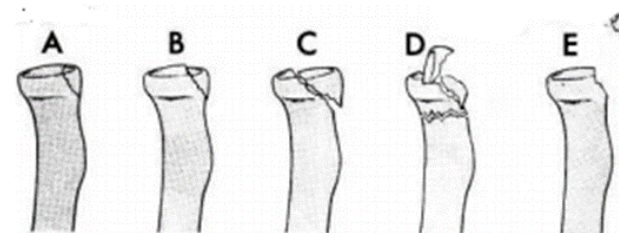


Fig. 62-10 RADIAL HEAD FRACTURE. A, clinical features and the radiograph may look normal. B, conservative treatment may be adequate. C, the more displacement, the more the joint will be affected later. D, with gross displacement of the fragment, fixation is necessary. E, a separated fragment may cause little trouble. *Think of the radial head as the base of a spinning top: as long as it can continue spinning, it won't get stiff!* Kindly contributed by Peter Bewes.

Typically, the contour of the elbow is normal, and not greatly swollen. Flexion & extension is possible but rotation difficult. The radial head is tender.

The elbow and the radiograph may look so normal that you can easily miss this. If you are not sure, and rotation remains painful, get a radial head view (62-11).

RADIAL HEAD VIEW

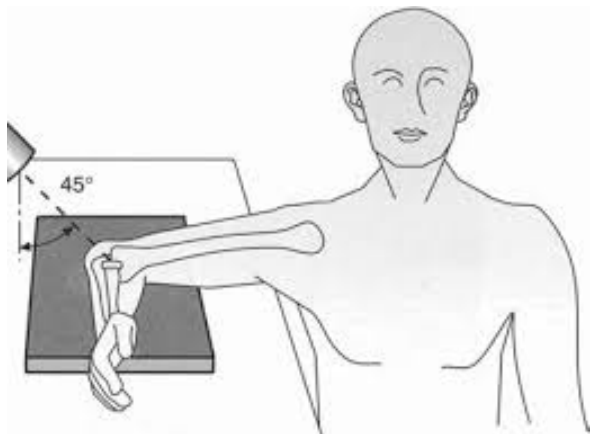


Fig. 62-11 POSITION FOR A RADIAL HEAD VIEW. This shows up all elbow fractures.

N.B. Any fractures that only show up after 2wks will be undisplaced and you can treat them conservatively.

CONSERVATIVE TREATMENT

Where there is insignificant displacement of the radial head (62-10A,B), conservative treatment will give as good results as fixation. There is no need to operate on a loose widely displaced fragment (62-10E), unless it locks the joint.

Reduce a dislocation (62.3) first, if present. If the elbow is very tense, aspirate the haematoma (62-2), and inject LA. Encourage active & easy movements, *especially rotation*. Apply a collar & cuff. *Don't apply PoP.*

If you can get accurate fixation done for 62-10C,D fractures, refer the patient. If not, do your best to rehabilitate the patient. For a non-union or malunion, excise the radial head.

EXCISION OF THE RADIAL HEAD (GRADE 3.4)

Never remove the head of the radius in a child, because this will interfere with growth.

Although the operation itself is not difficult, you can easily cut the deep branch of the radial nerve (posterior interosseous nerve); so refer if possible.

Exsanguinate the arm with an Esmarch bandage, and place a tourniquet (3.8) round the upper arm. Position the arm over the front of the chest, so that the posterior surface of the elbow is uppermost. Use an arm table if available. Leave the hand free so that you can rotate the wrist, pronate the forearm initially, and so turn the head of the radius.

Make a 5cm incision (62-12A) surface of the elbow staying anterior to a line connecting the most lateral point of the radial head to the radial epicondyle, extending downwards between the

extensor carpi ulnaris and *anconeus* muscles (62-12B).

Deepen the incision through the fascia to expose the joint capsule (62-12C). If there is much bruising, and you cannot define these muscles, remove them subperiosteally from the anterior surface of the radial column of the humerus (the 'over the top' approach).

RADIAL HEAD EXCISION

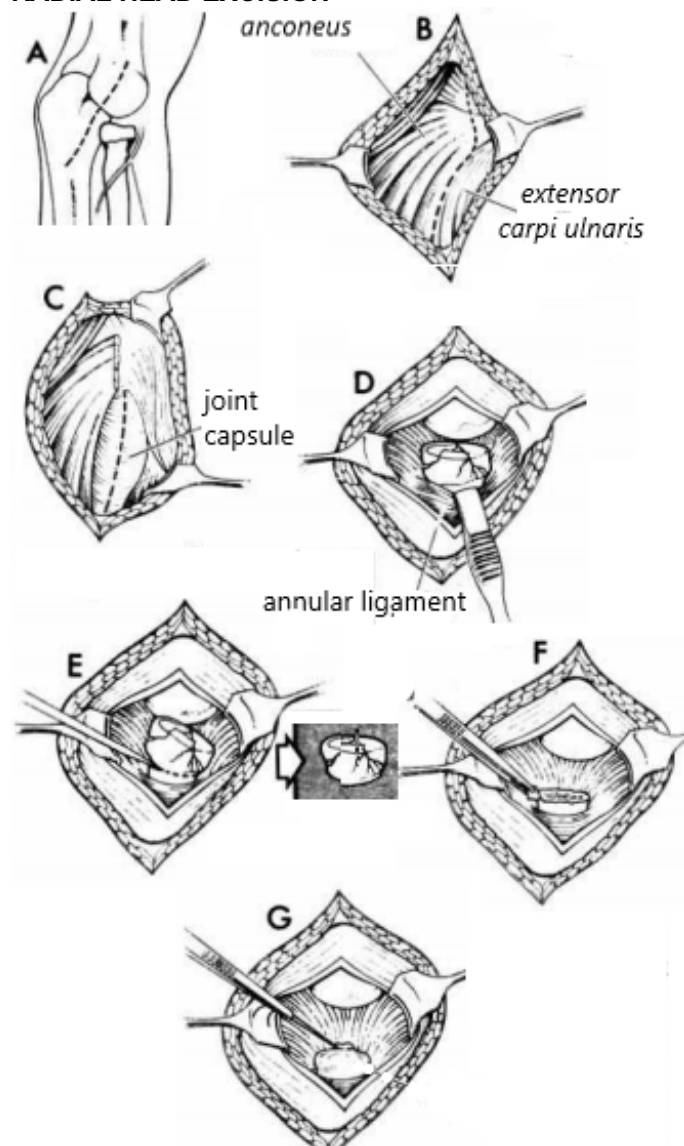


Fig. 62-12 RADIAL HEAD EXCISION. A, incision over the posterolateral surface of the elbow. B, extend the incision deeply. C, open the joint capsule. D, expose the broken radial head. E, lever the head off above the annular ligament. F, leave no loose pieces behind. G, cover the stump with soft tissue. After de Palma AF, *Management of Fractures and Dislocations, An Atlas*, WB Saunders, 2nd ed 1970 with kind permission.

CAUTION! The posterior interosseous nerve, a deep branch of the radial nerve, arises from it 2-3cm below the elbow. It winds round the lateral side of the radial neck, 1cm below its head, between the two planes of the *supinator*.

Don't dissect deeply in front of the radius, or distal to the annular ligament posteriorly. Unfortunately, the course of the nerve may vary considerably. Rather, create the space you need by mobilizing muscles subperiostally from the anterior surface of the radial side of humerus as described. Make a longitudinal incision in the capsule to expose the radial head & the capitulum (62-12D). Wash out blood clot from the joint.

Find the annular ligament and divide it, but *don't go much further distally* as you might damage the posterior interosseous nerve, the deep branch of the radial nerve.

Cut away the head of the radius with nibblers immediately proximal to the annular ligament (62-12E). Remove all loose fragments: you may need to check this with X-ray. Smooth the bone edges with a small rongeur. Then repair the annular ligament with non-absorbable sutures.

If the elbow has been dislocated, re-dislocate it to remove any loose fragments of the radial head that may be lying in other parts of the joint. Fragments are sometimes driven through the capsule and lie outside it. Inspect the capitulum for injury.

Rinse the wound forcibly. Close the capsule and the muscle with absorbable sutures. Release the tourniquet and control any bleeding.

POST-OPERATIVE CARE

Flex the elbow to 45-60°. Apply a pressure dressing to the wound and apply a backslab. Encourage exercising the fingers and shoulders from the 1st day. After 1wk, encourage use of the elbow, but *avoid vigorous exercise or forced passive movement*.

If there is a stiff elbow, check for loose fragments left behind. *Don't force movements*.

62.8 Olecranon fracture

A direct blow to the point of the elbow or a fall on the outstretched hand whilst the *triceps* is contracted may break the olecranon. In both cases the elbow is acutely tender and swollen. Sometimes the radial head is also injured.

If extension of the forearm against gravity is possible, the extensor mechanism of the elbow is intact.

If no extension of the forearm against gravity is possible, the extensor mechanism needs repair.

If the extensor mechanism is intact, place the arm in a sling and encourage movements, regardless what the radiograph shows.

OLECRANON FIXATION

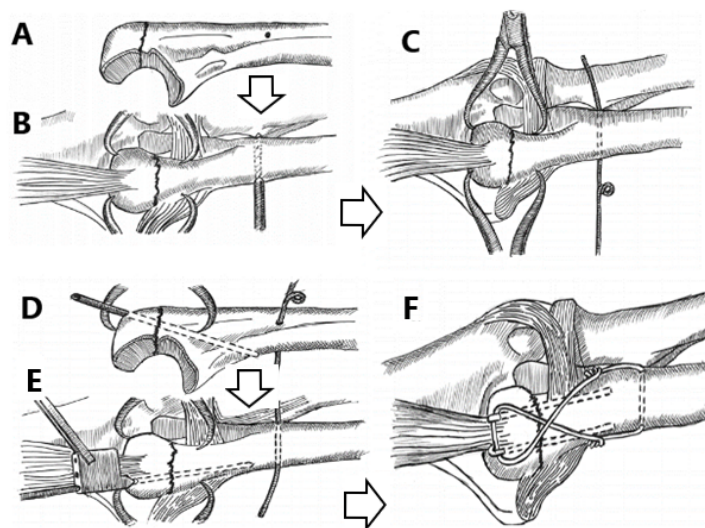


Fig. 62-13 OLECRANON FIXATION. A, hold the olecranon fragment onto the ulnar shaft, and B, drill this transversely 4cm distally. C, thread a tension wire through this drill hole. D, introduce a K-wire medially through the olecranon fragment, and E, another laterally. F, pass K-wires beneath the *triceps* to join the other distal wire in a figure-of-8 loop. The stiff K-wires maintain alignment, while the figure of 8 of soft wire holds the fragments together.

OLECRANON INTERNAL FIXATION (GRADE 3.1)

If the extensor mechanism is ruptured, to enable elbow function to return, you must repair it.

Exsanguinate the arm with an Esmarch bandage, and place a tourniquet (3.8) round the upper arm.

Make an 8cm midline posterior longitudinal incision just lateral to the elbow joint. *Take care to visualize the ulnar nerve to avoid it.* Incise and expose the olecranon fragment: it may be in smaller pieces than you expect from the radiographs.

Open the joint and rinse away any blood clot. Hold the fragments together with 1 or 2 bone hooks or towel clips to reduce the fracture carefully and approximate the joint line (62-13A). There is almost always a small spike on one side that fits exactly into a gap on the opposite fragment. Hold the hook so that it presses in the long axis of the ulna.

N.B. The fracture line will be easier to see if you strip away some periosteum from around it.

Drill the ulnar shaft transversely 4cm distal to the fracture line for the insertion of the tension band (62-13B). Thread the tension wire through the drill holes from the medial side (62-13C).

Introduce 2 K-wires parallel medially & laterally through the proximal olecranon into the ulna towards its anterior cortex (62-13D,E).

Pass the tension wire in a figure-of-8 loop beneath the *triceps* tendon around the protruding K-wires. Twist both ends of the wire together and then cut the olecranon ends of the K-wires & bend them to hold the tension wires (62-13F)

EXCISION OF THE DISTAL OLECRANON (GRADE 3.3)

If $<1/2$ the olecranon is broken off, and internal fixation is not possible, you can excise the distal part and suture the *triceps* to the distal ulna & fascia.

Remove the distal bone fragments, and cut them away from the *triceps* tendon. Drill 2 holes in the ulnar shaft, and pass strong non-absorbable sutures through these holes, and then through the *triceps* tendon (62-14).

CAUTION! Find the ulnar nerve and gently retract it.

EXCISION OF THE DISTAL OLECRANON FRAGMENT

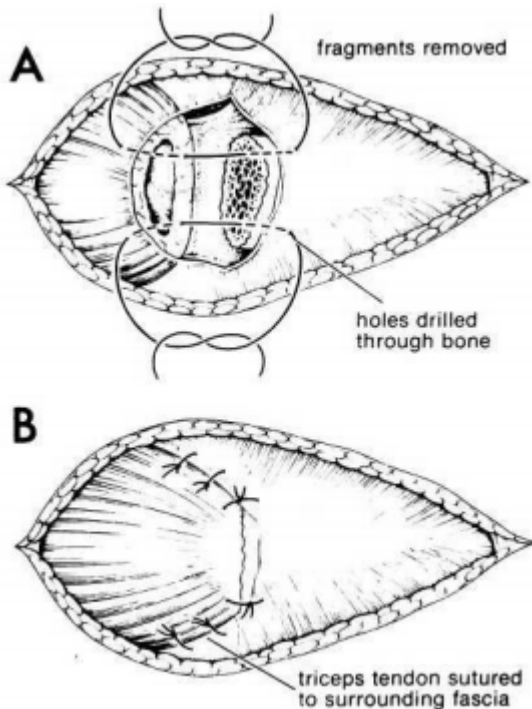


Fig. 62-14 FIXATION OR EXCISION OF THE OLECRANON FRAGMENTS. A, after exposing the fracture site, remove the olecranon fragments, and drill holes through the ulna to fix the *triceps*. B, fix the tendon to the fascia for extra stability. After Bentley G, Greer RB, Rob and Smith's *Operative Surgery: Orthopaedics*, Butterworth 4th ed, 1998 with kind permission.

POST-OPERATIVE CARE

Encourage early return to light work.

CAUTION! Don't splint the elbow, especially not in extension.

