

Radial Head Fracture Repair and Rehabilitation

Surgical Indications and Considerations

Anatomical Considerations: The elbow is a complex joint due to its intricate functional anatomy. The ulna, radius and humerus articulate in such a way as to form four distinctive joints. Surrounding the osseous structures are the ulnar collateral ligament complex, the lateral collateral ligament complex and the joint capsule. Four main muscle groups provide movement: the elbow flexors, the elbow extensors, the flexor-pronator group, and the extensor-supinator groups. Different types of radial head fractures can occur each of which has separate surgical indications and considerations. Fractures of the proximal one-third of the radius normally occur in the head region in adults and in neck region in children.

The most recognized and used standard for assessing radial head fractures is the 4-part Mason classification system. It is used for both treatment and prognosis.

Classification:

Type I fracture

A fissure or marginal fracture without displacement.

Type II fracture

Marginal fractures with displacement involving greater than 2 mm displacement.

Type III fracture

Comminuted fractures of the whole radial head.

Type IV fracture (variation)

A comminuted fracture, with an associated dislocation, ligament injury, coronoid fracture, or Monteggia lesion.

Pathogenesis: Severe comminuted fractures or fracture dislocations of the head of the radius often occur as the result of a fall on an outstretched arm with the distal forearm angled laterally, or a valgus stress on the elbow. Fractures can also occur from a direct blow or force to the elbow (e.g. MVA). Chronic synovitis and mild deterioration of the articular surfaces associated with arthritis (e.g. rheumatoid arthritis, osteoarthritis) of the humeroradial and proximal radioulnar joints resulting in bone deterioration may cause fractures as well.

Epidemiology:

Radial head fractures are relatively uncommon. These fractures occur in all ages.

Diagnosis

- Reported fall on outstretched arm
- Guarding with elbow flexed
- Pain on the lateral side of the elbow
- Swelling/effusion at lateral elbow
- Difficulty with flexion or extension of the elbow, decreased ROM
- Difficulty with pronation and supination of the forearm, decreased ROM
- Tenderness with palpation near the radial head
- Fat pad sign with radiograph examination, CT scan also used

Non-operative treatment:

Conservative treatment usually coincides with Type I radial head fractures. An undisplaced fracture does not need manipulation. Fractures in adults with slight displacement < 2 mm, an attempt is always made to reduce the fracture with manipulation. In children closed reduction alone is often successful. After reduction, sling immobilization with active motion is a well-documented treatment of choice. The addition of a posterior splint for a few days may add comfort for the patient. Initial pain control includes cryotherapy, NSAIDS, and pain medication. Protection of the radial head from accidental bumping can be accomplished by elastic wrapping or loosely taping molded thermoplast over the lateral elbow.

Operative treatment:

This type of treatment is indicated for radial head fractures Type II-IV. This type of treatment is an option when closed manipulation has failed. There are two types of operative treatment: radial head resection and open reduction internal fixation. Open reduction internal fixation has shown to have better results. With an ORIF the fractures are internally fixed with the use of low-profile mini-plates and or Herbert screws. The radial head fracture is accessed through a similar approach as in resection, which is a lateral or posterolateral approach. The fracture is reduced by small forceps, tenaculum clamps, or fixed with 1.0-mm Kirschner wires. Ligaments are sutured back into place using number-1 nonabsorbable braided sutures. The elbow is then fitted with a long arm cylinder cast and the elbow at 90 degrees of flexion. The cast is to be worn for 2 weeks after which it is changed to a hinged brace to allow elbow movement in the following 4 weeks.

NONOPERATIVE AND POSTOPERATIVE REHABILITATION

Note: The following rehabilitation progression is a summary of the guidelines provided by Kisner and Colby, Gutierrez, and Teperman. Refer to their publication to obtain further information regarding criteria to progress from one phase to the next, anticipated impairments and functional limitations, interventions, goals, and rationales.

REHABILITATION FOR NON-OPERATIVE RADIAL HEAD FRACTURES

Early Passive Motion: (2-7 days post fracture)

Goals: Control pain and edema

Protect fracture site

Minimize deconditioning

Maintain range in joints around the effected region (shoulder, wrist, fingers)

Prevent contractures

Intervention:

- Modalities, such as TENS and ice, for pain control
- Splint/Sling as direct by MD
- Monitor use and weight bearing instructions per MD
- Cardiovascular conditioning
- Gentle range of motion exercises of the shoulder, wrist, and fingers
- Passive flexion/extension of the elbow
- Passive pronation/supination of the elbow

Phase I maximum protection phase: (3-6 weeks post fracture)

Goals: Continue to control pain and edema as needed

Minimize deconditioning

Regain range of motion within pain limits

Prevent muscle atrophy

Intervention:

- Active assistive flexion/extension of the elbow
- Active assistive pronation/supination of the elbow
- Isometrics: flexion, extension, and pronation, supination
- Active assistive hyper extension of elbow (at 6 weeks)
- Gripping exercises

Phase II moderate protection phase: (6-8 weeks post fracture)

Goals: Regain full range of motion

Actively work within newly gained range of motion

Increase strength

Intervention:

- Active flexion/extension of the elbow
- Active pronation/supination of the elbow
- Active flexion/extension in standing with wand
- Pulleys with eccentric control of the elbow with flexion/extension

Phase III minimum protection phase: (8 weeks post fracture)

Goals: Educate patient on proper joint protection and therapeutic exercises

Gain adequate strength in the forearm flexors and extensors to increase stability at the elbow

Strengthen the elbow flexors and extensors to gain full range of motion

Intervention:

- Resistive exercises: standing with weights, theraband resisted (flexion, extension, pronation, supination) exercises
- Self-stretching: flexion/extension, pronation/supination, shoulder flexion/extension, and wrist flexion/extension, ulnar deviation/ radial deviation
- Advance elbow extension with radial deviation and elbow flexion with ulnar deviation

REHABILITATION FOR OPERATIVE RADIAL HEAD FRACTURES

Preoperative Rehabilitation

- Injury is protected with immobilization through casting, splinting and/or placed in a sling
- Patient is instructed of post-operative rehabilitation goals and plan

Immobilization: (3-5 days post op)

Goals: Control pain and edema

Protect fracture site with posterior splint or compression bandage

Minimize cardiovascular deconditioning

Maintain range in joints around the effected region (shoulder, wrist, and fingers)

Prevent contractures

Patient can don/doff sling independently with elbow at 90 degrees flexion with forearm in neutral

Intervention:

- Modalities, such as TENS and ice, for pain control
- Splint/Sling as direct by MD
- Monitor use and weight bearing instructions per MD
- Cardiovascular conditioning
- Gentle range of motion exercises of the shoulder, wrist, and fingers
- Passive flexion/extension of the elbow
- Passive pronation/supination of the elbow

Phase I maximum protection phase: (7 days - 3 weeks post op)

Goals: Continue to control pain and edema as needed

Minimize deconditioning

Regain range of motion within pain limits

Prevent muscle atrophy

Intervention:

- Active assistive flexion/extension with stick or pulleys
- Active assistive pronation/supination with stick or pulleys
- Cardiovascular conditioning
- Increase mobility to tolerance, prevent stiffness
- CPM

Phase II moderate protection phase: (4-6 weeks post op)

Goals: Regain full range of motion

Actively work within newly gained range of motion

Increase strength

Intervention:

- Active flexion/extension of the elbow
- Active pronation/supination of the elbow
- Active: flexion, extension, pronation, supination with a wand or pulleys
- Pulleys with eccentric control during flexion/extension
- Isometrics: flexion, extension, pronation, supination
- Gentle stretching using inhibition/elongation techniques or joint mobilization to increase range of motion

Phase III minimum protection phase: (12 weeks post op)

Goals: Increase strength (especially at end ranges)

Educate patient on proper joint protection and therapeutic exercises

Gain adequate strength in the forearm flexors and extensors to increase stability at the elbow

Strengthen the elbow flexors and extensors to gain full range of motion

Increase speed and control of limb movement

Intervention:

- Resistive exercises: standing with weights, theraband resisted (flexion, extension, pronation, supination) exercises
- Self-stretching: flexion/extension, pronation/supination, shoulder flexion/extension, and wrist flexion/extension, ulnar deviation / radial deviation
- Advance elbow extension with radial deviation and elbow flexion with ulnar deviation
- Higher speed and high intensity isotonic flexion/extension, pronation/supination while standing or performing ADLs
- Incorporate open and closed-chain exercises

Selected References:

Ashwood N, Bain G, Unni R. Management of Mason Type-III radial head fractures with a titanium prosthesis, ligament repair, and early mobilization. *J Bone Joint Surg.* 2004;86:274-80.

Gutierrez G. Management of radial head fracture. *Am Fam Physician.* 1997;55:2213-16.

Ikeda M, Sugiyama K, Kang C, Takagaki T, Oka Y. Comminuted fractures of the radial head. *J Bone Joint Surg.* 2005;87:76-84.

Teperman L. Active functional restoration and work hardening program returns patient with 2 1/2-year old elbow fracture-dislocation to work after 6 months: a case report. *J Can Chiropr Assoc.* 2002;46:22-30.