

Colles' Fracture

Description: A Colles' fracture refers to an extra-articular, transverse fracture of the distal radial shaft. It most commonly occurs within 1 in. of the articular surface, causing dorsal angulation of the distal fragment in the metaphyseal area, giving the appearance of an upside-down dinner fork, radial deviation of hand, swelling and ecchymosis. Severe point tenderness over the fracture site can be found with palpation.

Deforming forces in a Colles' fracture lead to:

- Ulnar positive variance: The radius is compressed (radial shortening) and the ulna is now too high. This causes a radial shift of the wrist and hand. Measurements less than 9mm in radial length in adults suggest comminuted or impacted fractures.
- Changes in radial tilt: Normal tilt is 15-25 degrees. Changes in angulation of the radial head may also suggest impaction.
- Changes in radial volar tilt: Loss of volar tilt causes difficulty with wrist flexion.

Many classification systems have been used to describe fractures involving the distal end of the radius such as the AO system and the Frykman system. However, the Frykman classification, which is a modification of AO, is more useful for the therapist and surgeon. It is based on the mechanism of injury and supports specific treatment guidelines for each classifiable injury. (Refer to *Journal of Hand Therapy* article listed in reference section for classification system table).

AO Classification of Colles' Fractures

Type	Description
A	Extra-articular
B	Partial articular
C	Complete articular
1	Simple articular and metaphyseal fracture
2	Simple articular with complex metaphyseal fracture
3	Complex articular and metaphyseal fracture

If severe enough, Colles' fractures may heal with some residual malalignment such as a shortened radius or a distal radial displacement, which disrupt the relationship of the distal radioulnar joint articular surfaces. This malalignment results in permanent loss of full wrist mobility. Other common complications of Colles' fracture include associated carpal fracture or ligamentous tear, triangular fibrocartilage complex (TFCC) tear, distal radioulnar joint (DRUJ) subluxation or dislocation, acute post reduction swelling/compartment syndrome. Late complications include extensor pollicis longus rupture, reflex sympathetic dystrophy (at times associated with distraction of an external fixator), median nerve compression/carpal tunnel syndrome, malunion, and contractures. Each of these conditions should be addressed early to avoid a more disabling result.

Frykman Classification of Colles' Fractures

Fracture Type	Radius	Ulna	Radiocarpal	Radioulnar
I	Extra-articular	Absent	Absent	Absent
II	Extra-articular	Present	Absent	Absent
III	Intra-articular	Absent	Present	Absent
IV	Intra-articular	Present	Present	Absent
V	Intra-articular	Absent	Absent	Present
VI	Intra-articular	Present	Absent	Present
VII	Intra-articular	Absent	Present	Present
VIII	Intra-articular	Present	Present	Present

Etiology: Most common mechanism of injury is a fall on an outstretched hand. The wrist usually lands in extension and the forearm in pronation. The lunate acts as a wedge to shear the radius off in a dorsal direction. The dorsal surface undergoes compression while the volar surface undergoes tension. The momentum from the fall often caused sprain of the ulnar collateral ligament and an avulsion fracture on the ulnar styloid process.

Non-operative versus Operative Management: Indications for non-operative management include patients with stable, non-displaced or minimally displaced fractures as well as patients with poor wound healing and/or medical illnesses that preclude them from surgery and those with sedentary lifestyles and low functional demands. They can be managed non-surgically by closed reduction, combination cast and splint immobilization of the wrist for about 6 to 8 weeks, and instituting early range of motion exercises when pain permits.

Surgical treatment is indicated for unstable/displaced, severely comminuted, or intra-articular distal radius fractures. An unstable injury is defined as a fracture that does not reduce adequately with closed fracture manipulation or that loses reduction below acceptable reduction parameters despite appropriate immobilization techniques. The goal is to restore articular congruity and axial alignment, including radial length, volar tilt, radial inclination, as well as maintenance of reduction, achievement of bony union, and restoration of hand and wrist function.

Surgical Procedure: High-energy injuries are often associated with extensive swelling, and operative intervention should be performed after swelling has decreased, usually several days after injury. Various surgical methods include percutaneous pinning, external fixation, or open reduction and internal fixation (ORIF) with volar or dorsal plating.

Acute Stage / Severe Condition: Physical Examinations Findings (Key Impairments)

ICF Body Functions code: b7101.3 SEVERE impairment of mobility of several joints

- Swelling and ecchymosis around the distal radioulnar joint may be present
- Limited wrist flexion and/or extension active and passive mobility
- Limited forearm supination and/or pronation active and passive mobility
- Pain at mid range of limited motions
- Severe tenderness to palpation of the radiocarpal, ulnomensico-triquetral, distal radioulnar, and/or intercarpal joints

Sub Acute Stage / Moderate Condition: Physical Examinations Findings (Key Impairments)

ICF Body Functions code: b7101.2 MODERATE impairment of mobility of several joints

As above, except:

- Pain at end range of limited motions
- Moderate tenderness to palpation of the radiocarpal, ulnomensico-triquetral, distal radioulnar, and/or intercarpal joints
- Hypomobile radiocarpal, ulnomensico-triquetral, distal radioulnar, and/or intercarpal accessory movement tests

Settled Stage / Mild Condition: Physical Examinations Findings (Key Impairments)

ICF Body Functions code: b7101.1 MILD impairment of mobility of several joints

As above, except:

- Mild pain at end range of with overpressure of wrist flexion and/or extension motions
- Mild pain at end range of with overpressure of forearm supination and/or pronation motions
- Mild tenderness to palpation of the radiocarpal, ulnomensico-triquetral, distal radioulnar, and/or intercarpal joints

Intervention Approaches / Strategies

Non-operative Rehabilitation

Acute Stage / Severe Condition:

Goals: Protection with short-arm cast

Control pain and edema

Maintain range in uninvolved joints (fingers, elbow, shoulder)

Incorporate basic activities of daily living (ADLs)

- Active range of motion (AROM) and passive range of motion (PROM) to the digits
- AROM and active-assisted range of motion (AAROM) exercises to the elbow and shoulder
- Elevation, retrograde massage, and compressive wraps along the hand and digits
- Remove short-arm cast at 6-8 weeks if fracture appears radiographically and clinically healed

Sub Acute Stage / Moderate Condition:

Goals: Protection with splint as needed

Continue to control pain and edema as needed

Increase range of motion (ROM)

Incorporate activities of daily living (ADLs)

- Continue exercises as above
- AROM wrist extension and flexion
- AROM forearm supination and pronation
- PROM utilizing low load / prolonged stretch technique

Settled Stage / Mild Condition:

Goals: Full range of motion (ROM)

Begin strengthening program including grip strength

Return to all activities (exception to contact sports and heavy labor)

- Continue exercises as above
- Advance as tolerated to progressive resistive exercises (PREs) for all joints

Intervention for High Performance / High Demand Functioning in Workers or Athletes

Goal: As above

Return to optimum level of patient function

- Approaches / Strategies listed above

- External Devices
 - Protective equipment
 - Splint / Tape

Post-Operative Rehabilitation for External-Fixation Immobilization

Acute Stage / Severe Condition: Week 1-6

Goals: Control pain and edema

Protect surgical fixation from outside forces

Maintain range in uninvolved joints (fingers, elbow, shoulder)

Prevent dystrophic changes

- Splint for pin protection
- Elevation
- AROM of uninvolved joints (AROM of wrist not possible)
- Supination / pronation ROM
- Desensitization program for irritated radial sensory nerve or chronic regional pain syndrome if necessary.

Sub Acute Stage / Moderate Condition: Week 7-10

Goals: Protect fracture healing site

Continue to control pain and edema as needed

Restore ROM and reduce stiffness of involved joints

- Active, active-assisted and passive range of motion exercises to wrist and forearm
- Emphasis on extension, radial deviation and supination range of motion
- Static progressive splinting for wrist extension, wrist flexion and supination if needed after removal of external-fixation

Settled Stage / Mild Condition: Week 10-16

Goals: Full range of motion (ROM)

Begin strengthening program

Progress tolerance to performance of activities of daily living (ADLs)

- Approaches / Strategies listed above
- Progressive passive stretching
- Wrist and forearm active range of motion (AROM) exercises, isometric exercises, progressing to resisted exercises using dumbbells or theraband
- Grip strengthening
- Functional activities and ADL training – progressing activity tolerance

Intervention for High Performance / High Demand Functioning in Workers or Athletes

Goal: As above
Return to optimum level of patient function

- Approaches / Strategies listed above
- External Devices
 - Protective equipment
 - Splint / Tape

Post-Operative Rehabilitation for Volar-Fixed Angle Plating (ORIF)

Acute Stage / Severe Condition: Week 1-3

Goals: Protect surgical fixation from outside forces
Control pain and edema
Maintain range in uninvolved joints (fingers, elbow, shoulder)
Maintain range of motion of wrist
Incorporate basic activities of daily living (ADLs)

- Elevation
- Begin gentle active range of motion (AROM) of the wrist and forearm
- Active range of motion of fingers, shoulder and elbow
- Resting static wrist splint in 30 degrees extension
- Protective static wrist splint
- Functional activities and sedentary work activities allowed involving less than 2lbs lifting

Sub Acute Stage / Moderate Condition: Week 4-7

Goals: Protection
Continue to control pain and edema as needed
Increase range of motion (ROM)
Incorporate activities of daily living (ADLs)

- Progress active range of motion to more progressive passive stretching
- Gradually discontinue use of protective static wrist splint
- Expand the performance of daily activities – ok to add limited resistance if indicated and tolerated

Settled Stage / Mild Condition: Week 8-12

Goals: Full range of motion (ROM)
Begin strengthening program

Return to all activities (exception to contact sports and heavy labor)

- Active range of motion (AROM) exercises, isometric exercises, progressing to resisted exercises using dumbbells or theraband
- Grip strengthening
- Advance activities and ADLs

Intervention for High Performance / High Demand Functioning in Workers or Athletes

Goal: As above

Return to optimum level of patient function

- Approaches / Strategies listed above
- External Devices
 - Protective equipment
 - Splint / Tape

Selected References:

Donatelli R, Wooden M. *Orthopaedic Physical Therapy*. Philadelphia, USA: Churchill Livingstone, 2001.

Smith D, Brow K, Henry M. Early active rehabilitation for operatively stabilized distal radius fractures. *J Hand Ther*. 2004;17:43-49.