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 doral 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

- Clincal 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