Objectives

- Anatomical considerations
- Ulnar sided wrist pain
  - Ulnar positive variance
  - Ulnar negative variance
- Salvage Procedures

ANATOMICAL CONSIDERATIONS

Distance Radioulnar joint (DRUJ)

What is it?

- Distance Radioulnar joint (DRUJ)
  - Formed by sigmoid notch of radius and ulnar head
  - Where is the axis of rotation for the forearm?
  - What position does the ulnar head move into during pronation?

Triangular fibrocartilage complex (TFCC)

Originates from sigmoid notch and inserts into the ulnar fovea and the base of the styloid

Includes:
- Dorsal and palmar radioulnar ligaments
- Ulnocarpal ligaments
- ECU tendon sheath / ulnar collateral ligament
- Meniscus Homologue
- Articular disc (triangular fibrocartilage proper)

http://upload.wikimedia.org/wikipedia/commons/7/77/Anatomy_TFCC_2.jpg

TFCC

- Stabilizes the DRUJ and separates it from the carpus and distal radius
- The ulna absorbs 20% of axial loading forces (as in gripping) through its articulation with TFCC and ulnar carpus

Palpated just radial to the ulnar head
**DRUJ and TFCC**

What a Team!!

**Excellent article**


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**Ulnar-Sided Wrist Pain**

- Let's look at the patient who is diagnosed with a distal radius fracture but keeps pointing to the ulnar side of the wrist and complaining
- What could be happening?

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**Wrist Kinematics**

- Dorsal Angulation of the radius after a distal radius fracture increases the stress/torque across the DRUJ and TFCC
- Radius shortening also causes a significant kinematic alteration and tension on the TFCC

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**Ulnar variance**

- Normal articular relationship between the radius and ulna disrupted
- Loads through the ulnar or radial increases
- Ulnar variance = the distance that the distal articular portion of the ulnar head extends below (negative) or above (positive) the articular surface of the radius
Positive Ulnar Variance

- **Positive**: in +4, 60% load goes to radius
  - Increased stress on lunate and triquetrum
- **Associated conditions**:
  - Ulnar impaction syndrome
  - TFCC tears
  - Lunate-triquetrum (LT) tears

Causes and symptoms of Ulnocarpal Abutment

**Causes**:
- Malunited radial shortening or angulation
- DRUJ ligament injuries

**Symptoms**:
- Pain localized to dorsal aspect of wrist over DRUJ or directly over TFCC region
- Intermittent clicking sensation, activity related swelling, decreased strength and motion

Ulnocarpal abutment syndrome

- Also known as impaction, loading, and impingement
- **Degenerative** syndrome associated with positive ulnar variance
- Sequence of events:
  - Wearing of the articular disc of TFCC
  - Chondromalacia of ulnar head and ulnar aspect of lunate
  - Disruption of LT ligament

Treatment

- If radial articular alignment is satisfactory =
  - Ulnar shortening osteotomy
- If radial malalignment is significant =
  - Corrective radial osteotomy

Testing for Ulnocarpal abutment

- **GRIT** (gripping rotatory impaction test) – identifies articular disc tears associated with ulnar impaction syndrome
- Gripping while pronating can increase impaction of the ulna on ulnar-sided structures because the variance moves in a positive direction
GRIT

- Measures grip strength in 3 forearm positions (neutral, full supination, and pronation)
- Sup/Pro values are calculated as a ratio relative to neutral grip
- Ratio > 1 = potential for impaction or an articular disc tear is high

Surgical Option for Ulnar Abutment

- Darrach procedure
- Ulnar Shortening Osteotomy (USO)
  - Maintains articular surfaces of the ulnocarpal joint and DRUJ and tightens the ulnocarpal ligaments and TFCC = stabilizing effect
- Radial Lengthening

Ulnar Styloid Impaction/Impingement Syndrome

- Impaction between ulnar styloid tip and triquetrum, seen in patients with excessively long ulnar styloids.
  - Treatment initially conservative avoidance of repetitive wrist flexion/UD, wrist orthosis, anti-inflammatories
  - After 6 mo. no improvement – ulnar styloid partial resection
  - Orthosis for 2 weeks
  - Hand Therapy started after immobilization period with gentle AROM

DRUJ INSTABILITY

DRUJ Instability

- Prominence of distal ulnar head is a sign of DRUJ instability
- “S” shape to the wrist (radial shortening, positive ulnar variance)

DRUJ Testing
Piano Key Sign

- Sign – gentle downward pressure applied to distal end of ulna with forearm pronated. Head moves volarly but springs back when pressure is released
- Positive = “note” of pain

Piano Key Test

- Grasp distal ulna & move it passively in volar & dorsal direction at extremes of pronation & supination (up to 5mm may be noted)
- Done initially in neutral
- Positive test = Pain, tenderness, and increased mobility relative to uninjured side

Ulnar Compression Test (DRUJ Grind Test)

- Apply radially directed pressure on ulnar head, into sigmoid notch of the radius.
- Combine with pronation and supination.
- Compression will be painful with presence of arthritis

Classification of Tears

- Type 1 = traumatic
  - Fall on extended wrist with pronation or traction injury to ulnar side of wrist
- Type 2 = degenerative
  - Associated with positive ulnar variance

Classification for Type 1 Tears

- Palmar and Mayo
  - 1A = central
  - 1B = ulnar (with or without styloid FX)
  - 1C = palmar/distal from carpus
    - Unocarpal ligs
  - 1D = radial (with or without fracture of sigmoid notch)

Ulnar Sided Wrist Pain

TFCC LESIONS
Classifications for Type 2 Tears

- Palmar and Mayo
- Classifications slowly worsening wear
  - 2A – TFCC wear only
  - 2B – now lunate or ulnar head chondromalacia
  - 2C – Perforation of TFCC
    - lunate./ulnar head chondromalacia
    - LT perforation
  - 2D – Add ulnocarpal arthritis

Central vs. Peripheral

- **Central Portion** consists of chondroid fibrocartilage and bears compressive forces between ulnar head and triquetrum (smooth but mobile gliding surface) – devoid of vasculature
- **Peripheral** portion is ligamentous with thick collagen structure to bear tensile loads (palmar and dorsal limbs)
  - Primary arterial supply is dorsal branch of anterior interosseous artery

Central tear=poor blood supply
Peripheral tear= good blood supply

TFCC Injuries- Causes and Symptoms

- Injuries usually result from a rotational injury to the extended wrist
- Common Complaints
  - Decreased strength
  - Pain at the limits of
- Pain primarily with rotation suggests DRUJ involvement.
- Pain with ulnar deviation suggests TFCC pathology or ulnar impaction.

TFCC testing

**Fovea Sign/Sulcus Sign**
- Palpate between ulnar head and the triquetrum
- Fovea is a groove at base of ulnar styloid that serves as an attachment for TFCC
  - Sensitivity 92.5%
  - Specificity 86.5% (10)

TFCC testing

**TFCC load test**
- Detects ulnar abutment or TFCC tears
- Ulnar deviation and axial loading of wrist moving volarily and dorsally or rotate the forearm
- Positive with pain, clicking, crepitus, and reproduction of symptoms
**TFCC Debridement** (central tear)
- Volar wrist splint
- AROM 3-5 days postop
- No impact loading
- Light strengthening at 4-6 weeks
- Gradually resume ADL's and wean from splint

**Peripheral repair**
- Week 1 Long arm cast
- Week 2-4 long arm splint Munster style to avoid sup/pron
- Week 4-6 short arm splint and begin forearm ROM
- Week 6-10
  - AROM
  - Avoid extremes of rotation
  - Continue use of splint except for bathing and exercise
  - Light ADL’s
  - Week 10 – begin gentle PROM
  - Light strengthening
- 12 weeks continue and upgrade strength program
  - Begin dynamic/static progressive splinting

**TFCC Repair with Ulnar Shortening**
- Immobilize and mobilize per TFCC repair guidelines
- USO treated as a fracture
  - Depends on fixation type
- Again avoid gripping in pronation and resistive sup/pron exercises

**NEGATIVE ULNAR VARIANCE**

**Keinbock's Disease**
- Avascular Necrosis (AVN) of Lunate
- Unknown etiology
  - Poor Vascularity
  - Negative ulnar variance
  - Sometimes history of trauma
- Predominant in 30-40 yo

**Negative Ulnar Variance**
- Associated with Kienbock’s disease
Kienbock's Disease

• 4 Stages
  – Stage 1 = linear compression fracture lunate
  – Stage 2 = density is abnormal but no lunate or carpal collapse
  – Stage 3 = lunate collapse

 Stage 1

• Stage 3
  – 3A without carpal collapse
  – 3B with carpal collapse
• Stage 4 = extensive osteoarthritic changes
• What about Stage 0
  – Pain at lunate
  – No radiographic changes
  – Changes noted on MRI

Link to pictures of Stages http://orthoinfo.aaos.org/topic.cfm?topic=A00017

Kienbock's Disease

• Treatment
  – scaphoid, trapezoid, trapezium (STT) fusion
  – risk for radioscaphoid arthritis
  – Radial Shortening – mainstay treatment for all but stage IV
  – Ulnar Lengthening

Stage 2

Preiser's disease

• Rare condition
• Avascular necrosis of scaphoid without evidence of fracture

Preiser's disease

Salvage Procedures
Salvage Procedures

- Darrach
- Sauve-Kapandji
- Bower’s hemi-resection
- One bone forearm
- Distal ulna arthroplasty
- Total wrist fusion
- Total wrist arthroplasty

- With all of the salvage procedures ask:
  - What is the pathology?
  - What are we trying to achieve with the surgery?
  - This should guide your treatment.
  - Be cautious with being over aggressive.

Darrach

- Distal ulna resection
- Reserved for the elderly less active or rheumatoid patient
- Can have problems with the ulnar stump (instability)

Darrach

- Cast/Bulky dressing for 7-10 days, then if stable and relatively pain free:
  - Wrist orthosis - at 2 to 4 weeks remove for flex/ext, sup/pron (mid range)
  - Wean out of orthosis and begin full go ROM after 4 weeks if still pain free
  - Gentle strength at 4-6 weeks
  - Avoid power grip until 8-12 weeks post op

Darrach

- If unstable:
  - Long arm cast or orthosis, neutral forearm, up to 4 weeks between exercises
  - Protected AROM at 2 weeks, pain free
  - Wean out of orthosis and progress slowly
  - Watch for “clicking” and “popping”
  - Wrist Strap may be helpful

Suave-Kapandji

- Fusion of the DRUJ and creation of a pseudoarthrosis in the distal ulna proximal to the fusion
- Rotation then occurs at the pseudoarthrosis
- Ulnar support for the carpus is preserved, TFCC and ECU remain stabilized
- Problem with this is instability with the ulnar stump (more common when instability is present pre-op)
Suave - Kapandji

- Long arm cast 7-10 days
- Munster splint with neutral forearm rotation for 3-4 weeks (k-wire fixation)
  - Gentle sup/pro to 45 degrees
- Or wrist orthosis (depending on fixation)
- Wrist AROM at 4 weeks post op
- PROM at 6-8 weeks post op
- Orthosis use until 6th post operative week
- Strength after fusion confirmed

Bower’s Hemi resection Interposition Arthroplasty

- Hemi resection with interposition arthroplasty
- Involves the resection of only the articulating portion of the distal ulna and interposing soft tissue to prevent radio-ulnar impingement
- Does not correct ulnar plus deformity or DRUJ instability

One bone forearm

- will create one bone to provide stability and eliminate pain but sacrifices all rotation (rare)

DRUJ Prosthesis

Salvage procedures continued

- Distal ulna implant arthroplasty may be a promising option
- Has been shown to have less Radioulnar convergence than Darrach and interposition arthroplasty (11) – but cadaveric model
**Total wrist fusion/ wrist arthrodesis**

- Fusions are reliable and will facilitate stability and pain free motion
- Total wrist arthroplasties are used with extreme caution because the long term results of this procedure are not fantastic for young active patients

**Total Wrist Fusion**

- Immobilize in cast and/or orthosis for 8-12 weeks
- Begin ROM of all uninvolved joints ASAP after surgery
- Begin with gentle strengthening and upgrade as appropriate after immobilization/fusion is completed
- Goals: normal motion of all uninvolved joints and functional strength

**Total Wrist Arthroplasty** (replacement)

- Total wrist arthroplasties are used with extreme caution because the long term results of this procedure are not fantastic for young active patients

**Total Wrist Arthroplasty**

- Custom Volar Wrist Orthosis
- Initiate AROM of wrist is initiated between 2 and 6 weeks dependent on fit of prosthesis and soft tissue integrity
- Orthosis is used up to 6 weeks and strength can be started at this time with gentle isometrics and progressing toward isotonic.
- What Range of Motion do these patients typically achieve??

**Special Tests Breakdown**

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**Thank You!!!**

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References


References


