Carpal Fracture / Nonunion

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I have no disclosures relevant to the material presented in this discussion.

Pretty Girl Behind Every Tree??

AvantOrtho.com
Scaphoid Fractures / Nonunion

- Continue to humble me!
- When you master it – Teach me!!

Everything Else

- Pin and Immobilize
- When in doubt, Cut it out!!!
- If they can’t Use it, then Fuse it!!

Outline

Pathogenesis
- Fall outstretched wrist extended >95° with >10° radial deviation
- Children – distal pole most common

Natural History
- Overall incidence of nonunion 5-10%
- DJD develops within 10 years with nonunion

Imaging / Diagnostic Studies
- PA ulnar-deviated
- Semi-pronated (Waist/Distal Third)
- Semi-supinated (Dorsal Ridge)
- CT / MRI / Bone scan
Bone Scan (PBS) is a sensitive diagnostic modality, but lacks specificity, which may result in over-diagnosis. The potential value of SPECT combined with CT for the diagnosis of an occult scaphoid fracture is significant. A study of 10 patients with suspected occult scaphoid fractures showed that SPECT/CT has the potential to be more accurate than PBS. It can discriminate between scaphoid, other carpal bones, and bone bruises.

### SPECT/CT

#### Scaphoid Fractures

- **Conservative Treatment**
  - LAC vs. SAC vs. Spica
- **Surgical Treatment**
  - Percutaneous
  - Arthroscopic-assisted
  - Volar
  - Dorsal
  - Hardware Selection
Scaphoid Fracture Nonunions

- Delayed diagnosis or treatment
- Inadequate immobilization
- Proximal fracture
- Initial and progressive displacement
- Fracture comminution
- Associated carpal injuries
- Infection
- Co-morbid Conditions (ICD-10!!!)

Mayo

- Mayo’s Classification
  - Distal articular surface
  - Distal tubercle
  - Distal third
  - Middle third
  - Proximal third

Russe

- Horizontal Oblique
- Transverse
- Vertical Oblique
Scaphoid Nonunions

- Classifications
  - Mayo-Russe-Herbert

- Treatment Options
  - Percutaneous
  - Volar Wedge Bone-Grafting
    - Distal Radius
    - ICBG
    - Tri-cortical vs. Cancellous
    - Allograft
  - Vascularized Bone Grafting
  - Partial Scaphoid Excision

- 19 patients
- ORIF with 2 HCS for scaphoid nonunions
- Bone grafting techniques
  - 14 cortisocancellous autograft from iliac crest
  - 5 capsular-based vascularized distal radius graft
  - 2 medial femoral condyle free vascularized bone graft
- All fractures had bone union at 3.6 months
- Corticocancellous strut, cancellous autologous nonvascularized bone graft, and HCS
- Waist fracture nonunions with humpback deformity and no AVN
- 17 patients
- All 17 united with a mean union of 3.6 months

19 patients (1987-2010)
- Distal Scaphoid Excision – Nonunion
- Mean follow-up 15 Years
  - Increased grip strength / Arc of Motion
  - Small decrease in revised carpal height ratio
  - Small increase in radiolunate angle
  - Two patients failed (Pain)

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Everything Else – Carpal Fx / Nonunion

- 3 main groups
  - Perilunate injuries
  - Axial injuries
  - Avulsion/Impaction injuries

Lunate Fractures

- Palmar surface of lunate
  - Volar extrinsic wrist ligaments (Long/Short Radiolunate)
  - Vascular conduit (Testut)

- Palmar lip fracture
  - Capitate subluxed volarly
  - Late instability

- Extended volar carpal tunnel approach

- Repair volar wrist capsule if possible

Triquetral Fractures

- 2nd most common fractured carpal
  - Dorsal avulsion
  - Body

- Conservative
  - Immobilization

- ORIF
  - Dorsal approach
  - K-wires vs. Screws vs. Anchor
  - Supplemental pinning to lunate or hamate

- Excision

- Reverse peri-lunate instability pattern
Triquetrum

- Sesamoid bone
- Most common fracture pattern – Transverse
- Indirect avulsion mechanism through FCU
- Comminuted – Direct Trauma
- Treated conservatively initially
- Excised late if symptomatic

Pisiform Fractures

Pisiform

- Sesamoid bone
- Most common fracture pattern – Transverse
- Indirect avulsion mechanism through FCU
- Comminuted – Direct Trauma
- Treated conservatively initially
- Excised late if symptomatic
Really?

- Nonunion of the pisiform bone in a 9-year-old boy.
- Brouwers L1, Hannemann PP2, Brink PR2.

- A 9-year-old boy with an unrecognized fracture of the pisiform bone.
- Underwent a pisiformectomy 10 months after injury due to a nonunion of the pisiform bone.
- Good results were obtained and the wrist did not show any functional impairment.

Hook of Hamate Fractures

- Most treated conservatively initially.
- Excised late if symptomatic
  - Volar approach
  - Direct ulnar approach
  - Protect deep motor branch of ulnar nerve
- ORIF
  - Higher complication rate

Hamate Body Fractures

- Associated with 4th or 5th CMCFx/Dislocations
- Dorsal shear mechanism
- ORIF to restore articular margin / CMC joint
  - Dorsal longitudinal or curvilinear approach
- May lead to post-traumatic DJD = Arthrodesis
Hamate

Capitate Fractures

- Associated with perilunate instability patterns
- Axially directed force
  - Fracture line often in frontal place
  - Requires ORIF
  - Dorsal Approach
- Nonunion or Delayed union (~50%)
- Watch for AVN

How many of these have seen Me?

- Nonunion of capitate due to late diagnosis in a teenager.
  - Gümrüştaş SA, Tosun HB, Ağar I, Uludağ Aı.

- 13-year-old boy late-diagnosed capitate fracture
  - Short-arm cast for 3 months.
  - One year after the trauma, total union of the fracture.
Trapezoid Fractures

- Believed to be least fractured carpal bone

- Frontal plane dorsal shear fracture
  - Can destabilize the index CMC

- CRPP vs. ORIF
  - Standard dorsal 3-4 approach
  - Protect SBRN & Dorsal Branch of Radial Artery

- May lead to post-traumatic DJD = Arthrodesis
Trapezium Fractures

- Nearly always involves one of its 4 articular facets
- Frequently leads to subluxation of CMC joint
- ORIF
- Trapeziectomy +/- Palmar Oblique Ligament Recon.
- CMC Arthroplasty
- Dealer's Choice on Approach

Trapezial ridge fracture
Pitfalls

- Initial radiographs may be negative
  - Repeat PE and X-rays as necessary
- Be Aware of Carpal Instability Patterns
- Screws & Plates
  - Less chance for hardware migration
  - Increased stability
  - May allow earlier mobilization
- Persistent post-traumatic symptoms
  - Partial / Total wrist arthrodesis
  - Partial carpectomy
  - Selective arthroplasties

Thank You!!