

1 Elbow Tendinopathies

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2 Tendinosis

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

3 Tendinosis vs Tendinitis

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

4 Distal Biceps Rupture: Epidemiology

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

5 Bilateral ruptures of the distal biceps brachii tendon

Schneider et al., JSES 2009; 18: 804–07

- Retrospective review, 25 pts, non-simultaneous bilateral biceps ruptures
- All pts male, average age 50 (range 28 to 76)
- Mean time between ruptures 2.7 yrs (0.5 to 6.3)
- Pts found to have higher rate of nicotine (50%) and anabolic steroid use (20%)

6 Distal Biceps Anatomy

- Short head and long head
- Musculocutaneous innervation
- Elbow flexor, forearm supinator
- Radial tuberosity insertion
- Bicipital aponeurosis (lacertus fibrosis)

7 Distal biceps tendon insertion: An anatomic study

Hutchinson et al., JSES 2008; 17: 342–46

- 20 cadavers dissected to find biceps footprint
- Insertion at posteroulnar to middle aspect of the radial tuberosity in all specimens
- Shape of insertion is semilunar or oval
- Reinsertion should be aimed at the posteroulnar aspect of the radial tuberosity

8 Proper placement of the distal biceps tendon

during repair improves supination strength

Prud'homme-Foster et al., JSES 2015; 24: 527–32

- 8 fresh frozen cadavers, biomechanical study
- Anatomic repair is to ulnar side radial tuberosity
- Supination torque enhanced by cam effect of the radial tuberosity
- 40% less supination torque w/nonanatomic repair than with anatomic repair

- 9 **Distal Biceps Tendon Anatomy: A Cadaveric Study**
Eames et al., JBJS 2007; 89A: 1044–49
 - In 10/17 cadavers, long & short heads had distinct insertions on radial tuberosity
 - Short head inserted distally, better flexor
 - Long head inserted proximally, better supinator
 - Bicipital aponeurosis may be stabilizer
- 10 **Bicipital Aponeurosis (Lacertus Fibrosis)**
 - Envelops biceps, volar forearm muscles
 - Statically, lacertus stabilizes the biceps
 - As forearm muscles contract, biceps is pulled medially
 - Should lacertus be preserved or released?
- 11 **Distal Biceps Potential Mechanisms of Rupture: Arterial Supply, Mechanical Impingement**
Seiler et al., JSES 1995; 4: 149–56
 - Proximal one-third supplied by brachial artery
 - Distal one-third from posterior interosseous recurrent artery
 - 2-cm middle-third is a hypovascular zone where blood supply is from paratenon
 - Radioulnar space for tendon is 48% less in pronation than in supination
- 12 **Clinical History**
 - Sudden forced extension on flexed elbow
 - Eccentric contraction of the biceps
 - Tearing sensation anterior elbow, audible pop
 - Loss of normal biceps contour, bruising
 - Weakness elbow flexion, forearm supination
- 13 **Clinical Exam**
 - Absence palpable tendon (hook test)
 - Bicipital crease interval (bicipital crease ratio)
 - Weakness on resisted forearm supination
 - Biceps squeeze test
 - Passive forearm pronation test
 - Bicipital aponeurosis flex test
- 14 **Diagnostics**
 - Radiographs may show spurs, avulsion fracture
 - Ultrasound may confirm complete rupture
 - MRI most helpful for partial distal biceps tear
- 15 **Best MRI for Distal Biceps: FABS Technique**
- 16 **Nonoperative Treatment of Distal Biceps Tendon Ruptures**
Freeman et al., JBJS 2009; 91–A: 2329–34
 - 20 cases (18 pts, 16 males), 50 yrs (range 35–74)
 - 7 dominant arm, 9 nondominant arm, 2 both
 - All had PT including ROM and strengthening
 - Mean supination strength 74% +/- 33%
 - Mean flexion strength 88% +/- 16%
 - Overall satisfactory outcomes, one unsatisfactory
- 17 **Classic Two-Incision Technique**
Morrey, 1985

- Anterior incision, deliver tendon, whip stitich
- Advance large clamp between radius and ulna
- Posterior approach between EDC and ECU
- Expose and prepare radial tuberosity, deliver sutures through drill holes and tie

18 Evolution of Single Anterior Incision Repair

- Lintner, 1996 – Suture anchors
- Bain, 2000 – Endobutton
- Mazzocca, 2005 – Endobutton, interference screw
- Mazzocca, 2008 – Cortical button, interference screw
- Siebenlist, 2011 – Double intramedullary cortical button
- Tanner, 2013 – Power-optimizing, cost-effective direct suture repair

19 Single vs Double-Incision Technique Distal Biceps Tendon Repair

Grewal et al., JBJS 2012; 94-A: 1166–74

- Prospective, randomized, Therapeutic Level I study
- Single incision, two suture anchors (n = 47)
- Double incision, transosseous drill holes (n = 44)
- Elbow flexion strength 10% better w/two incisions
- LABC neurapraxia 40% pts w/one incision
- Four tendon re-ruptures due to noncompliance

20 My Preferred Approach

- Diagnosis of complete tear is clinical
- MRI confirmation unnecessary
- Single incision, cortical button w/o screw
- Conservative postop & rehabilitation protocol

21 Postoperative Protocol

- Long-arm splint w/forearm neutral rotation
- Long-arm hinged extension block orthosis at one week, passive flexion, active extension
- Block extension at 60 degrees 2nd week, then 30 degrees 3rd week, full extension 4th week
- Active pronosupination during 4th week
- Full active ROM, biceps isometrics, 7–12 wks
- Progressive strengthening, 13–26 weeks

22 Distal Biceps Partial Tears

- Anterior elbow pain radiating to biceps often after injury event (lifting, forced extension)
- Tender distal biceps, weak resisted supination
- MRI often diagnostic but may be equivocal
- Nonsurgical rx including PT does not help
- Surgical options are in situ repair vs take-down and re-attachment

23 Distal biceps tendon tears in women

Jockel et al., JSES 2010; 19: 645–50

- 15 cases (13 pts), mean age 63 yrs (range 48–79)
- 7 single injury, 8 insidious onset, 6 cystic mass
- 14 partial tears, all did well with surgical repair

- Distal biceps tears rarely occur in women
- Age is older than men, no trauma, associated with cyst, mostly partial tears

24 Chronic Distal Biceps Tears

- Primary repair in extreme flexion
- Reconstruction with Achilles tendon allograft
- Tenodesis to brachialis

25 Surgical Complications

- LABC neurapraxia
- PIN palsy
- Heterotopic ossification
- Radioulnar synostosis
- Tendon re-rupture
- CRPS / RSD
- Wound infection

26 Drilling Angle & PIN Safety

- Position full supination
- Drill perpendicular to long axis of radius
- Aim 0 to 30 degrees ulnarly to improve margin of safety

27 Review of 150 Acute Triceps Ruptures

Mirzayan, 2014 ASES Meeting

- Average age 49 years (range 15 to 79)
- Males 93%, dominant side 70%
- Injury mechanism – fall 51%, weight lifting 20%
- Bony avulsion on lateral radiograph 58%
- Complete rupture 77%, at bony insertion 97%
- Smokers 7%, anabolic steroid use 3%

28 Diagnosis

- Eccentric load, resisted elbow extension
- Weight lifters, offensive linemen in football
- Exam – pain & weakness w/resisted extension, palpable tendon defect, positive squeeze test
- XR – bony avulsion or olecranon fracture
- MRI – for confirmation of partial tears and to assess degree of injury

29 Treatment Methods

- Partial tears < 50% (myotendinous junction or intratendinous) – extension splinting
- Acute complete tears < 3 wks – anatomic repair by transosseous suture or anchors
- Chronic tears w/retraction – reconstruction w/tendon autograft or allograft

30 Snapping Medial Triceps

- May be associated w/ulnar neuropathy
- Treat medial head by excision or lateralization
- Treat ulnar nerve by anterior transposition

31 Lateral Epicondylitis: Epidemiology

- Affects 1–3% adults per year
- Age range 30–50 years
- Men & women equally affected
- More common on dominant side
- Risk factors include repetitive lifting, manual labor

32 Anatomy & Histology

- ECRB most commonly affected
- EDC involved 35–50% patients
- No evidence of acute inflammation
- Angiofibroblastic tendinosis

33 Clinical Diagnosis

- Insidious onset or lateral elbow trauma
- Wrist extension activity is provocative
- PE – Tenderness at CEO, positive resisted wrist extension
- XRs – may show CEO calcification 7% but rarely alter management
- MRI – may quantify tendon involvement

34 Nonsurgical Treatment Options

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

35 My Treatment Protocol

- Activity modification, counterforce strap, short-arm splint (night), encourage patience
- OT – stretching, strengthening, ASTYM
- Aggressive needling w/lidocaine
- If no better after one year, open CEO release, partial epicondylectomy
- Recalcitrant cases – arthroscopic debridement, denervation