Rehabilitation of Elbow Injuries

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• Introduction

The elbow functions to facilitate positioning of the hand in space; it serves as a mechanical lever through the forearm for lifting and as a means of force transmission. Motion at the joint is a combination of flexion extension and pronosupination that facilitates activities of daily living. Trauma to the elbow can be challenging to treat. The anatomy is complex and stability of the joint may be compromised by injury to the bones, ligaments and soft tissue which confer stability. Moreover, the articular surfaces are unforgiving of small defects or mal-alignment and the elbow has an unfortunate tendency towards stiffness following trauma and or immobilization. Thus, rehabilitation following elbow injuries can be a challenge.

• Evaluation

Evaluation of the injured elbow begins with a history and physical examination. The mechanism of injury is sought, details surrounding the injury and clues to associated injuries are assessed. Patients are queried about loss of consciousness and, in the setting of lacerations or abrasions, tetanus immunization status. Past medical history as it pertains to and influences current and future treatment is noted. Palpation and
assessment of the limb proximal and distal to the elbow, particularly the wrist and forearm, is performed to exclude concomitant injury. The neurovascular status of the limb, including the status of the major peripheral is documented. Plain film radiographs in multiple plains are obtained to evaluate for bony injury or dislocation. If the elbow has been dislocated, an attempt is made to reduce the elbow. Important information regarding the stability of the elbow can be obtained during the closed reduction. Following reduction, the elbow is gently extended to assess the arc and positions of instability, if any. If the elbow is completely stable through the arc of flexion and extension and there are no fractures which require treatment, immediate motion is commenced. If however, the elbow has a tendency to subluxate, the positions of instability are noted, and the elbow is immobilized in the position of stability. If operative treatment is otherwise not indicated, a hinged elbow brace with the stop placed 20 degrees short of the position of instability, allowing full flexion of the elbow. Gradually the elbow is mobilized and extended over a few weeks’ time to allow full motion.

Any fractures are noted and appropriate treatment instituted according to the subsequent sections.

- Radial head fractures

  Radial head fractures are typically readily diagnosed based upon examination and plain film radiographs. Patients are typically tender over the lateral aspect of the elbow, and may have pain with motion of the elbow particularly in pronosupination. Radial head fractures may be classified according to the Mason Classification.
Options for management of radial head fractures include nonoperative treatment with early mobilization, fragment excision in the setting of a single fragment and/or a bony block to motion; open reduction and internal fixation (ORIF); radial head excision; or radial head replacement arthroplasty.

If nonoperative treatment is employed, the patient is offered a sling for comfort and asked to mobilize within a week. Patients are followed radiographically and clinically to ensure motion is coming along and further displacement does not change the treatment recommendations. Within approximately 4 to 6 weeks, most patients’ acute pain has resolved and motion arc has normalized or nearly normalized.

Surgical Treatment

Fragment excision may be considered in the setting of small fragments that are less than 25% of the head, which are too small, osteoporotic or comminuted for fixation, and do not articulate with the proximal radial ulnar joint. The elbow should remain stable before and after fragment excision and patients may be mobilized early.

Radial ORIF may be performed using screws or plate-and-screw constructs. Lower profile screw fixation, provided that stable fixation is achieved, may result in better motion and less need for hardware removal compared to plate fixation.

In some fractures in which preoperative radiographs suggest they are irreparable based on the amount of comminution or multifragmentary pieces, replacement arthroplasty or excision may be considered. Excision is undesirable in the setting of instability of the elbow and should be avoided in such situations. In addition, in association with longitudinal instability of the forearm such as the Essex-Lopresti injury, radial head excision is to be avoided.
Postoperatively, it is ideal if the radial head fixation is stable enough to permit early motion. If ligament injury is absent and the injury represents an isolated radial head fracture treated with stable fixation or implant arthroplasty, typically the patient is placed in a splint and sling for comfort for a few days and initiate gentle range of motion exercises within a few days. If there has been an associated ligament injury, such as an LUCL and/or medial collateral ligament that has been repaired, then the patient is generally immobilized in a splint at 90 degrees in pronation (for LUCL repair), supination (for medial collateral ligament repair) or neutral (if both have been repaired), and subsequently allowed to start early flexion-extension motion provided stability permits it, with avoidance of terminal extension and forearm rotation. Pronosupination is permitted when the elbow is flexed greater than 90 degrees. At the 6-week mark, if full motion has not yet been achieved, one can consider nighttime extension splinting.

- Olecranon fractures

Olecranon fractures may be classified according to the Mayo Classification system, which includes characteristics of stability, displacement and comminution. In addition to the types represented by this classification system, avulsion fractures and complex fracture dislocations involving the radial head and or coronoid may also occur.

Some nondisplaced fractures (Mayo Type I) may be treated symptomatically and nonoperatively with no more than 3 weeks of immobilization in a long arm splint or cast in mid-flexion. Typically, patients are closely followed with serial radiographs and clinical examination within 7-10 days. Radiographs are examined to ensure displacement does not occur, and clinically patients are followed and
mobilized early to avoid stiffness. Active resisted elbow extension and weight bearing are avoided for 6-8 weeks.

Surgical Treatment: Surgical options include excision of fracture fragments and repair of the triceps tendon and open reduction internal fixation.

*Fragment excision:* Excision and repair of the triceps tendon to the distal fragment is most appropriate for small proximal fragments, osteoporotic or comminuted fractures and in the setting of low demand or elderly patients. Easily up to 30% of the olecranon or more may be excised without implications upon stability; some series suggest up to 80% may be excised. It is important to realize that the anterior stabilizers including the coronoid must be intact to consider excision of the proximal olecranon fragment lest instability occur postoperatively. Following excision, the triceps is reattached to the bone via suture anchors or bony tunnels. Following wound closure, the elbow is immobilized for 4 to 6 weeks postoperatively.

*Open reduction and internal fixation:* Options include tension band wiring constructs, intramedullary devices and plate and screw constructs. Following fixation of the fracture, the wound is closed in layers and the elbow is splinted in mid flexion. Provided that stability of fracture fixation is satisfactory, range of motion exercises are initiated within a few days. The patient is seen within a few days to a week for range of motion assessment and wound inspection. A supervised physiotherapy program may be helpful particularly for patients who are hesitant to move the arm. Radiographs are obtained and repeated at 6 weeks and until bone healing is complete. Loss of the terminal 10-15 degrees of extension is particularly common and appears
Elbow dislocations

Elbow dislocations may occur as simple injuries (without associated fractures) or as complex injuries with associated fractures. Dislocations are named according to the direction of the forearm relative to the humerus and are most commonly posterior or posterolateral. Prereduction radiographs are obtained and the elbow dislocation is reduced. After reduction, gentle range of motion is performed to evaluate the stability of the elbow. Post reduction films are obtained. The elbow is splinted at 90 degrees of flexion or placed in a sling if entirely stable throughout the motion arc. The neurovascular status of the arm is assessed before and after reduction.

Many elbow dislocations are stable following reduction and all that is needed is mobilization. Others remain stable in a small arc of motion or are unstable and may require treatment for the instability or for associated injuries.

In the setting of simple elbow dislocations, an early active motion protocol following reduction is safe and effective. Glen Ross and colleagues investigated Naval academy students with simple elbow dislocations who underwent closed reduction. Early motion was permitted and immobilization avoided. A high rate of satisfactory outcomes was noted, with only a single patient with a re-dislocation.

In those in whom the elbow is unstable in some arc of motion, typically full extension, but in whom concomitant injuries do not mandate surgical treatment, the elbow is immobilized 20-30 degrees more flexed than the position of instability. After 7-10 days, the elbow may be reassessed clinically and radiographically, and placed in...
to a hinged elbow splint allowing full flexion but limiting extension. Gradually over
the course of a few weeks the elbow is followed clinically and radiographically and it
may be gradually extended and then the splint discontinued provided congruent
reduction remains. In some cases, apparent “gapping” of the joint may be seen (so
called “radiographic drop-sign” but does not represent instability and is treated with
active elbow flexion.

Surgical treatment is indicated when concomitant injuries provide an indication
for surgical treatment or in the setting of a grossly unstable elbow which is unstable
in any position. Structures to be addressed include those which provide stability to the
elbow: bony congruity provided by the radial head and coronoid and the medial and
lateral ligament complexes.

It is important to ensure that the patient leaves the operating room with the elbow
in a stable arc of motion and with a congruent reduction. It is better to apply an
external fixation with the elbow congruently reduced than risk redislocation or
residual malalignment. The external fixator should be applied via open skin incisions,
particularly proximally where the radial nerve is vulnerable. Direct visualization of
the proximal pin sites is made and the external fixator is applied.

Typically an external fixator is left in place for 4 weeks, then removed in the
operating room. Prior to removing the pins, the connecting bar is disassembled,
leaving the pins in bone. The elbow is then examined under fluoroscopy to determine
if it remains reduced and to inspect arc of motion. If the elbow continues to be
unstable, the bar connectors may be reapplied and fluoroscopy confirms the elbow is
locked in a reduced position. If the elbow is stable, the pins may be removed. A manipulation under anesthesia may be performed if indicated.

Postoperative care and rehabilitation depends upon the stability obtained intraoperatively and the structures addressed. In general, the elbow is rehabilitated with elbow in a hinged elbow brace allowing flexion but limiting terminal extension and gradually increasing extension over time. The forearm position depends upon the competence of the ligament structures. If the lateral ligament structures are injured but the medial side is competent, the forearm is positioned into pronation. If the lateral structures are competent, but the medial sided structures are injured, the forearm is placed into supination. If both the medial and lateral ligament structures have been injured, the forearm is placed in neutral.

Outcomes following simple elbow dislocations are for the most part good, however patients do report some residual function difficulty. A group of 110 Scottish patients were noted to have a high rate of subjectively reported pain and instability. Interestingly, patients who reported instability in many cases did not have demonstratable instability on exam; patients who reported no instability in some cases had asymptomatic demonstratable instability on examination.

- Coronoid fractures

Coronoid fractures are rarely seen in isolation but more commonly occur in the setting of fracture dislocations of the elbow. Although previously the importance of coronoid fractures was not recognized, recent series have documented the role of the
coronoid to stability of the elbow and increasing interest has focused on proper
assessment and management.

Postoperative Care and Rehabilitation
Rehabilitation of the elbow is contingent upon the stability of the fixation construct
and the elbow joint itself which was obtained intraoperatively. If the fixation
construct is stable to allow early motion, this is ideal. The motion allowed must be in
an arc in which the elbow remains congruently reduced and does not subluxation.
Although a goal of surgery is to achieve sufficient construct integrity to mobilize the
elbow, joint stability should not be sacrificed to prematurely mobilize the elbow. In
addition, in some cases in which a stable joint cannot be achieved by other means, the
elbow may be congruently reduced and an external fixator applied.