

# Upper Extremity Injuries- From Exam to Workplace

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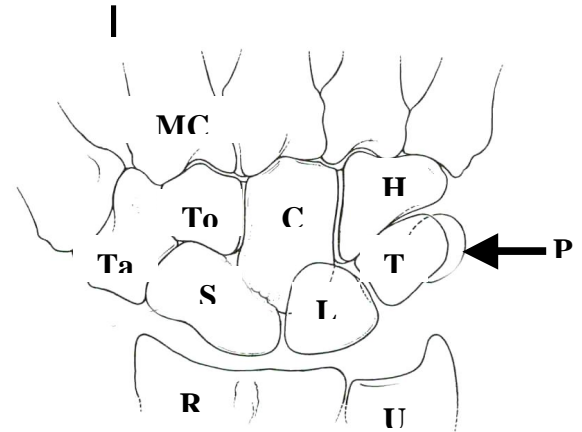
**NOTES**

- I. **Work Related Disorders**
  - A. Work Related Disorders ARE DIFFERENT From Non-Work Related Disorders
  - B. Work Related Disorders Require DIFFERENT TREATMENT than Non-Work Related Disorders
- II. **Surgery**
  - A. Surgery Is Frequently LESS SUCCESSFUL In Work Related Disorders than Non-Work Related Disorders
- III. **Factors to Consider**
  - A. Diagnosis
  - B. Job
    - a) Physical Requirements
    - b) Non-Physical Requirements
  - C. Patient
    - a) Non-Medical Issues
- IV. **Clinical Features**
  - A. Classic Presentation
  - B. Unclear Presentation
- V. **Continued Nonoperative Treatment**
  - A. Diagnosis Unclear
  - B. PsychoSocial Issues
  - C. Job Issues
- VI. **Surgical Success**
  - A. Surgery is frequently less successful in work related disorders than non-work related disorders
  - B. Surgical Success DECREASES as Pain Becomes A More Prominent Complaint
- VII. **General Treatment**
  - A. Education
  - B. Discuss Expectations
  - C. Attempt Return to Work Prior To Surgery
  - D. Discuss Need For Permanent Job Modification
  - E. Work With Rehabilitation Nurse Prior to Surgery
- VIII. **Return to work**
  - A. Multifactorial
  - B. Set expectations preop



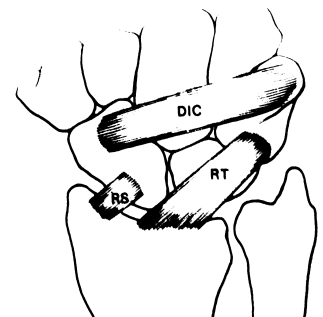
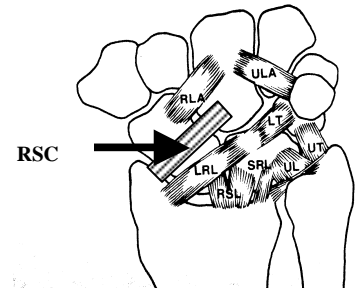
**NOTES**

- C. Modified work
- IX. Wrist anatomy- Bone**
- A. Two rows- proximal & distal
- B. Proximal row
1. Scaphoid
  2. Lunate
  3. Triquetrum
  4. Pisiform (sesamoid bone), not important in carpal kinematics
- C. Distal row
1. Trapezium
  2. Trapezoid
  3. Capitate
  4. Hamate
- D. Distal radius
1. Scaphoid facet
  2. Lunate facet
- E. Joints
1. Radiocarpal
  2. Midcarpal
  3. Intercarpal

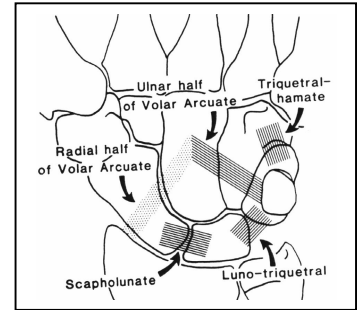


S- Scaphoid	To- Trapezoid
L- Lunate	C- Capitate
T- Triquetrum	H- Hamate
P- Pisiform	MC- Metacarpal
Ta- Trapezium	

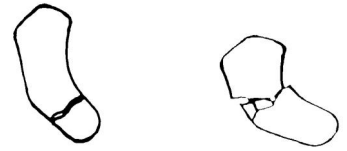
- X. Wrist anatomy- ligaments (bone to bone)**
- A. Intracapsular vs. non-intracapsular
- B. Capsular- intrinsic vs. extrinsic
- C. Intrinsic connect carpal bones
- D. Extrinsic connect carpal bone to noncarpal bones
- E. Extrinsic- superficial (S) & deep (D)
1. Radiocarpal-
    - a) Volar
      - (1) Radioscaphoid (RS)- S
      - (2) Radiolunate (RL)- S
      - (3) Long radiolunate (LRL)-S
      - (4) Short radiolunate (SRL)- D
    - b) Dorsal
      - (1) Radiotriquetral (RT)
      - (2) Dorsal intercarpal ligament (DIC)
      - (3) Dorsal radio scaphoid (DRS)
  2. Ulnocarpal
    - a) Ulnocapitate (UC)- S
    - b) Ulnotriquetral (UT)- D
    - c) Ulnolunate (UL)- D
- F. Intrinsic
1. Proximal row
    - a) Scapholunate



- (1) dorsal part most important
  - b) Lunate-triquetral
  - c) Scaphoid-triquetral- part of dorsal intercarpal ligament
2. Distal row
    - a) Tight dorsal and palmar ligaments
  3. Midcarpal cross midcarpal joint
    - a) Triquetral-hamate-capitate (Ulnar arm arcuate ligament)
    - b) Scaphoid-capitate (Radial arm arcuate ligament)
    - c) Scaphoid-trapezium-trapezoid
- G. Non-intracapsular
1. transverse carpal ligament (carpal tunnel)
  2. Pisohamate
  3. Pisometacarpal
- XI. Wrist pain- see algorithm**
- A. Radial column
  - B. Central column
  - C. Ulnar column
- XII. Radial wrist pain**
- A. DeQuervains tendonitis
  - B. Sensory radial nerve entrapment
  - C. FCR tendonitis
  - D. Distal radius fracture
  - E. DJD-Scaphoid trapezial trapezoid joint, thumb CMC
- XIII. Central wrist pain**
- A. Dorsal ganglion
    1. Occult vs., obvious
  - B. Instability
    1. Scapholunate ligament injury
  - C. Kienböck's disease (AVN lunate)
  - D. Atypical CTS
  - E. Fracture
    1. Proximal pole scaphoid fracture
    2. Lunate fracture
- XIV. Ulnar wrist pain**
- A. Ulnar impaction
  - B. TFCC tear
  - C. L-T ligament tear
  - D. DRUJ instability/ arthritis
  - E. Ulnar styloid fracture
  - F. Triquetral fracture- very common
  - G. Hamate body or hook fracture
  - H. ECU tendonitis



- I. Pisotriquetral pain- instability/synovitis/DJD
- XV. **Scaphoid Fractures**
- A. *Must R/O in all wrist injuries, x-ray all*
  - B. Most common carpal fx
    - 1. Proximal, waist or distal fx
  - C. Vascular supply may be tenuous
  - D. Proximal fx poorer prognosis, more avascular necrosis (AVN), longer time to heal, higher inc. Nonunion
  - E. PE- "snuff box" tender
  - F. X-ray
    - 1. PA, lat, oblique,
    - 2. Scaphoid Views
      - a) PA in ulnar dev.
      - b) Pronated oblique 45°
      - c) Ulnarly elevated oblique
      - d) 2 weeks rex-ray, if (-) & pain-- continue immobilization or get CAT scan
      - e) CAT scan in longitudinal axis of scaphoid
      - f) MRI may give early accurate dx
      - g) Stable vs. unstable
      - h) Stable tubercle fx, nondisplaced waist
      - i) Unstable oblique distal third, displaced waist fx, proximal pole fx, fx-dislocation, comminuted fracture
  - G. Treatment
    - 1. If nondisplaced (< 1mm displace, no angulation, lateral intrascaphoid angle < 35°, may need cat scan to know) tx long arm thumb spica (LATS) cast x 6 weeks, short ATS (SATS) cast until healed
      - a) Duration distal waist 2-3 months, mid waist 3-4 mos, proximal 4-5 mos
    - 2. If displaced need ORIF
      - a) > 1 mm displaced
      - b) S-L angle > 60°
      - c) C-L angle >15
      - d) Intrascaphoid angle > 45°, ? >35°
    - 3. If pain and x-ray (-), SATS cast x 2 weeks
      - a) rex-ray, if (-) & no pain, nontender D/C cast
      - b) rex-ray, if (-) & pain-- continue immobilization or get CAT scan



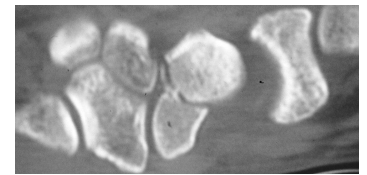
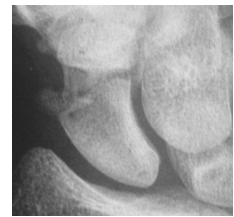
Nondisplaced Proximal Fx

Comminuted waist Fx

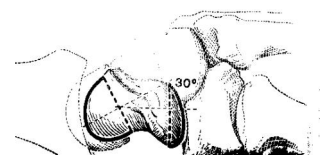


Displaced waist Fx

Scaphoid fracture

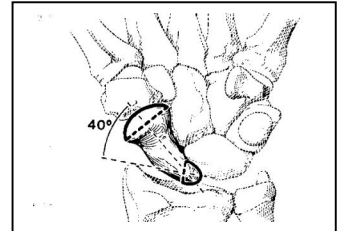


ORIF scaphoid fracture



Lateral Intrascaphoid angle

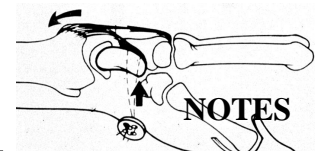
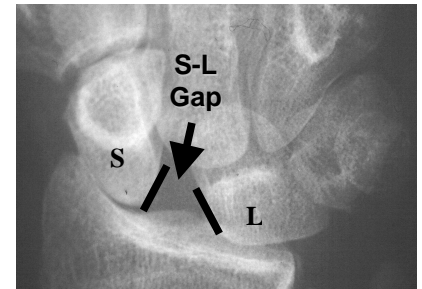
4. delayed union > 3 mo
    - a) ? role electrical stimulation
    - b) ORIF, +/- screw, +/- bone graft
  5. if scapholunate gap (S-L dissociation) needs surgery
- H. Confirm Healing
1. Non tender
  2. No fracture line
  3. Bone bridging on CAT – Best- cheaper easy
  4. MRI
- I. Nonunion > 6 mo
1. ORIF, bone graft
- J. Avascular necrosis (AVN)
1. still try to get to heal
  2. more in proximal fx
- K. Malunion
1. if DISI deformity, (lunate tipped dorsally on true lateral x-ray
  2. lateral scaphoid angle normal < 35° (CAT scan), if > 45° & healed 27% satisfactory, DJA 54%



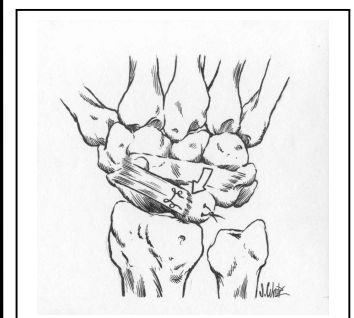
AP Intrascaphoid angle

**XVI. Wrist-Scapho-lunate Ligament Tear**

- A. FOOSH injury, dorsal radial-central pain
- B. Diagnosis
  1. Tender S-L, + provocative testing (Scaphoid shift test)
  2. X-ray, scapho-lunate gap (comparison x-ray), ↑ s-l angle >70°, AP clenched fist view may show gap
  3. Distraction x-rays- change in intercarpal distances, break in Gilula's line
  4. Arthrogram/tomogram-leak between rows
  5. MRI +/- arthrogram
  6. Video fluoroscopy
  7. Arthroscopy- BEST invasive, need OR
- C. Acute- anatomic reduction & primary ligament repair possible
- D. May be misdx “simple wrist sprain”, delay in tx can compromise care
- E. Treatment
  1. If suspected immobilize and make diagnosis
  2. ? Partial cast 8 weeks (How to DX partial?)
  3. Percutaneous pinning after reduction (scope assisted?)



Blatt Capsulodesis



4. **Current recommendation** ORIF ligament repair & pin fixation +/- capsulodesis (Blatt vs. reverse Blatt vs. DIAL) - cast 8-12 weeks, 12-24 mos to MMI
5. Chronic
  - a) As above
  - b) Tenodesis (Brunelli)
  - c) Ligament reconstruction (bone-ligament-bone)- may be the future
  - d) Limited fusions for late treatment

## **XVII. Lunate triquetral ligament tear**

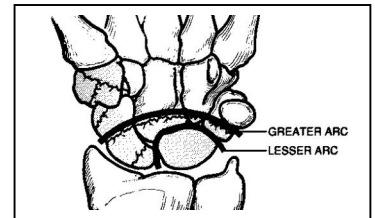
- A. Traumatic vs. degenerative
- B. Partial vs. complete
- C. Acute vs. chronic
- D. Traumatic- ulnar side wrist load with wrist extension and carpal pronation
- E. Degenerative- Most common, attritional associated with ulna + variance
- F. Symptoms
  1. Ulnar wrist pain
  2. +/- clicking
  3. Weakness
  4. +/- ulnar nerve sx
- G. Diagnosis
  1. Tender L-T ligament dorsally or ulnar snuff box (between ECU/FCU)
  2. L-T ballottement test
  3. Ulnar carpal shuck
  4. X-ray, Lunate-triquetral gap, loss of Gilula's line, ulnar + variance (If VISI must have other injury), comparison x-ray
  5. Distraction x-rays- change in intercarpal distances, break in Gilula's line
  6. Arthrogram/tomogram-leak between rows
  7. MRI +/- arthrogram normal L-T lig hard to see on MRI
  8. Video fluoroscopy
  9. Arthroscopy- BEST invasive, need OR
- H. Treatment
  1. If suspected immobilize and make diagnosis
  2. Doesn't not progress to DJD
  3. Acute
    - a) ? cast 8 weeks
    - b) Percutaneous pinning after reduction (scope assisted?)

**NOTES**

- c) ORIF ligament repair & pin fixation  
 +/- capsulodesis, cast 8-12 weeks, 6-12 mos to MMI
- 4. Chronic
  - a) **Live with it**-- grip > 85%, minimal pain, brace for activities
  - b) Ulnar shortening- if normal static x-rays, ulnar positive, may tighten ulnar ligaments
  - c) Ligament reconstruction
    - (1) Capsulodesis
    - (2) Tendon augmentation
    - (3) (bone-ligament-bone)- may be the future
  - d) L-T fusion, difficult to heal

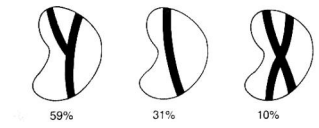
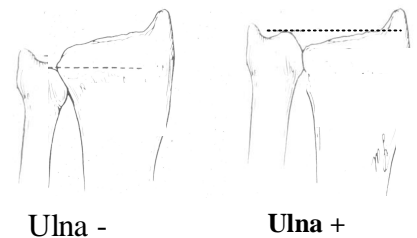
**XVIII. Lunate/ Perilunate Dislocations, Fracture/Dislocation**

- A. Severe injury usually obvious
- B. May involve Scaphoid fx (most common) or other carpal or distal radius fx
- C. Need anatomic reduction and fixation
- D. Cast 8-12 weeks
- E. Complication AVN lunate, DJD



**XIX. Kienböck's Disease** (Peste 1843, Robert Kienböck 1910)

- A. Avascular necrosis of lunate
- B. Risk factors
  - 1. Ulnar negative variance
  - 2. Vascularity
  - 3. Lunate geometry ?
  - 4. Ethnic-Rare Chinese, Black
  - 5. Mechanical injury
- C. Associated with Ulnar variance (Hulten 1928)
  - 1. Kienböck's  $\cong$  75% ulnar negative
  - 2. Normal  $\cong$  25% ulnar negative
- D. Lunate vascularity (Gelberman, Panagis JHS 1980)
  - 1. Y 59%
  - 2. I 31%
  - 3. X 10%
  - 4. Increased Intraosseous pressure, venous stasis, (similar to AVN hip) (Jenson 1993)
- E. Trauma- mild or repetitive
- F. Cause ? combination trauma, vascular, Ulnar neg variance
- G. At presentation
  - 1. Man > woman
  - 2. Sx 1-2 years



**Lunate Blood Supply**  
 Gelberman et al JHS1980

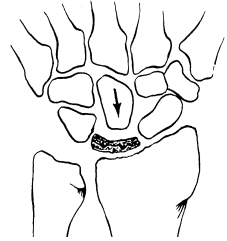


**Stage I Kienböck's**

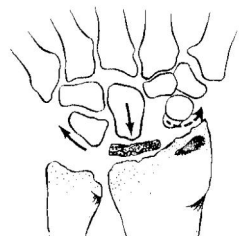
3. Young adults (15-30 yo)
  4. Mild or repetitive trauma
  5. Insidious
  6. Pain, stiff, weak
- H. X-rays
1. Early – normal with negative variance
  2. Later lunate sclerosis, fracture
  3. Late- lunate collapse DJD
- I. Bone Scan- may be positive before x-ray but nondiagnostic
- J. Cat Scan
1. helps to classify
  2. identify fracture ( $\cong 90\%$ )
- K. MRI
1. **Best test** sensitive and specific
- L. Stage
1. Stage 0 Normal x-ray, abnl MRI
  2. Stage 1 Normal x-ray, linear fx on CT
  3. Stage 2  $\uparrow$  density, NI lunate size
  4. Stage 3 Lunate collapse, 3A scaphoid rotation, 3B Scaphoid rotation
  5. Stage 4 DJD
- M. Treatment (All approx 70% successful)
1. Nonoperative
    - a) Observation
    - b) Cast
  2. Revascularization
    - a) Dorsal radial, pronator quadratus, pisiform
  3. Lunate decompression- curettage, bone graft and external fixator
  4. Drilling Radius/ulna
  5. Joint leveling
    - a) Ulnar neg
    - b) Radial shortening (favored) vs. ulnar lengthening
  6. Lunate excision
    - a) Partial vs. total, ligament reconstruction
    - b) Do not use silicone replacement
  7. Wedge osteotomy
    - a) Lateral closing wedge
    - b) Lateral opening wedge vs. medial closing
  8. Limited arthrodesis



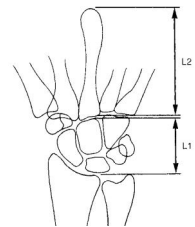
Stage II Kienboeck's



Stage III Kienboeck's



Stage IV Kienboeck's



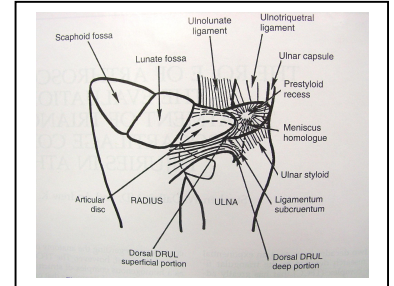
Carpal Height Ratio

## NOTES

- a) STT vs. Scapho-capitate fusion
9. Capitate shortening
10. Salvage
  - a) Total wrist fusion vs. Proximal row carpectomy
11. Neurectomy

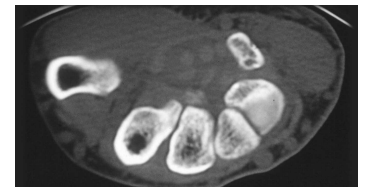
**XX. Distal radioulnar joint(DRUJ)- triangular fibrocartilage complex (TFCC)**

- A. The TFCC is the most important stabilizer of the DRUJ
- B. Anatomy
  1. Dorsal and volar ligaments
  2. Avascular central portion
  3. Attachments radius to fovea of the ulna (ligamentum subcrurum) and ulna styloid
  4. ulnolunate & ulnotriquetrum ligaments
- C. x-ray may show ulnar styloid avulsion
- D. Classification
  1. Traumatic
  2. Degenerative
- E. Assess Ulna variance
- F. Assess stability of DRUJ
- G. Diagnostic testing
  1. X-rays
  2. MRI/ Arthrogram
  3. CAT scan for assessment of DRUJ alignment
  4. Arthroscopy- gold standard for dx of a tear
- H. DRUJ sublux/dislocation unusual without radial fx
- I. Treatment
  1. Traumatic
    - a) if reduced immobilize in neutral rotation
    - b) Repair if unstable
    - c) ORIF styloid
    - d) Repair to fovea and ulna styloid
  2. Degenerative
    - a) Arthroscopy debride
    - b) Ulna shortening if needed (wafer vs. shaft)



**XXI. Hook of hamate**

- A. racquet sports or golf, hammer
- B. undx ulnar wrist pain may complain of dorsal or palmar pain
- C. x-rays may be nondx (oblique, carpal tunnel view), if suspicious CAT scan (best) or bone scan

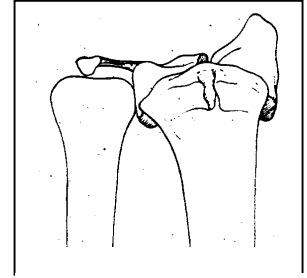


CAT scan hook of hamate fracture

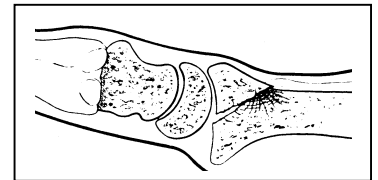
D. TX- cast immobilization, if still SX excise

## XXII. Distal radius fracture

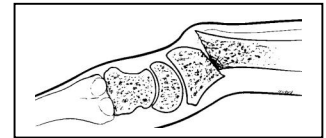
- A. may be associated with TFCC injury or ulnar styloid avulsion
- B. often have ulnar sided pain long after radius healed (usually resolves)
- C. S-L lig injury may be coincident
- D. non-displaced- immobilize 4-8 wks depending on age, activity, fx
- E. intra-articular, may displace, articular alignment most important predictor of result
- F. any displacement (acceptable  $< 1\text{mm}$  articular displacement, radial inclination  $>10^\circ$ , dorsal tilt  $< 10^\circ$ , shortening 3mm)
- G. Treatment Options
  - 1. Closed reduction &
    - a) cast
    - b) PCP
    - c) External fixation
    - d) External fixation & PCP
  - 2. Open reduction &
    - a) internal fixation
    - b) external fixation
    - c) bone graft



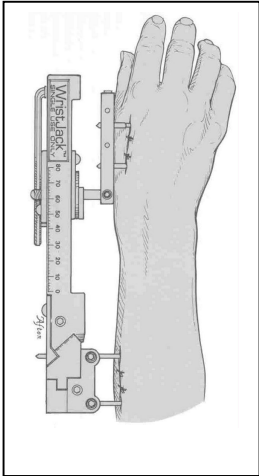
Comminuted, intrarticular  
Ulnar styloid fracture



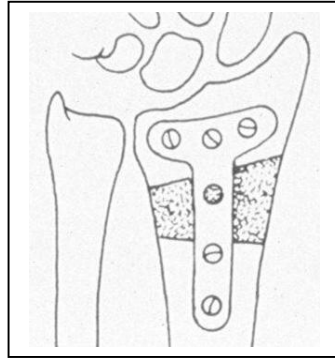
Dorsal lip fx



Volar displaced



**External Fixator**



**ORIF**



**Volar locking plate**

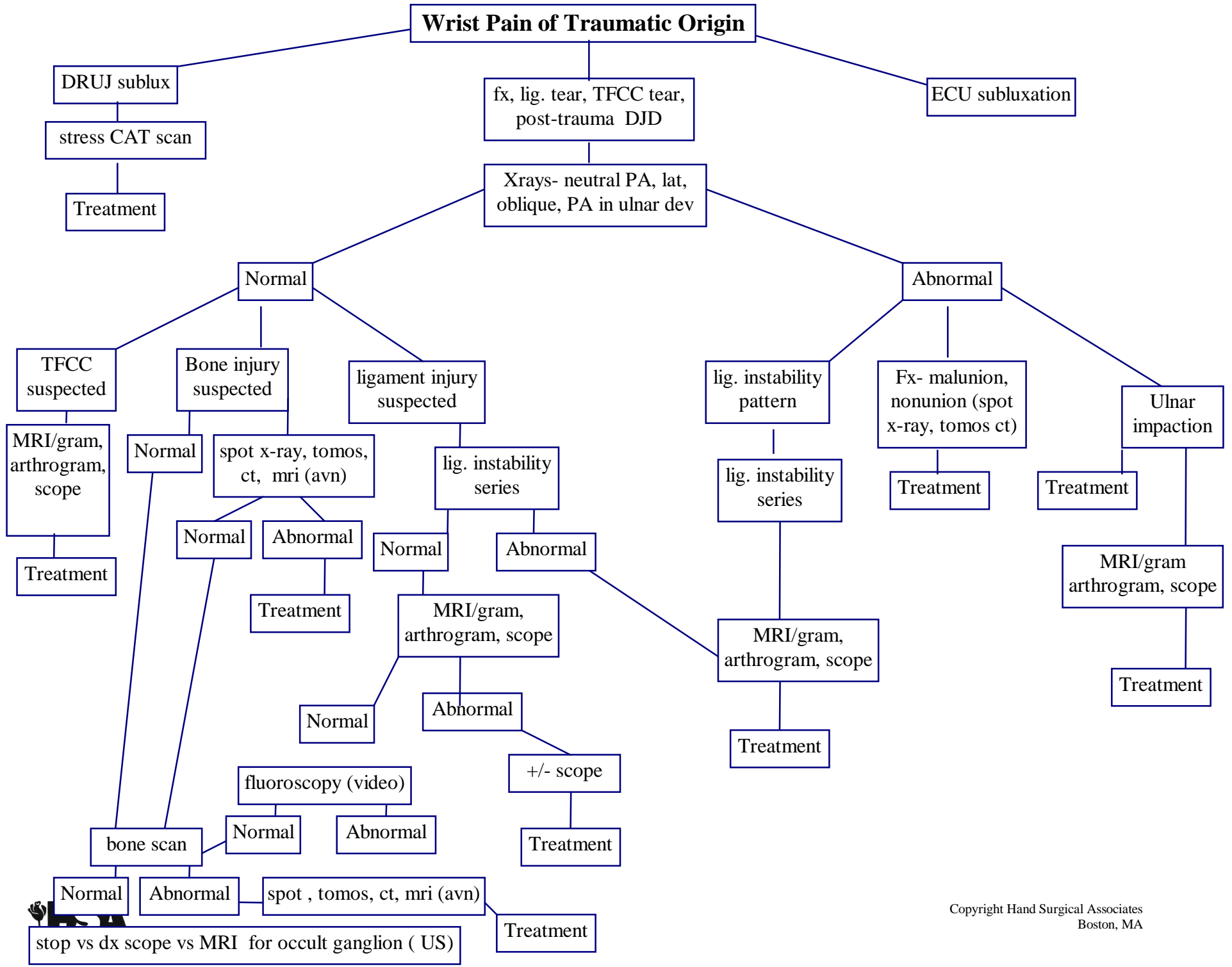


**Fragment specific fixation-  
Trimed**

### XXIII. REFERENCES

### NOTES

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## Distal Radius Fractures

### Classification & Treatment Algorithm

#### Extra-Articular

##### Undisplaced

- Cast
- careful F/U

##### Displaced

##### Reducible

##### Stable

- Cast

##### Unstable

- PCP
- Ext Fix
- ICBG etc.
- ORIF

##### Irreducible

- ORIF (limited)
- Ext Fix
- K-wires
- Plates/screws
- ICBG etc

#### Intra-Articular

##### Undisplaced

- Cast
- careful F/U

##### Rim (volar/dorsal) Fx

- ORIF
- plates/screws
- k-wires
- Consider Int fix even if nondisplaced

##### Displaced

##### Simple

##### Reducible

- Ext Fix
- PCP

##### Irreducible

- ORIF ? limited
- Ext fix
- K-wires
- screws/plates

##### Complex

##### Reducible

- Ext fix
- K-wires
- ? ICBG
- screws/plates

##### Irreducible

- ORIF ? limited
- Ext fix
- K-wires
- screws/plates
- ? ICBG

