1 Distal Radioulnar Joint
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2 Topic Outline
   - Anatomy
   - Evaluation / Diagnosis
   - Acute Injuries
   - TFCC Tears
   - Instability
   - Contracture
   - Ulnocarpal Impingement
   - Arthritis

3 Osteology
   - Trochoid Joint
     - Ulnar head articulates with sigmoid notch
     - Minimal articular contact
     - DRUJ at level Lister’s tubercle
     - Distal radius fractures extending into the lunate fossa also involve the sigmoid notch and the DRUJ

4 Biomechanics
   - Axis of rotation of the forearm extends through radial head proximally and the fovea of the ulnar head distally

5 DRUJ is inherently unstable
   - Differential radii of curvature
   - Through arc pronosupination
   - Radius rotates about ulna
   - Ulna translates in sigmoid notch

6 Extrinsic Stabilizers
   - 1 = ECU tendon
   - 2 = 6th DC subsheath
   - 3 = Pronator quadratus
   - 4 = Intraosseous ligament

7 Intrinsic Stabilizer – TFCC
   - Central articular disc
   - Volar radioulnar ligament
   - Dorsal radioulnar ligament
   - Disc–lunate ligament
   - Disc–triquetral ligament

8 TFCC Vascularity
   - Peripheral 20% well-vascularized and may heal
   - Ulnar and anterior interosseous arteries
   - Central 80% avascular
9 Anatomy of Volar & Dorsal Radioulnar Ligaments
- Each ligament has two components
- Deep or proximal component (ligamentum subcutentum) attaches to fovea
- Superficial or distal component attaches to ulnar styloid

10 Ligamentum subcruentum is key stabilizer to A–P stress

11 Stability of the DRUJ: What We Have Learned in 25 Years
Kleinman WB, JHS 2007; 32–A, 1086–1106
- Extrinsic and intrinsic stabilizers
- Ligamentum subcruentum is key stabilizer
- Importance of clinical exam in diagnosis
- Clinical applications

12 Clinical History
- Classic thorough history
- Determine mechanism of injury
- Elicit provocative activities
- Often not very helpful

13 Physical Examination
- Point tenderness at dorsal rim TFC or fovea
- Ulnar abutment test
- TFC load or grind test
- Push–off test
- Dorso–volar shuck test

14 Instability Assessment
- Evaluate at extremes of pronosupination
- Side–to–side comparison is mandatory
- Expect laxity in neutral rotation
- If DRUJ instability is symptomatic, then AP shuck test is provocative

15 Pronation
- Deep palmar marginal ligament (ligamentum subcruentum) is TAUT
- Dorsal articular compression
- Instability to dorsal-directed stress = deep palmar radioulnar ligament tear

16 Supination
- Deep dorsal marginal ligament (ligamentum subcruentum) is TAUT
- Palmar articular compression
- Instability to volar–directed stress = deep dorsal radioulnar ligament tear

17 Dorsopalmar Stability of the Distal Radioulnar Joint
Stuart & Berger, JHS 2000; 25–A, 689–99
- Biomechanical study on human cadavers
- Dorsal translation of distal ulna is constrained by palmar radioulnar ligament
- Volar translation of distal ulna is constrained by dorsal radioulnar ligament

18 Diagnostic Imaging
- Plain radiographs
• CT scan, axial views
• Triple-injection arthrogram
• MRI / MRA
• Arthroscopy

19 **Ulnar Variance**
- Ulnar length relative to radius
- Neutral rotation PA wrist
- Ulnar positive – ulnocarpal impingement, TFCC tears
- Ulnar negative – Kienbock’s

20 **DRUJ Fractures & Dislocations**
- Distal radius fractures involving sigmoid notch
- Ulnar articular surface fractures (chondral)
- Ulnar styloid fractures + / – DRFx
- Acute DRUJ dislocation w/TFCC disruption
- Combination bony & soft tissue injuries (Essex–Lopresti lesion)

21 **Ulnar Styloid Base Fractures**
- ORIF if displacement more than 2 mm
- Tension band technique
- Intraosseous compression screw
- Immobilize for 6 weeks

22 **Acute DRUJ Dislocation with Isolated TFCC Disruption**
- Spectrum of pathology from sprain to dislocation
- Check for distal ulnar deformity or instability
- Assure DRUJ reduction, immobilize x 6 weeks
- Open if DRUJ is locked or reduction incongruous

23 **Chronic DRUJ Problems**
- Isolated TFCC tear without instability
- TFCC disruption with instability
- Instability + / – malunion
- Contracture + / – malunion
- Ulnocarpal impingement / abutment
- Arthritis, primary or post–traumatic

24 **Classification of TFCC Lesions**
Palmer, JHS 1989; 14-A, 594-606
- Based on anatomic study, clinical experience
- Class 1: Traumatic lesions; Stages A-D designating central or peripheral tears
- Class 2: Degenerative lesions; Stages A-E describing ulnar abutment syndrome

25 **Approach to TFCC Tears**
- EUA for DRUJ instability
- Central tears > arthroscopic debridement
- If ulnar positive > wafer shortening ulna
- Dorsal / ulnar tears > arthroscopic repair
- Volar tears and any patient with DRUJ instability > arthroscopic thermal shrinkage
26 DRUJ Instability + / - TFCC Tear
- Arthroscopic thermal shrinkage
- Purpose is to stabilize the DRUJ
- Oratec bipolar thermal radiofrequency probe
- Heat energy to TFCC, ligamentum subcruentum
- Primary treatment + / - TFCC repair
- Immobilization x 6 weeks

27 Chronic DRUJ Instability
- Typical patient is female, FOOSH, no fx
- Correct diagnosis is delayed
- Reconstruct if moderately severe instability or failed thermal stabilization
- Sanders technique with free tendon autograft
- Graft is anchored in soft tissue radially

28 Anatomic Reconstruction of Distal Radioulnar Ligaments for Posttraumatic DRUJ Instability
Adams & Berger, JHS 2002; 27–A, 243–51
- Clinical study of anatomic reconstruction
- Location radial tunnel guided by C-arm
- May be done w/corrective radial osteotomy to address bony deformity
- 12 of 14 patients improved at 1–4 year F/U

29 Summary: DRUJ Instability
- Under-recognized cause of ulnar wrist pain
- Clinical diagnosis; work-up often negative
- May result from DRFx, TFCC tear
- May be present despite negative arthroscopy due to occult ligamentum subcruentum tear
- Must be addressed to resolve symptoms

30 DRUJ Contracture
- Posttraumatic after fx or immobilization
- May be associated w/radial & ulnar malunions
- Supination loss = Volar capsular contracture
- Pronation loss = Dorsal capsular contracture
- Volar capsulectomy for all contractures
- Add dorsal capsulectomy for pronation loss

31 DRUJ Capsule: Clinical Anatomy & Role in Posttraumatic Limitation of Forearm Rotation
Kleinman & Graham, JHS 1998: 23–A, 588–99
- Cadaver & clinical study
- DRUJ capsular contracture can limit motion
- “Silhouette” capsulectomy improved forearm rotation in all 9 patients
- Avoid instability by preserving TFCC

32 Ulnocarpal Abutment Syndrome
- Radioulnar length discrepancy
• Ulnar positive (possibly neutral or negative)
• Posttraumatic shortening distal radius
• Increased ulnocarpal loading
• Palmer Class 2 – TFCC perforation, lunate-ulnar dome compression, LT ligament tear

33 Formal Ulnar Shortening
• Indicated for ulnocarpal impingement
• May help indirectly with DRUJ instability
• TFCC non–destabilizing tear may be present
• Ideal range for shortening is 2 to 6 mm
• Precision osteotomy is preferable
• Beware ulnar nonunion, DRUJ incongruity

34 Precision Oblique Osteotomy for Ulnar Shortening
Rayhack et al., JHS 1993; 18-A, 908–18
• Clinical study 1988–90
• 23 transverse osteotomies averaged 21 weeks to heal, one nonunion
• 17 oblique osteotomies averaged 11 weeks to heal, no nonunions

35 Wafer Distal Ulnar Shortening
• Resection of ulnar dome
• Mild ulnar positive variance
• Allows TFCC repair
• Open or arthroscopic
• Avoids osteotomy nonunion

36 Wafer Distal Ulna Resection for TFC Tears and/or Ulna Impaction Syndrome
Feldon et al., JHS 1992; 17-A, 731–7
• Clinical review
• All 13 cases good to excellent at one year
• Recommended resecting 2 to 4 mm
• Contraindicated if DRUJ instability, arthritis

37 DRUJ Arthritis
Treatment Options
• Darrach distal ulna resection
• Limited distal ulna resection (Bowers, Watson)
• DRUJ fusion w/pseudoarthrosis (Sauve–Kapandji)
• Distal radioulnar arthrodesis (one bone forearm)
• Hemiarthroplasty of distal ulna
• Total DRUJ replacement (Scheker)

38 Darrach Resection
• Malunited Colles fractures, painful DRUJ motion
• Low demand patients
• Creates ulnocarpal & distal radioulnar instability
• Difficult salvage
39 □ Salvage of Failed Darrach Procedure
   Kleinman & Greenberg, JHS 1995; 20-A, 951–8
   • Three component procedure
   • Longitudinal intramedullary tenodesis w/ECU
   • PQ transfer through interosseous space
   • Temporary radioulnar pinning
   • Six patients had painless pronosupination & significant grip strength improvement

40 □ DRUJ Arthroplasty: The Hemiresection–Interposition Technique
   Bowers, JHS 1985; 10-A, 169–78
   • Articular surface resection, free tendon graft
   • TFCC, ulnocarpal ligaments must be intact
   • 38 patients with OA, RA or PTA
   • 90% had pain relief at average 2.5 year F/U
   • Add ulnar shortening if stylocarpal impingement

41 □ Ulnar Head Replacement
   • Avanta U-head prosthesis (Mayo Clinic)
   • Metallic stem, modular head
   • Non–cemented
   • TFCC & ECU subsheath reattachment

42 □ Distal Radioulnar Joint Implant Arthroplasty
   Cooney & Berger, JASSH 2005; 5(4), 217–31
   • Early clinical results are encouraging
   • 18 of 22 patients good or excellent, 27 months
   • Primary indications include distal ulna fx, RA
   • Secondary indications include failed Darrach (w/radioulnar impingement), failed Bowers or failed DRUJ stabilization

43 □ Traumatic ECU Subluxation
   • Injured in supination, ulnar deviation position
   • Painful ECU snap w/supination
   • Immobilize in pronation, dorsiflexion, radial deviation
   • Reconstruct w/retinacular flap (Spinner–Kaplan)

44 □ Take Home Points
   • Assess DRUJ congruity / stability after redux all DRFx
   • Identify patients w/acute DRUJ instability and immobilize
   • Assess patients w/chronic ulnar wrist pain for DRUJ instability
   • If symptomatic DRUJ instability, AP shuck test is provocative
   • Correct bony deformities before soft tissue DRUJ procedures
   • Preserve ulnar head at wrist similar to radial head at elbow

45 □ Distal Radioulnar Joint Dysfunction
   Katolik & Trumble, JASSH 2005; 5(1), 8–29
   • Good review article & reference list
   • Summarizes topics in this presentation
   • ASSH Hand Surgery Update 4, Chapter 12