

1 **Tendinopathies: Current Concepts in Surgical Treatment**

Bernard F. Hearon, M.D.

Clinical Assistant Professor, Department of Surgery

University of Kansas School of Medicine - Wichita

July 21, 2017

2 **Tendinosis**

- Defined as non-inflammatory intratendinous collagen degeneration
- Histology - angiofibroblastic hyperplasia includes hypertrophic fibroblasts, vascular hyperplasia, disorganized collagen
- Areas of focal necrosis, calcification
- No acute inflammatory cells

3 **Tendinosis vs Tendinitis**

- "Tendinosis" implies intrinsic degenerative condition, determines therapeutic goals, sets reasonable outcome expectations
- "Tendinitis" implies an inflammatory condition, is misleading, allows misguided treatment, unreasonable expectations

4 **Corticosteroid Injections**

- Mainstay of nonsurgical treatment
- Mechanism of action is unknown since these are not inflammatory conditions
- In most studies, injection follow-up is short
- How many injections? Data suggest two injections, then surgery most cost effective

5 **Supraspinatus Tendinosis - Anatomy**

- Originates on suprascapular fossa
- Inserts on anterior facet, greater tuberosity
- Insertional footprint
 - 12 mm (medial-lateral)
 - 25 mm (anterior-posterior)
 - 3.5 mm is superior GHJ capsule

6 **Pathogenesis**

- Intrinsic factors
 - Hypovascular zone
 - Age-related microtrauma
- Extrinsic factors
 - Acromial morphology (Bigliani)
 - Internal impingement
 - Glenohumeral joint instability
 - Sports-related trauma, overuse

7 **Athletes At-Risk**

- Overhead athletes
 - Baseball pitchers
 - Tennis players

- Volleyball players
- Softball pitchers
- Weight-lifters

8 **Partial-Thickness Cuff Tears**

- Location
 - Articular, bursal, interstitial
 - Tendon(s) involved
- Grade of tear (Ellman, CORR 1990)
 - I - < 3 mm (<25%)
 - II - 3-6 mm (25-50%)
 - III - > 6 mm (>50%)

9 **Natural History**

- No evidence of active healing
- Expect tear size to increase over time
- Lo, AAOS 2012 - 37 pts followed 4.4 yrs
 - Grade I or II - 14% increased in size
 - Grade III - 55% increased in size

10 **Physical Findings**

- Painful arc of motion
- + impingement signs (Neer, Hawkins)
- Pain (+/- weakness) on manual resistive muscle testing (shoulder ER, abduction)
- + impingement test (pain relief with subacromial injection)

11 **Basis for Surgical Indication**

- Patient factors
 - Age, activity level
 - Occupation, sports participation
- Clinical factors
 - Pain severity, history of trauma
 - Weakness, response to conservative therapy
- Pathologic factors (found on MR-arthrogram)
 - Location of tear
 - Grade of tear

12 **Surgical Treatment Options**

- Grade I or II (<50% thickness tear)
 - Arthroscopic debridement alone
 - Debridement and acromioplasty
- Grade III (>50% thickness tear)
 - Arthroscopic or open repair
 - Take-down or trans-tendinous repair

13 **Proximal Biceps Tendinosis - LHB Anatomy**

- Originates at supraglenoid tubercle
- Intra-articular, extrasynovial portion, 35 mm
- LHB stabilizers form biceps pulley sling
 - Superior glenohumeral ligament
 - Coracohumeral ligament
 - Subscapularis tendon, superior aspect
 - Supraspinatus tendon, anterior aspect

14 Pathogenesis

- Vascular anatomy (intrinsic)
 - Thoracoacromial, brachial arteries
 - Intra-articular hypovascular zone
- Mechanical stresses (extrinsic)
 - Intra-articular - compression, shear
 - Extra-articular - tension

15 LHB Lesions

- Isolated tendinosis lesions
- Tendinosis w/SLAP lesion
- LHB instability w/pulley sling rupture
 - Superior subscapularis tear
 - Anterior supraspinatus tear
- LHB rupture

16 Clinical Presentation

- Anterior shoulder pain radiating to biceps
- Overhead athletes, tennis, volleyball
- + Speed, + Yergason suggest tendinosis
- Throwers w/scapular dyskinesis, GIRD
- + O'Brien, + relocation indicate SLAP lesion
- MR-arthrogram best for biceps-labral view

17 Surgical Treatment Options

- LHB tenotomy
 - Degenerative tendon, older patients
 - Cosmetic deformity, biceps cramping
- LHB tenodesis
 - Arthroscopic, suture technique w/RCR
 - Open, subpectoralis technique

18 Illustrative Case - HPI

- 48 yr-old female PA, CrossFit enthusiast
- 6-mo history right anterolateral deltoid pain
- Overhead weight-lifting, snatching 155 lb, dead-lifting 300 lb
- Could not tolerate CrossFit weight-lifting

- Night pain unrelieved by NSAIDs, PT

19 **Physical Exam**

- Active FF 150°, abd 165°, ER 56°
- Impingement signs were negative
- O'Brien test, SLAP test were positive
- Relocation and release test was positive
- No rotator cuff weakness, but pain on resisted shoulder abduction

20 **MR-Arthrogram showed partial supraspinatus tear, SLAP lesion.**

21 **Nonoperative Treatment**

- Modified work-out routine, but continued training for CrossFit competition
- Three subacromial injections during five-month training period
 - First injection helped for 6 wks
 - 2nd, 3rd injections helped for 2 wks

22 **Arthroscopy confirmed partial supraspinatus tear, Ellman grade III, which was treated with arthroscopic trans-tendinous repair.**

23 **Arthroscopy also confirmed high-grade SLAP lesion which was treated with LHB tenotomy, limited open subpectoralis tenodesis.**

24 **Surgical Outcome**

- At six months postop, right shoulder pain improved and she was satisfied
- On exam, FF 162°, abd 164°, ER 42°
- No rotator cuff weakness, but mild pain on resisted shoulder abduction
- Advised to modify CrossFit routine

25 **Epidemiology of Distal Biceps Rupture**

- Male mesomorphs (rare in females)
- Age range 30-60 years (mean 47 yrs)
- Dominant extremity (86%)
- Incidence 1.2 ruptures per 100K per yr
- Smokers 7.5 times greater risk

26 **Distal Biceps Partial Tears**

- Less common than complete ruptures
- Diagnosis increasing frequency (MRI, US)
- Anterior elbow pain radiating to biceps
- Injury event (lifting, forced extension)
- Unexplained elbow pain w/o trauma
- No sports-related predilection

27 **Distal Biceps Anatomy**

- Musculocutaneous innervation
- Elbow flexor, forearm supinator
- Posterolateral radial tuberosity insertion
 - Short head inserts distal, better flexor

- Long head inserts proximal, supinator
- Bicipital aponeurosis (lacertus fibrosis)

28 Pathogenesis

- Blood supply (intrinsic factor)
 - Proximal third - brachial artery
 - Distal third - post interosseous recurrent
 - 2-cm middle-third is a hypovascular zone
- Mechanical impingement (extrinsic factor)
 - Washer-ringer effect with pronosupination
 - Radioulnar space 48% less in pronation

29 Diagnosis

- Physical findings
 - Palpable, tender distal biceps
 - Weakness resisted supination
- Radiographs usually negative
- Advanced imaging - MRI
 - To confirm partial tear, may be equivocal
 - Unnecessary for complete tear

30 MRI - FABS Position

- Shows full length of distal biceps
- Mandatory to show partial tear
- Patient is prone w/elbow on coil
 - Flexed elbow
 - ABducted shoulder
 - Supinated forearm

31 Treatment Options

- Nonoperative treatment does not help
- In situ distal biceps repair
- Distal biceps take-down, re-attachment
 - One-incision technique
 - Two-incision technique
 - Multiple re-attachment options

32 Meta-Analysis of Surgical Outcomes

- Behun, JHS 2016
- 19 studies, 86 partial tears repaired
- 65 pts failed trial non-surgical treatment
- Surgical repair - 94% satisfactory outcome
- LABC paresthesia common complication

33 One-Incision Technique

- Diagnosis of complete tear is clinical

- MRI unnecessary
- Single incision, cortical button w/o screw
- Conservative postop & rehabilitation protocol

34  **My Preferred Surgical Technique for Distal Biceps Repair Tension-Slide Technique w/Cortical Button Fixation Sethi, Tech Hand 2008**

35  **Postoperative Protocol**

- Long-arm splint, wk 1
- Long-arm extension block orthosis, wks 2-4 with protected early motion
- Active pronosupination, wk 4
- Full active ROM, biceps isometrics, wks 7-12
- Progressive strengthening, wks 13-26
- Many surgeons are moving toward early active ROM postoperatively

36  **Distal Biceps Tears in Women**

- Rarely occur in women
- Jockel, JSES 2010 - 15 cases, mean 63 yrs
- 7 single injury, 8 insidious, 6 cystic mass
- 14 partial tears improved with repair
- Women - older, partial tears, atraumatic, associated w/peritendinous cyst

37  **Distal Biceps Partial Tear - Illustrative Case - HPI**

- 49 yow male RHD salesman
- 4-month history right elbow pain anteriorly w/o antecedent trauma
- Pain with elbow flexion, pronation, lifting
- IM cortisone, Dosepak - temporary relief


38  **Physical Exam**

- Full active elbow range of motion
- Tenderness along distal biceps tendon
- Trace weakness on resisted elbow flexion
- 4+/5 weakness on resisted forearm supination
- All provocations reproduced his elbow pain

39  **At surgery, partial distal biceps tear was confirmed and treated by take-down and repair w/tension-slide technique.**

40  **Surgical Outcome**

- At 3 months postop, elbow pain resolved
- Patient satisfied with early result
- Elbow ROM 0-148°, full pronosupination
- Progressive activity next 3 months
- Return to full activity at 6 months

41  **Lateral Epicondylitis or "Tennis Elbow" - Epidemiology**

- Affects 1-3% adults per year
- Age range 30-50 years

- Men and women equally affected
- Dominant side
- Risk factors - repetitive lifting, manual labor

42 **Pathoanatomy**

- Common extensor origin
 - ECRB affected in nearly all patients
 - EDC involved in 35-50% patients
- Pathohistology
 - No evidence of acute inflammation
 - Angiofibroblastic tendinosis

43 **Clinical Presentation**

- Sports - racquetball, squash, fencing, tennis (groundstrokes)
- Insidious onset or lateral elbow trauma
- Wrist extension activity is provocative
- Repetitive eccentric loading is causative

44 **Diagnosis**

- Physical findings
 - Tenderness at common extensor origin
 - Resisted wrist extension is provocative
- Radiographs - rarely alter management
- MRI - quantifies lesion, but unnecessary

45 **Nonsurgical Treatment**

- Activity modification
- NSAIDs
- Orthoses
- Stretching, ASTYM
- Eccentric strengthening
- Iontophoresis
- Steroid injection
- PRP injection
- Botox injection
- Autologous blood injection
- Extracorporeal shock wave

46 **My Treatment Protocol**

- Activity modification, counterforce strap, short-arm splint (night), encourage patience
- Therapy - stretching, strengthening, ASTM
- Aggressive needling w/lidocaine
- After 1 yr, open CEO release, partial lateral epicondylectomy
- Recalcitrant - arthroscopy, denervation

47 **Open vs Arthroscopic Technique**

- Prospective, randomized, controlled trial
- Open - 15 women, 19 men (mean 47 yrs)
- Scope - 13 women, 21 men (mean 45 yrs)
- No difference in outcome 1 yr postop
- Level I study - McDonald, ASES 2014

48 **My Preferred Surgical Technique for Chronic Tennis Elbow Common Extensor Origin Release, Partial Lateral Epicondylectomy Nirschl, JBJS 1979**

49 **Medial Epicondylitis or "Golfer's Elbow" - Epidemiology**

- Overall prevalence < 1%
- Age range 30-60 years
- Men and women equally affected
- Other medial pathology in 10-20%
- Occupation-related (military, brick layers, carpenters)

50 **Clinical Presentation**

- Overhead throwing sports (baseball, javelin) in late cocking or early acceleration phase
- Other sports - tennis (serving), golf, rowing
- Insidious onset is most common
- Repetitive eccentric loading is causative

51 **Physical Exam**

- Tenderness at medial epicondyle
- Pain, weakness on resisted VF, pronation
- May occur with ulnar neuritis, subluxation
- Distinguish from elbow UCL insufficiency, cervical radiculopathy

52 **Diagnostics**

- Radiographs - usually normal, but up to 25% show medial calcification
- Ultrasound - focal tendon lesion, but operator-dependent
- MRI / MRA - to rule out other pathology


53 **Nonoperative Treatment**

- Activity modification
- Rest from throwing, golfing
- NSAIDs
- Counterforce strap, taping
- Short-term splinting
- ASTYM, but not ESWT
- Steroid injection, trephination
- Flexor-pronator stretching
- Concentric strengthening
- Eccentric strengthening

54  **Surgical Option - Debridement of Focal Tendon Defect**

55  **Associated Ulnar Neuropathy**

- Negative prognostic factor
- Gabel, JBJS 1995
 - 24/25 better w/mild ulnar neuropathy
 - 2/5 better w/mod-severe symptoms
- Kurvers, JBJS 1995
 - 11/16 w/o ulnar neuritis symptom-free
 - 3/24 w/ulnar neuritis were asymptomatic

56  **My Preferred Technique for Medial Epicondylitis with Concomitant Ulnar Neuropathy**
Ulnar Nerve Transmuscular Transposition with Step-Cut Lengthening of the Flexor-Pronator Fascia

57  **de Quervain's Disorder**

- Fritz de Quervain, Swiss surgeon, 1895
- Stenosing tendinosis 1st dorsal compartment
- Degenerative tendon changes, retinacular thickening
- Middle age, dominant side, repetitive lifting
- Women 6 times more often than men

58  **Clinical Diagnosis**

- Radial-sided wrist pain, localized swelling
- Provoked by thumb abd, wrist UD
- Tenderness - radial styloid, 1st DC
- Provocative tests - Finkelstein, Eichhoff
- Thumb pseudo-triggering, retinacular cyst
- Distinguish from basal thumb arthrosis

59  **Local Anatomy**

- APL, EPB in 1st dorsal compartment
- APL is radial-volar, multiple slips (2-7)
- EPB is dorsoulnar, usually one small slip
- Vertical septum often separates APL, EPB
 - 20-40% cadavers
 - 70-90% at surgical release
- Proximity of superficial radial nerve

60  **Treatment Options**

- NSAIDs, splinting are palliative
- Injection effective only if in EPB subcompartment
- 1st DC release if wrist pain persists
- Yuasa, JHS 1998 - May decompress only EPB if septated 1st DC

61  **Preferred surgical treatment is release of 1st dorsal compartment including EPB subcompartment if present.**

62 Intersection Syndrome

- APL, EPB muscle bellies cross ECRL, ECRB
- "Intersection syndrome" coined by Dobyns
- Tendinosis of 2nd dorsal compartment
- Repetitive motion (rowing, weight-lifting)
- Majority improve with 2nd DC injection
- Injection failures require 2nd DC release

63 Nonoperative treatment of intersection syndrome is injection at intersection 1st and 2nd dorsal compartments.

64 Preferred surgical treatment of intersection syndrome is 2nd dorsal compartment release.

65 ECU Tendinopathy

- 2nd most common dorsal tendinopathy
- Uncommon cause of ulnar-sided wrist pain
- Spectrum of pathology
 - Tendinosis
 - Subluxation
 - Tear (partial, complete)

66 ECU Tendinosis

- Majority from direct blow or twisting injury, some from repetitive motion or overuse
- Pain, swelling along ECU tendon sheath
- Exam - tenderness, bogginess along ECU
- Pain reproduced by resisted wrist DF, UD
- Injection - effective first line treatment
- Release 6th compartment if injection fails

67 ECU Synergy Test

- Described by Ruland, JHS 2008
- Distinguishes ECU tendinosis from wrist intra-articular process (TFC tear)
- ECU contracts on resisted thumb abd, wrist in neutral, forearm supinated

68 ECU Subluxation

- Anatomy - ECU subsheath, distal ulnar groove
- Injury mechanism - wrist supination, VF, UD
- Racquet, stick sports - baseball, golf, tennis
- Painful tendon snapping w/pronosupination
- ECU subluxes ulnar and volar to groove with supination, reduces with pronation
- Diagnosis made on clinical grounds

69 ECU Subluxation - Treatment Options

- Acute (< 6 wks) - immobilize wrist in pronation, dorsiflexion, radial deviation
- Chronic (> 6 wks)
 - Stabilize ECU with retinacular flap (Spinner-Kaplan, CORR 1970)

- Stabilize ECU subsheath to ulnar groove

70 **Patellar Tendinosis - Arthroscopic Patellar Tendon Release**

- 30 athletes (27 men), 4.4-yr follow-up
- Synovial hypertrophy inferior patellar pole
- Fat pad resection, release inferior patella
- Knee function improved, pain decreased
- 97% pts had good or excellent outcomes
- Level IV study - Maier, 2013 Arthroscopy

71 **Illustrative Case - HPI**

- 36 yow male golf coach
- Bilateral knee pain after fall snow skiing
- Anterior pain aggravated by twisting, sports, squatting
- NSAIDs, PT did not help

72 **Physical Exam**

- Normal, non-antalgic heel-to-toe gait
- Full active passive knee ROM bilaterally
- Patellar tenderness bilaterally
- No instability to valgus or varus stress
- Negative anterior, posterior drawer
- Negative Lachman, McMurray

73 **Knee radiographs were normal.**

74 **MRI - T2-weighted sagittals showed nonhomogeneous signal at patellar tendon insertion on the patella.**

75 **At arthroscopy, there was synovial hypertrophy treated with debridement, partial patellar tendon release from inferior pole.**

76 **Surgical Outcome**

- At 3 wks postop, knee pain resolved
- Passive range of motion: 0-130°
- No patellar tendon tenderness
- Good quadriceps set, no extension lag

77 **Achilles Tendinosis - Surgical Treatment Options**

- Non-insertional tendinosis
 - Open debridement of compromised tendon
 - Protected weight-bearing, early motion
- Insertional tendinosis
 - Debridement retrocalcaneal bursa, devitalized tendon, calcaneal traction spur, Haglund's lesion
 - Repair / reattachment of Achilles to calcaneus