

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

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

34 **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

35 **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

36 **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

37 **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

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

39 **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

40 **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

41 **Pathoanatomy**

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

42 **Clinical Presentation**

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

43 **Diagnosis**

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

44 **Nonsurgical Treatment**

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

45 **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

46 **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

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

48  **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)

49  **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

50  **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

51  **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


52  **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

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

54  **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

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

56  **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

57  **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

58  **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

59  **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

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

61  **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

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

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

64 **ECU Tendinopathy**

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

65 **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

66 **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

67 **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

68 **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

69 **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

70  **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

71  **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


72  **Knee radiographs were normal.**

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

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

75  **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

76  **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