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Wrist Detective: Investigating the Traumatic Wrist Injuries

Rachel Pigott MPH, OTR/L, CHT, CLT-LANA

Objectives

• Identify methods for diagnosing distal radius (DR) fractures, factors that influence rehabilitation and outcomes in DR fractures, and an appropriate plan of care for DR fractures.
• Identify methods for diagnosing scapholunate (S-L) injuries, factors that influence rehabilitation and outcomes, and an appropriate plan of care for S-L injuries.
• Identify methods for diagnosing scaphoid fractures, factors that influence rehabilitation and outcomes, and an appropriate plan of care for scaphoid fractures.
Mapping it Out

• Investigating FOOSH Injuries
  o Epidemiology
  o Speed and Force
• Distal Radius Fractures
• S-L Injuries
• Scaphoid Fractures

Investigating FOOSH Injuries

  Epidemiology
  Force and Speed
Who Cares??

Collaborative Care............... Improved Outcomes....... 

Where are you getting your Information?

Not Always Possible In a Perfect World
Epidemiology

• The usual suspects…… Distal Radius
  o Pediatric and Elderly (Our Focus Today)
  o 18% of all Fractures in Elderly (65 yo +)
  o Rising prevalence
  o Cognitively intact
  o Women > Men


Epidemiology

• The usual suspects ……. S-L ligament injuries
  o Middle Aged
  o Lack of large Epidemiological Studies, mainly case series, small cohort studies
  o WHY????????
  o Coding
  o What is published???
**Epidemiology**

- The usual suspects ....... S-L ligament injuries
  - Associated Injuries
    - DR FX
    - With high energy injury DR FX
    - Small N – 14 of 15
    - Surgery beneficial grade 3-4 tears
    - Age matches SL injury


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**Epidemiology**

- 563.32 Traumatic rupture of scaphocapitate ligament
  - 563.321, Traumatic rupture of right scaphocapitate ligament
    - 563.321A, Initial encounter
    - 563.321B, Subsequent encounter
  - 563.325, Sequelae
  - 563.32 Traumatic rupture of left scaphocapitate ligament
    - 563.321, Initial encounter
    - 563.322, Subsequent encounter
  - 563.32 Traumatic rupture of unspecified scaphocapitate ligament
    - 563.329, Initial encounter
    - 563.329, Sequelae

- 563.2 Traumatic rupture of radiocapitate ligament
  - 563.1, Initial encounter
  - 563.2, Subsequent encounter
  - 563.29, Sequelae

- 563.121, Traumatic rupture of left radioscaphoid ligament
  - 563.121A, Initial encounter
  - 563.121B, Subsequent encounter
  - 563.125, Sequelae

- 563.12 Traumatic rupture of right radioscaphoid ligament
  - 563.121, Initial encounter
  - 563.122, Subsequent encounter
  - 563.125, Sequelae

- 563.12 Traumatic rupture of unspecified radioscaphoid ligament
  - 563.129, Initial encounter
  - 563.129, Sequelae

- 563.32 Traumatic rupture of scapholunate ligament
  - 563.321, Initial encounter
  - 563.322, Subsequent encounter
  - 563.325, Sequelae

- 563.32 Traumatic rupture of left scapholunate ligament
  - 563.321, Initial encounter
  - 563.322, Subsequent encounter
  - 563.325, Sequelae

- 563.32 Traumatic rupture of right scapholunate ligament
  - 563.321, Initial encounter
  - 563.322, Subsequent encounter
  - 563.325, Sequelae

- 563.32 Traumatic rupture of unspecified scapholunate ligament
  - 563.329, Initial encounter
  - 563.329, Sequelae

- 563.2 Traumatic rupture of radiolunate ligament
  - 563.1, Initial encounter
  - 563.2, Subsequent encounter
  - 563.29, Sequelae

- 563.2 Traumatic rupture of left radiolunate ligament
  - 563.1A, Initial encounter
  - 563.2A, Subsequent encounter
  - 563.29A, Sequelae

- 563.2 Traumatic rupture of right radiolunate ligament
  - 563.1B, Initial encounter
  - 563.2B, Subsequent encounter
  - 563.29B, Sequelae

- 563.2 Traumatic rupture of unspecified radiolunate ligament
  - 563.19, Initial encounter
  - 563.29, Sequelae

- 563.2 Traumatic rupture of scaphocapitate ligament
  - 563.1A, Initial encounter
  - 563.2A, Subsequent encounter
  - 563.29A, Sequelae

- 563.2 Traumatic rupture of left scaphocapitate ligament
  - 563.1B, Initial encounter
  - 563.2B, Subsequent encounter
  - 563.29B, Sequelae

- 563.2 Traumatic rupture of right scaphocapitate ligament
  - 563.19, Initial encounter
  - 563.29, Sequelae

- 563.2 Traumatic rupture of unspecified scaphocapitate ligament
  - 563.29, Sequelae
Epidemiology

- The usual suspects …… S-L ligament injuries
  - Age matches SL injury
  - Scaphoid FX …… controversy

  - N = 18
  - No SL injuries

  - N=41
  - 10 of 41 found SL

Scaphoid Fractures

- Young Males highest incidence
- Mean Age = 22
- Greater incidence lower Socio Economic Status (SES)
- UK
- N=415

Speed and Force

HIGH Force and Velocity

LOW Force and Velocity
Speed and Force

- Resisting Deforming Forces
- Bone Density

Distal Radius Fractures
DR FX
Force Transmission

- As force travels through wrist from:
  - 3rd MC
  - To CSL joint primarily at MC joint
  - To Radiocarpal joint:
    - RS 50-56%
    - RL 29-35%
    - UL 10-21%

80% of Force Transmission

Anatomy of the Distal Radius

- Radial Inclination
- Radial Height
- Palmar Tilt
Diagnosis of DR FX

- Visible Deformity
- Radiograph

What Makes it Worse?

- Loss of Radial Height
- Loss of Palmar Tilt/
  Dorsal Angulation
- Loss of Radial Inclination
What Makes it Worse?

- Intra Articular
- Fracture between or through scaphoid and lunate facets
- Severe Comminution

Sources of Information

- Collaborative Care
  - Physician Script/Referral
  - Radiograph
  - Radiography Report
  - OR Note
  - Physician Note
  - Therapist – Physician Communication
DR FX – Treatment Options

- Closed Reduction and Casting/Orthosis
- External Fixation
- Open Reduction Internal Fixation (ORIF)
  - Volar Plating

DR FX ORIF – Volar Plating

- Increased rate of Volar Plating
Post Op Rehab DR FX ORIF

- Orthosis of choice = Wrist
- Progression of Exercise Intensity
  - AROM - 1-2 weeks
    - No Optimal Start Time Established
  - PROM POW 4
  - Orthosis Weaning POW 6
  - Strength POW 6-8


Post Op Rehab DR FX ORIF

- What Else?
  - Edema Management
  - Scar Management
  - Pain Management
Post Op Rehab DR FX ORIF

• Things to look out for
  o Infamous scarring FPL

Post Op Rehab DR FX ORIF

• Things to look out for
  o Wrist Extension who is the driver
Post Op Rehab DR FX ORIF

- Things to look out for
  - Crepitus
  - Ulnar Sided Wrist Pain
  - Sympathetic Nervous System Symptoms
  - Carpal Tunnel

An ounce of Prevention is Worth a Pound of cure

- Things to look out for
  - Frozen Shoulder
  - Finger Stiffness - PCS

DR FX Outcomes

Severe pain with function first two months → Resolution of pain and dysfunction 6 months → One Year Still symptoms for some


Scapholunate Ligament Injuries (S-L)
Proximal Carpal Row Biomechanics - Quick

- Distal Carpal Row
  - Acts as one unit

- Proximal Carpal Row
  - More motion between these bones
  - Scaphoid potential energy flexion
  - Triquetrum = extension
  - SL-LT ligs create balance between these forces

Carpal Ligaments Intrinsic

Dorsal

Volar
S-L Injury

- Lunate goes with carpal bone that is still connected with
  - Scaphoid flexes
  - Triquetrum extends

- S-L disruption, lunate goes with triquetrum = extension of lunate = DISI
Diagnosing the S-L Injury

- Radiography – can be static film or loaded
  - S-L interval 3-5mm or greater
  - Terry Thomas Sign
  - Cortical Ring Sign
  - S-L angle greater than 60
Dorsal  
Volar  

SL Injury Additional Testing

- MRI  
  - Partial or Complete? Where is tear?
- Arthroscopy  
  - Drive Thru Sign
SL Injury Special Testing
Watson Scaphoid Shift

UD and slight extension to.... RD and slight flexion

What Makes it Worse

• Timing is everything
  o Acute < 3 weeks
    • Healing potential
  o Sub acute 3-6 weeks
  o Chronic > 6 weeks
    • Reducible?
    • Arthritic changes?

• Type of Instability
  o Pre Dynamic
  o Dynamic
  o Static
Treatment of SL Tears Conservative

- Grade I and II
- Hold until stiff, stable – immobilize 3-12 weeks
  - Thumb Spica Orthosis
- Then immobilize intermittently (between exercises)

Thoughts on Wrist Rehabilitation

- Let's not just think of the wrist as motion and strength
- What do we need from our wrist?
  - Be able to accept and transfer force
  - Functional range
  - Protective reflexes
Thoughts on Rehabilitation

- Let's get more sophisticated
  - Is there an arc of motion that limits stress to the injured structure?
  - Is there a muscle contraction that has been shown to improve stability for injured structure?
  - How can we work on improving proprioception lost during immobilization?

Dart Thrower’s Motion

- Ulnar Deviation and Wrist Flexion
- Radial Deviation and Wrist Extension
Role of DTM

• Dart Throwing Motion (DTM)
  o Most functional tasks are performed in this plane of motion
  o With this motion more action is at midcarpal joint thus limiting stress to radiocarpal joint
  o Less motion of Scaphoid and Lunate
  o What next.... Implications for early motion protocols for fractures, SL injuries, and ligament repairs
    • Whoa wait still need to clarify things

• Widening of SL interval has been shown in 4D computed tomography study with DTM


• There is further research needed perhaps there is a limited DTM range safe in the repaired SL

Muscles as Stabilizers

• Muscle Loading and Carpal Alignment
  o Contraction of certain muscles may improve carpal alignment
    • SL friendly = FCR, FCU, APL, ECRL; cause scaphoid supination and decreased stress to SL


<table>
<thead>
<tr>
<th>Muscles</th>
<th>Supinator</th>
<th>Pronator</th>
<th>SL</th>
<th>LT</th>
<th>MCI</th>
</tr>
</thead>
<tbody>
<tr>
<td>FCR</td>
<td>X – but only for Scaphoid with partial SL injury</td>
<td>X</td>
<td>sometimes</td>
<td>X</td>
<td></td>
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<tr>
<td>ERCL</td>
<td>X</td>
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<tr>
<td>FCU</td>
<td>X</td>
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</tr>
</tbody>
</table>
Treatment of S-L Tears

Conservative

• After immobilization period initiate gentle AROM
  o What arc of motion would be beneficial to start with?
• When to start PROM? Be judicious remember our goal is stability over mobility
• Strength
  o Isometrics DTM
    • FCR if incomplete SL – Why?
  o Be cautious with power grip strength – Why?

Surgical Treatment of SL Tear

• SL Repair
• Reconstruction with Tendon Graft
• Dorsal Capsulodesis
• Tendon Weaves
• Reduction Association of Scaphoid and Lunate
Therapy Post S-L Repair or Reconstruction

• Knowledge is Power – find out what type of surgery was performed --- this may change your treatment
• Thumb spica cast or orthosis for 8 weeks
  o What happens to our proprioceptive reflexes during this time?
• Education – expected outcomes, might not have full motion that is OK
  o Goal = stability over mobility

Therapy Post S-L Repair or Reconstruction

• Early Mobilization Phase
  o Gentle AROM, emphasize DTM first
  o Proprioceptive training
    • DTM AROM
    • Joint Position Sense
    • Mirror box/Visual influence
  o Scar management
Therapy Post S-L Repair or Reconstruction

- PROM
  - Starts a couple weeks after AROM
  - Be judicious and gentle ensuring not to destabilize repair
  - Could this be done in more stable arc of DTM?

- Strength
  - Pain free and good mobility
  - Start isometrics in DTM working to isotonics
  - Perturbation exercises eg. Gyroscope, mini baps board
  - Reactive muscle activation

- Dynamic or Static Progressive Orthosis – not really in the plan

Variations in Rehabilitation Post SL Repair

- Dorsal Capsulodesis
  - AROM only, little or no passive flexion exercises except per MD

- RASL
  - Motion can begin early than SL repair
    - 4-6 weeks
Scaphoid Fractures

Location, Location, Location

- Blood flow to the scaphoid – retrograde distal- proximal
- Proximal Pole heals slower
- Risk for AVN
- Rests at 45 degrees angle to radius
- EDUCATION

Henry Vandyke Carter - Henry Gray (1918) Anatomy of the Human Body (See "Book" section below)
Bartleby.com: Gray's Anatomy, Plate 221
Diagnosing Scaphoid FX

- Palpation
- Radiograph
- CT
- MRI

Scaphoid Fractures

- Conservative Treatment
  - Initial Cast immobilization
    - Starts with Long Arm Thumb Spica cast transitioning to short art thumb spica
    - 8-12ish … or 24 weeks
    - Longer with proximal pole injuries –Why??
  - Thumb Spica Orthosis
    - Transition to when patient first starts motion
Scaphoid Fractures

• Conservative Treatment
  o Early mobilization phase
    • Transitioned from cast to orthosis
    • Start with gentle AROM
    • Role of DTM type exercises – Why is this a good place to start with scaphoid fractures?
  o PROM
    • Typically at least two weeks after AROM initiated
  o Strength with evidence of union
    • What would be good to start with?

Scaphoid Fractures

• What would we expect we will need to work on with these patients?
  o Important to educated initially on Digital ROM during immobilization phase
  o Thumb mobility – specifically composite flexion
  o In hand manipulation
  o Wrist motion
    • Initiation of wrist extension with wrist extensors rather than digital extensors
Scaphoid Fractures

• What would we expect we will need to work on with these patients?
  o Proprioceptive reflexes
    • DTM
    • Joint position sense
    • RMA
    • Perturbation training
Scaphoid Fracture

- Post Fixation
  - Orthosis Forearm based TSO
  - AROM initiated 6-8 weeks
  - PROM 2 weeks after initiation of AROM
  - Strength 2 weeks after PROM approximately
Objectives

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- Identify methods for diagnosing scapholunate (S-L) injuries, factors that influence rehabilitation and outcomes, and an appropriate plan of care for S-L injuries.
- Identify methods for diagnosing scaphoid fractures, factors that influence rehabilitation and outcomes, and an appropriate plan of care for scaphoid fractures.

Thank You!!!
### Management of Upper Extremity Trauma

- **Mon 2/6**  Understanding Multi-Trauma Hand and Upper Extremity Injuries  
  Carol Recor, OTR/L, CHT
- **Tues 2/7**  Wrist Detective: Investigating Traumatic Wrist Injuries  
  Rachel Pigott, OTR/L, CHT
- **Wed 2/8**  Management of Upper Extremity Nerve Injury  
  Christine Novak, PhD, PT
- **Thurs 2/9**  Occupational Therapist’s Management of Upper Extremity Burns  
  Nora Barrett, MS, OTR/L, CHT
- **Fri 2/10**  Tendon Trauma: Keys to Optimal Outcomes  
  Rebecca Neiduski, PhD, OTR/L, CHT