INTRODUCTION
The surgical management of fracture of the radial head is primarily a function of the presence or absence of associated injuries (1,2). We have assessed the Mayo experience and demonstrated a correlation between the Mason type of fracture and associated injuries and describe a classification scheme to reflect this association (Table 5-1). In general, any type II or III fracture should be considered to have an associated lesion, unless proven otherwise (3).

The spectrum of management covers the broad potential of resection (4,5), internal fixation (6,7), or replacement (8–12). The indications for radial head restoration are principally related to associated injuries that dictate the presence of a functioning radiohumeral articulation. Management of the uncomplicated fracture according to the Mason grade is shown in Figure 5-1. Our management for those with associated injuries is shown in Figure 5-2.

OPEN REDUCTION AND INTERNAL FIXATION
Indications
- Those circumstances in which the patient is young and active and in whom a radial articulation would be of value
- Fractures with less than three fragments (13), fractures in which there is associated articular or ligamentous injury, including
  - Medial or lateral collateral ligament deficiency (14)
  - Coronoid fracture (11)
  - Axial (Essex-Lopresti) instability (15)

Contraindications
- Circumstances in which a radial head fixation is not necessary and uncomplicated fractures or when there is more than three fragments
- If open reduction and internal fixation is possible and indicated, there are three broad categories of surgical technique:
  - Interfragmentary compression
  - Axial compression for radial neck fractures
  - Plate fixation
PART II  Fractures and Trauma

OPERATIVE TECHNIQUES

In this chapter, we review our technique for ORIF using interfragmentary fixation, plate fixation for more than three fracture fragments and comminuted neck fractures, and crossed screw fixation for noncomminuted neck fractures.

Interfragmentary Compression

*Indications*  Large single-fragment slice fractures or large two-fragment fractures (7)

*Contraindications*  Communion of the femoral neck

---

**TABLE 5-1**  General Classification of Radial Head Fracture Based on the Presence or Absence of Associated Injury

<table>
<thead>
<tr>
<th>Primary Classification</th>
<th>Complex (Complicated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple (Uncomplicated)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Fracture type</td>
<td>Associated injury</td>
</tr>
<tr>
<td>Mason</td>
<td></td>
</tr>
<tr>
<td>Type I</td>
<td>Ligament Dislocation</td>
</tr>
<tr>
<td>Type II</td>
<td>Mason IV</td>
</tr>
<tr>
<td>Type III</td>
<td>MCL</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Secondary Classification</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fracture type</td>
<td>Associated injury</td>
</tr>
<tr>
<td>Mason</td>
<td>Ligament Dislocation</td>
</tr>
<tr>
<td>Type I</td>
<td>Essex-Lopresti Fracture</td>
</tr>
<tr>
<td>Type II</td>
<td>Coronoid</td>
</tr>
<tr>
<td>Type III</td>
<td>Olecranon</td>
</tr>
</tbody>
</table>

**Radial Head Fracture**

<table>
<thead>
<tr>
<th>Mason Classification</th>
<th>Associated Injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Ligament Dislocation</td>
</tr>
<tr>
<td>II</td>
<td>Essex-Lopresti Fracture</td>
</tr>
<tr>
<td>III#</td>
<td>Coronoid</td>
</tr>
</tbody>
</table>

* Complicated = associated elbow ligamentous or articular injury
# = Resection more commonly recommended in those >60 year of age

**FIGURE 5-1**  Treatment logic followed by the author when managing an uncomplicated fracture of the radial head.
Fracture of the Radial Head

Position
The patient is placed supine, and the arm is brought across the chest.

Surgical Incision
- Associated injuries dictate the nature of the incision.
- If associated injuries will require a medial exposure, a posterior incision is made. Otherwise, a lateral Kocher-type incision is performed (Fig. 5-3).

FIGURE 5-2
Treatment logic employed for the management of radial head fractures occurring in the presence of associated injuries.

FIGURE 5-3
With the patient in a supine position with the arm brought across the chest, the distal portion of the Kocher incision is made over the radial head and over the lateral epicondyte.
Deep Exposure

- There are two options for exposing the radial head:
  - Through Kocher interval (Fig. 5-4)
  - Through Kaplan interval, that is, splitting the extensor carpi radialis brevis (16) (Fig. 5-5)
- If Kocher interval is employed, the ECRB is elevated anteriorly and the anconeus posteriorly. The lateral collateral ligament is identified if it has not been torn. If intact, an incision is made anterior to the origin of the collateral ligament (Fig. 5-6).
- The fracture is identified and inspected. If greater exposure is necessary, the anterior aspect of the lateral collateral ligament is reflected.

**Note:** In the majority of instances, the slice-type fracture occurs in the nonarticular margin of the radial head.

---

**Figure 5-4**

*Fig. 5-4*  
**A:** The interval between the anconeus and extensor carpi ulnaris is well visualized here.  
**B:** This interval is entered, and the muscles are retracted.

**Figure 5-5**

*Fig. 5-5*  
**A**, **B:** Sharp dissection of the extensor carpi ulnaris and minimal elevation of the anconeus by a periosteal elevator reveals the lateral capsule.
**Fracture of the Radial Head**

**Reduction**  The hematoma is removed, and the fracture is reduced. A sharp tenaculum or towel clip is used to hold the slice fracture aligned. A 0.45 K-wire is used to stabilize the reduction (Fig. 5-7).

*Note:* In most instances, the slice fracture involves the nonarticulating margin of the circumference of the radial head. Hence, a screw with a head may be used as this affords superior compressive force.

**FIGURE 5-6**
The lateral capsule is opened just anterior to the lateral complex, which originates at the humerus and attaches to the ulna (A). The fracture has been identified and the hematoma cleaned with a water pick (B).

**FIGURE 5-7**
A, B: The fracture has been reduced. A K-wire is used to secure the fracture, and it is placed in the anterior half of the fracture fragment.
**Fixation**  A 2.0-mm drill bit is directed perpendicular to the fracture surface and in such a way as to allow for a second screw if the fragment is large enough, that is, greater than 30% of the articular surface (Fig. 5-8). The track is tapped (Fig. 5-9), and an appropriate-length 2.7-mm screw is placed across the fracture (Fig. 5-10). The K-wire is removed, and a second screw is inserted across the fracture using the same technique.

**Closure**  The annular ligament is not repaired.

- It will heal.
- A simple closure is adequate in the uncomplicated fracture.
- If the lateral stabilizing structures have been torn, the lateral ulnar collateral ligament is carefully repaired.
- A running locked no. 5-0 nonabsorbable suture is used for this purpose (Fig. 5-11).
- Skin closure is routine.

**Aftercare**  In uncomplicated fractures, we allow motion at 3 to 5 days. The routine is modified as a function of associated injury.

---

**FIGURE 5-8**

A,B: The forearm is slightly pronated, exposing the posterior half of the fracture fragment. A drill sleeve is used, and a 2.0-mm drill bit is employed.
Fracture of the Radial Head

FIGURE 5-9
The screw hole is tapped to receive the 2.7-mm screw.

FIGURE 5-10
A 2.7-mm screw is then inserted across the fracture fragment, preferably perpendicular to the fracture surface. The errors in screw length should be with the screw slightly short rather than slightly long. Anticipation of the slightly increased depth of insertion after the countersink should also be taken into consideration.

FIGURE 5-11
A: A running locked suture is used to close and repair the LUCL if it has been disrupted by the injury. B: A heavy no. 5 nonabsorbable suture is used for this purpose.
Fractures of the Radial Neck: Noncomminuted

There have been some changes in the philosophy in the management of this fracture in recent years (3,17). Due to the fact that there is a tendency for scarring around the plates traditionally used for fixation of this fracture, a less invasive approach and technique has been developed. This is termed axial or longitudinal fixation methodology.

**Indications**  Noncomminuted radial neck fracture

**Contraindications**  
- More than one radial head fragment  
- Comminution of the neck fracture component

**Surgical Exposure**  Patient positioning and surgical exposure are described above.

**Fracture Reduction**  The fracture is assessed (Fig. 5-12), and the articular surface is first reduced anatomically.  

**Note:** When there is comminution of a fracture of the radial neck, the technique requires restoration of the neck length; hence, a plate may be necessary to stabilize the fracture. If this is not the case, axial fixation is our preference.

**FIGURE 5-12**  
When a fracture involves the radial neck, is not comminuted, and further involves only a single head fragment, “axial” screw fixation is preferred to a plate.
Fracture of the Radial Head

Reduction

- A smooth K-wire is introduced at the margin of the radial head ideally off the articular margin to stabilize the fracture (Fig. 5-13).
- The forearm is then rotated approximately 180 degrees.
- At this point, a size 2.5- or 2.7-mm screw is introduced from the margin of the radial head, through the radial head, across the fracture, and down the intramedullary canal of the opposite cortex of the distal fragment (Fig. 5-14).

Note: The screw does not penetrate the cortex but rather follows the intramedullary canal in a tangential fashion.

- The forearm is then rotated again 180 degrees.
- The K-wire is removed, and a second screw is placed across the head and neck and down the canal in a similar fashion (Fig. 5-15).

Note: Cannulated screws may be used in this instance.

- Closure is routine.
- Motion is started as indicated based on the status of any associated injury and the stability of the fracture fixation.

**FIGURE 5-13**
The head fragment is first stabilized with a K-wire (A) and possibly a tenaculum as needed (B).

**FIGURE 5-14**
Cannulated or noncannulated 2.5-mm screws are inserted at the margin of the radial head across the fracture and down the shaft to engage but not penetrate the cortex.
FIGURE 5-15
A: Radial neck fracture, no involvement of the radial head. B: Fracture fixed with cross screws. C: If a head fragment were to be present, intrafragmentary screw fixation would be used.
Radial Neck Fractures, Comminuted

If there is comminution of the radial neck fracture, then plate fixation is indicated (Fig. 5-16).

FIGURE 5-16
A radial/head neck fracture dislocation in a 38-year-old physician.

Technical Notes

● The plate is applied to the nonarticulating margin of the radial head.
● Low-profile, locking screw plates have been designed for this particular function and are preferred if a plate is felt to be necessary (Fig. 5-17). Typically, two screws in the radial head and two to three screws on the proximal radius are adequate (Fig. 5-18).

Note: In some instances of comminution, a small bone graft should be placed in the comminuted region. This may be obtained from the margin of the proximal ulna by simply extending the incision and elevating the anconeus.
FIGURE 5-17
RESULTS
The outcome of open reduction and internal fixation for radial head fractures relates to the nature of the fracture and the presence or absence of associated injuries (18). As noted above, those patients with more than three fragments demonstrated poor outcome when treated by reduction and fixation (7). In general, one would expect at least a 90% to 95% satisfactory outcome in the open reduction and internal fixation of type II radial head fractures even those complicated by elbow dislocation (3,11,13). The outcome of radial neck fractures has also been demonstrated to be quite satisfactory; however, the typical complication is one of limited pronation and supination. In some instances, this requires removal of the plate used to provide fixation for the neck fracture (19). Patients with more comminuted radial head fractures or those with associated injuries have a prognosis that is generally dictated by the associated injuries; this may be as poor as 50% satisfactory outcome with the upper limit of the expectations being 85% (20).

COMPLICATIONS
Complications are principally those of failure of fixation of posttraumatic arthritis. In approximately 5%, the fracture will not completely heal. Limitation of motion is typical particularly in those who have sustained an ulnohumeral dislocation, and forearm rotation is lost if plate fixation is employed (12,19).

REFERENCES


