Introduction

Epidemiology
incidence
1.5-4% of all fractures
radial head fractures are among the most common elbow fractures (33%)
Pathophysiology
mechanism of injury
fall on outstretched hand
elbow in extension + forearm in pronation
most force transmitted from wrist to radial head
Associated injuries
35% have associated soft tissue or skeletal injuries including
ligamentous injury
lateral collateral ligament (LCL) injury
most common (up to 80% on MRI)
medial collateral ligament (MCL) injury
combined LCL/MCL
Essex-Lopresti injury
distal radioulnar joint (DRUJ) injury
interosseous membrane disruption
other elbow fractures
coronoid fracture
olecranon fracture
elbow dislocation
terrible triad (elbow dislocation, radial head fracture, coronoid fracture)
carpal fractures
scaphoid fracture

Anatomy

Osteology
elbow joint contains two articulations
ulnohumeral (hinge)
radiocapitellar (pivot)
60% load transfer across elbow joint
proximal radius
nonarticular portion of the radial head is a ~90 degree arc from radial styloid to Lister
hardware placement)
Ligaments
lateral collateral ligament complex
lateral ulnar collateral ligament (LUCL)
primary stabilizer to varus and external rotation stress
deficiency results in posterolateral rotatory instability
radial collateral ligament (RCL)
accessory lateral collateral ligament
annular ligament

stabilizes proximal radioulnar joint
medial (ulnar) collateral ligament (MCL)
three bundles
anterior bundle
primary stabilizer to valgus stress (radial head is second)
posterior bundle
transverse bundle
Biomechanics
radial head confers two types of stability to the elbow
valgus stability
secondary restraint to valgus load at the elbow, important if MCL deficient
longitudinal stability
restraint to proximal migration of the radius
contributions from interosseous membrane and DRUJ
load-sharing from wrist to radiocapitellar joint, dependant on radiocapitellar surface a
loss of longitudinal stability occurs when
radial head fracture + DRUJ injury + interosseous membrane disruption (Essex-Lopre
radial head must be fixed or replaced to restore stability, preventing proximal migration of the ra

Classification

Mason Classification (Modified by Hotchkiss and Broberg-Morr	
Type I	Nondisplaced or minimally displaced (<2mm), no mechanical block to rotation
Type II	Displaced >2mm or angulated, possible mechanical to forearm rotation
Type III	Comminuted and displaced, mechanical block to mo
Type IV	Radial head fracture with associated elbow dislocati

Presentation

Symptoms
pain and tenderness along lateral aspect of elbow
limited elbow or forearm motion, particularly supination/pronation
Physical exam
range of motion
evaluate for mechanical blocks to elbow motion
flexion/extension and pronation/supination
aspiration of joint hematoma and injection of local anesthesia aids in evaluation of me
stability
elbow
lateral pivot shift test (tests LUCL)
valgus stress test (tests MCL)
DRUJ
palpate wrist for tenderness
translation in sagittal plane > 50% compare to contralateral side is abnormal

may be difficult to determine on exam, can get dynamic CT scan in neutral, pronation
injury
interosseous membrane
palpate along interosseous membrane for tenderness
radius pull test
>3mm translation concerning for longitudinal forearm instability (Essex-Lopresti)

Imaging

Radiographs
recommended views
AP and lateral elbow
check for fat pad sign indicating occult minimally displaced fracture
additional views
radiocapitellar view (Greenspan view)
oblique lateral view of elbow
beam angled 45 degrees cephalad
allows visualization of the radial head without coronoid overlap
helps detect subtle fractures of the radial head
CT
further delineate fragments in comminuted fractures
identify associated injuries in complex fracture dislocations

Treatment

Nonoperative
short period of immobilization followed by early ROM
indications
isolated minimally displaced fractures with no mechanical blocks (Mason Type I)
outcomes
elbow stiffness with prolonged immobilization
good results in 85% to 95% of patients
Operative
ORIF
indications
Mason Type II with mechanical block
Mason Type III where ORIF feasible
presence of other complex ipsilateral elbow injuries
outcomes
fragments
ORIF shown to have worse outcome with 3 or more fragments compared to ORIF wit
isolated vs. complex
ORIF isolated radial head fractures versus complex radial head fractures (other asso
show no significant difference in outcomes at 4 years
isolated fractures trended towards better Patient-Rated Elbow Evaluation score, lowe
lower rate of secondary capsular release
fragment excision (partial excision)
indications

fragments less than 25% of the surface area of the radial head or 25%-33% of capite
outcomes
even small fragment excision may lead to instability
radial head resection (complete excision)
indications
low demand, sedentary patients
in a delayed setting for continued pain of an isolated radial head fracture
contraindications
presence of destabilizing injuries
forearm interosseous ligament injury (>3mm translation with radius pull test)
coronoid fracture
MCL deficiency
radial head arthroplasty
indications
comminuted fractures (Mason Type III) with 3 or more fragments where ORIF not fea
than 25% of the radial head
elbow fracture-dislocations or Essex Lopresti lesions
radial head excision will exacerbate elbow/wrist instability and may result in proximal
ulnocarpal impingement
outcomes
radial head fractures requiring replacement have shown good clinical outcomes with
compared to ORIF for fracture-dislocations and Mason Type III fractures, arthroplasty
lower complication rate and higher patient satisfaction
retrograde titanium nail reduction and stabilization
indications
not yet considered mainstream treatment as it is in the pediatric population
outcomes
small powered case studies show good outcomes

Techniques

Approaches to Radial Head
overview
PIN crosses the proximal radius from anterior to posterior within the supinator muscle
in both Kocher and Kaplan approaches, the forearm should be pronated to protect PI
pronation pulls the nerve anterior and away from the surgical field
Kocher approach
interval
between ECU (PIN) and anconeus (radial n.)
key steps
incise posterior fibers of the supinator
incise capsule in mid-radiocapitellar plane
anterior to crista supinatoris to avoid damaging LUCL
pros
less risk of PIN injury than Kaplan approach (more posterior)
cons

risk of destabilizing elbow if capsule incision is too posterior and LUCL is violated, wh
of the capitellum
Kaplan approach
interval
between EDC (PIN) and ECRB (radial n.)
key steps
incise mid-fibers of supinator
incise capsule anterior to mid-radiopatellar plane (have access)
pros
less risk of disrupting LUCL and destabilizing elbow than Kocher approach (more ant
better visualization of the coronoid
cons
greater risk of PIN and radial nerve injury
ORIF
approach
Kocher or Kaplan approach
plates
fracture involved head and neck
posterolateral plate placement
safe zone (nonarticular area) consists of 90-110 degree arc from radial styloid to List
neutral rotation to avoid impingement of ulna with forearm rotation
bicipital tuberosity is the distal limit of plate placement
anything distal to that will endanger PIN
countersink implants on articular surface
screws
headless compression screws (Hebert) if placed in articular surface
better elbow range of motion and functional outcome scores at 1 year compared to pl
Radial Head Resection
approach
Kocher or Kaplan approach
complications after excision of the radial head include
muscle weakness
wrist pain
valgus elbow instability
heterotopic ossification
arthritis
proximal radial migration
decreased strength
cubitus valgus
Radial head arthroplasty
approach
Kocher or Kaplan approach
technique
metal prostheses

loose stemmed prosthesis
that acts as a stiff spacer
bipolar prosthesis
that is cemented into the neck of the radius
silicon replacements are no longer used
indepedent risk factor for revision surgery
complications
overstuffing of joint that leads to capitellar wear problems and malalignment instability
overstuffing of joint is best assessed under direct visualization