Management of High Energy Carpal Instability

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Disclosures
• Stryker: Consultant and Speaker
• Acumed: Consultant and Speaker
• Axogen: Speaker and stock ownership

High Energy Carpal Instability

• KB
  • 35 yo laborer
  • Fall from a height
  • Significant wrist injury
  • Consulted for treatment

High Energy Carpal Instability

• Uncommon: 7% of carpal trauma
• Frequently delayed diagnosis
  • Early>late Rx
• Patterns
  • Variable
  • Multiple combinations
  • Bone/Soft Tissue
• Understanding Restoration of Anatomy is Essential in Treatment

High Energy Carpal Instability

• Anatomy
• Historical Considerations
• Biomechanics/Pathomechanics
• Patient Considerations
• Elements of Acute Treatment
• Results
• Complications and Salvage
Epidemiology and Patterns of Perilunate Fracture-Dislocations over a 17 Year Period
Leung, Egleseder, Abzug; JHS, Sept 2014

- 140 pts, 17 years
- Middle aged men, high energy injury
- Distribution
  - 42 TSPL
  - 43 PL
  - 46 additional fractures
- Results
  - Nearly 50% scaphoid
  - 22 fracture patterns
  - 3% open fractures
  - 15% median nerve symptoms

High Energy Carpal Instability

- 1855 Malgaigne (pre x-ray)
- 1897 Destot and Cousin
- 1902 deQuervain
- 1906 Tavernia in Lyon France
  - First clinical series

High Energy Carpal Instability

- Difficult to Study
  - Small series
  - Retrospective
  - Varying patterns/treatments
- Multi-center Experience JHS 1993
  - 166 pts
  - 7 centers

Perilunate Dislocations and Fracture-Dislocations: A Multicenter Study
G. Heidbrink, MD; J. C. Cailliet, MD; Lyon, France; R. L. Lieberfeld, MD; P. C. Amendt, MD; W. P. Quiner, MD; Bucyrus, Pennsylvania; J. Tabib, MD, Luzerne, Switzerland

Etiology

- Hyperextension Injuries
- High velocity, high energy
- Fall from heights
- Vehicular injuries
- Air bag deployment

Patterns of PLD/PLFD

- Hyperextension
- Palmar Tension
- Dorsal Compression

- Patterns of Injury are produced depending upon
  - Force
  - Position
  - Bone quality
  - Ligament loading
Patterns of PLD/PLFD

Patterns of PLD/PLFD

Patterns of PLD/PLFD

Patterns of PLD/PLFD

Carpal dislocations: Pathomechanics and progressive perilunar instability  
J Hand Surg, 1980
Jack K. Mayfield, M.D., Minneapolis, Minn., Roger P. Johnson, M.D., and Raphael K. Kilcoyne, M.D., Milwaukee, Wis.

Progressive Perilunar Instability

- Extension, Ulnar Deviation, Intercarpal Supination
- Stage 1: SL Dissociation
- Stage 2: Scaphoid and capitae
- Stage 3: Dorsal perilunate
- Stage 4: Lunate Dislocation
**Stabilizing Ligaments**

- **I**
  - SLD Radial Extrinsic SLIL

- **II**
  - Scaphoid and Capitate through space of Poirier
  - Radial ExtrinsicSLILRLT

- **III a**
  - Propagation ulnary
  - LT lig Avulsion fxs

- **IV**
  - Progressive Reduction Instability

- **V**
  - Greater Arc
  - Lesser Arc
  - Inferior Arc
Classification

Variety of Patterns
- Not Mutually Exclusive
  - Scaphoid fracture
  - SL ligament tear
  - DR fractures
  - Volar Patterns
  - Ulnar Patterns
    - Murray, Palmer, Shin
    - JHB, April 2012

Patient Presentation
- History
  - Clinical signs may be minimal
  - Deformity
  - Diffuse wrist tenderness
  - Limited ROM
    - Limited digital ROM
  - Neurologic Exam Critical
Wrist Fracture Dislocation

Factors in Treatment

- Restoration of Anatomy is KEY
- Apposition and De-tensioning to allow soft tissue healing
- Stable fixation to allow bony healing

Arthroscopic Management

- 20 patients, PLD and PLFD
- Arthroscopic Reduction and Perc Pinning
- 79% E/F ROM
- 78% Grip strength
- Reduction maintained in 75%
- 3E, 8G, 7F, 2P

Arthroscopic Management

- 31/40 patients with >1 year FU
- “Shoehorn” maneuver for reduction
- Screw fixation for PLFD
- Percutaneous Pinings
- SL anchor assisted repairs
**Arthroscopic Management**

Arthroscopic Mgt of Perilunate Injuries  
Liu et al., Hand Clinics, 2017

- E/F 115° (86% contralateral)
- Grip 83% contralateral
- Mayo wrist scores 87
- DASH 7
- 31/31 RTW (15 manual labor)
- Operative time 90-300 minutes!!

**Treatment**

- Anatomy-Restoration and Stabilization
- Open Treatment

**Open PLD**

**Surgical Approach**

Large rent in extensor retinaculum
Scaphoid Fractures
- Waist Fxs
- Most transverse
- Beware!!

Outcomes
- Mayo Clinic Series, 2011
  - 57 Patients (94 total cohort)
    - 30 perilunate, 64 fx-dislocations
    - 5 open
  - Varied approaches, most combined
  - Results
    - Grip strength similar
    - ROM favored fracture group
    - 1/3 additional procedures
    - 25% good to excellent
    - X-ray changes (35% soft tissue, 52% fx)

Outcomes
- 45 patients, 46 injuries
- Combined approach for all pts
  - SL repairs, Scaphoid ORIF, LT pinning
- Pathologic findings
  - Volar ligament rent: 100%
  - Dorsal avulsion 65%
  - SL tears in 35%

Outcomes
- Flexion/Extension: 82°
- Grip Strength: 59%
- Radiographically better for Fx group

Outcomes
- Results of Perilunate Dislocations and Perilunate Fracture Dislocations With a Minimum 15-Year Follow-Up
- Krief et al., JHS, Nov 2015
  - 73 patients (data on 30)
  - 15 year Follow-up
  - 14 PL, 16 PLFD
  - Variety of Treatments

Outcomes
- Results of Perilunate Dislocations and Perilunate Fracture Dislocations With a Minimum 15-Year Follow-Up
- Krief et al., JHS, Nov 2015
  - Distribution of the Various Treatments According to the Injuries
  - PLD
  - TIP/LFD
  - PLFD
  - Closed reduction and cast immobilization
  - Closed reduction and percutaneous pinning
  - Open repair via volar approach
  - Open repair via dorsal approach
  - Open repair via volar and dorsal approach
Outcomes

Results of Perilunate Dislocations and Perilunate Fracture Dislocations With a Minimum 15-Year Follow-Up

Krief et al., JHS, Nov 2015

- ROM: 68%
- Grip 70%
- Mayo WS: 70
- OA in 70%

Outcomes

Perilunate Dislocations and Transscaphoid Perilunate Fracture–Dislocations: A Retrospective Study With Minimum Ten-Year Follow-Up

Forli et al., JHS, 2010

- 18 of 54 patients
- PLD 11, PLFD 7
- Variety of Treatments
- Variety of Times between Dx and Rx

Outcomes

Perilunate Dislocations and Transscaphoid Perilunate Fracture–Dislocations: A Retrospective Study With Minimum Ten-Year Follow-Up

Forli et al., JHS, 2010

Late Treatment

- Case from ASSH Listserve
  - 42 yo athletic trainer
  - MCA June 2017
  - Mis-diagnosed in ER
    - Coincides with Clinical Epidemiology
    - Pain, limited ROM and MN symptoms

Outcomes

Clinical and radiological Assessment of PLD and PLFD Separately

<table>
<thead>
<tr>
<th>Pathology</th>
<th>Average Score</th>
<th>Flexion- Extension</th>
<th>Grip Strength</th>
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<tbody>
<tr>
<td>PLD</td>
<td>7</td>
<td>74</td>
<td>63</td>
</tr>
<tr>
<td>PLFD</td>
<td>11</td>
<td>77</td>
<td>76</td>
</tr>
<tr>
<td>PLD and PLFD</td>
<td>18</td>
<td>75</td>
<td>88</td>
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Late Treatment

- Case from ASSH Listserve
  - 42 yo athletic trainer
  - MCA June 2017
  - Mis-diagnosed in ER
    - Coincides with Clinical Epidemiology
    - Pain, limited ROM and MN symptoms
**Late Treatment**

- Options:
  - Closed Treatment not possible
  - Open Treatment
  - Salvage Procedures
    - PRC
    - LICF

- Raskin 1999
  - All PRC
  - Assoc Volar approach

- Naam 2010
  - Case specific Rx

**Late Treatment**

- Individualized
  - Reducible
    - Open Reduction and Fixation
    - Ligament Augmentations
    - RASL
  - Irreducible
    - PRC
    - Cartilage Damage
    - LICF

**Complications**

- Infection
  - Pin tracts
- Stiffness
- Late Carpal Collapse
- Arthritis
- AVN (?)

**Complications**

- Patient Issues
  - Dissatisfaction
  - Altered Functional abilities
  - Work issues
Future Directions

- Unanswered Questions
  - Uncommon Injury
  - Frequently Mis- or under-diagnosed
  - Variable Presentations
  - Variable Treatments

Future Directions

- Unanswered Questions
  - Evaluation
    - Pre-op cartilage assessment
    - Arthroscopic management
  - Timing of Treatment
  - Approaches
  - Ligament Augmentation vs Repair
  - What should be stabilized
  - How long to immobilize

Future Directions

- Hand Surgery Consortium
- Collaboration
- Randomized, Prospective Trials