Objectives

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

ANATOMICAL CONSIDERATIONS

DRUJ
What is it?

- Distal Radioulnar joint
  - 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?
  - What position is there the greatest contact of the ulnar head with the sigmoid notch?

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)

Palpated just radial to the ulnar head
**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

**Visualization of PRUL and DRUL tensioning with Forearm Rotation**

- Highly Recommended Reading 😊 and the source of the fabulous photos
- Altman, E. The ulnar side of the wrist: Clinically relevant anatomy and biomechanics. J Hand Ther.29(2016)111-122

**ULNAR SIDED WRIST PAIN**

**Ulnar variance**

- Normal articular relationship between the radius and ulna disrupted
- Loads through the ulnar or radial side of the wrist 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**

Ulnar sided Wrist Pain
Positive Ulnar Variance

- **Positive:**
  - Higher than the articular surface of the radius increases the amount of load going to the ulnar sided structures of the wrist
  - Central Portion of TFCC
  - Lunate and triquetrum
  - LT ligament
  - Increased stress on lunate and triquetrum

- **Associated conditions:**
  - Ulnar impaction syndrome
  - TFCC tears
  - LT tears

Ulnocarpal Abutment

- Also known as impaction, loading, and impingement

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

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

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

Ulnocarpal Abutment

- **Degenerative** syndrome associated with positive ulnar variance

  **Sequence of events:** (Associations NOT Causations)
  - Wearing of the articular disc of TFCC
  - Chondromalacia of ulnar head and ulnar aspect of lunate
  - Disruption of LT ligament

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
- Wafer 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
  - Corrective Osteotomy this is the choice with malalignment of radius articular surface – it is all about the angles ;-)
**Piano Key Test**

- Distal ulna is grasped and moved passively in volar and dorsal direction at extremes of pronation and supination.
- Done initially in neutral (up to 5mm may be noted).
- Pain, tenderness, and increased mobility relative to uninjured side.

**Ulnar Compression Test** *(DRUJ Grind Test)*

- Application of 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.

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**Ulnar Sided Wrist Pain**

**TFCC LESIONS**

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**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

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**Classifications for Type 1 Tears**

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

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**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 interosseus 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 motion
- 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 head of ulna and the triquetrum (ulnar snuffbox)
  - 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 volarly 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

- Associated with Kienbock’s disease
- 100% of stress through radius

Keinbock’s Disease

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

Kienbock’s Disease

• 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 AAOS Page For Pics of Stages = http://orthoinfo.aaos.org/topic.cfm?topic=a00017 (accessed on 8/12/16)

Kienbock’s Disease

• Treatment
  – STT fusion – risk for radioscaphoid arthritis
  – Radial Shortening – mainstay treatment for all but stage IV
  – Ulnar Lengthening

Stage 2

Kienbock’s Disease

• Treatment
  – Capitate Shortening with intermetacarpal artery (HORI Proc)
  – Vascularized Bone Grafts to lunate
  – Salvage procedures for Stage IV (PRC, TWA, denervation)

Stage 3

Salvage Procedures

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

SALVAGE PROCEDURES

Stage 4
• 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 and convergence on radius

**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
  – Avoid power grip until 8-12 weeks post op

• IF UNSTABLE
  – Long arm cast or orthosis, neutral forearm, up to 4-6 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
• Muenster splint with neutral forearm rotation for or wrist orthosis 3-4 weeks (depends on fixation)
  – Gentle sup/pro to 45 degrees
• 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

- One bone forearm – will create one bone to provide stability and eliminate pain but sacrifices all rotation

DRUJ Implant Arthroplasty

- Constrained/Total
  - More stable motion begins earlier
- Unconstrained/Partial
  - Depends on soft tissue envelope for stability immobilized 4-6 weeks before motion begins
- Limited options with implant complications

DRUJ Implant Arthroplasty

- Has been shown to have less Radioulnar convergence than Darrach and interposition arthroplasty, cadaveric model
- Literature reports good functional outcomes in the short term and low complication rate
  - With longer follow up notable disability remains

Total Wrist Fusions and Arthroplasties

- 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 Fusions and Arthroplasties
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 ad upgrade as appropriate after immobilization/fusion is completed
- Goals: normal motion of all uninvolved joints and functional strength

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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References