Flexor Pronator Strain, Epicondylitis, Avulsions

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RECOVER YOUR GAME

Disclosures

• I have no conflicts of interest in relation to this presentation

Flexor Pronator Strain

• Anatomy
• Function
• Forces
• Clinical Presentation
• Imaging Studies
• Treatment
Anatomy

- Common Flexor Tendon origin - Medial Epicondyle
- Pronator Teres
- FCR
- Palmaris Longus
- FDS
- FCU

Function

- Provides dynamic support to valgus stress during throwing motion
- Contraction during early arm acceleration resists valgus and flexes wrist during ball release

Elbow Forces

- Elbow valgus torque peaks at late cocking phase - during maximal shoulder external rotation (MER)
- Can approach torque up to 120 Nm
- Significantly higher torque in pitchers who endure an injury

Correlation of Torque and Elbow Injury in Professional Baseball Pitchers

Sawicki et al. JSES, 2004

Adam WA. AJSM, 2010.
Fastballs caused the greatest torque
Curveballs produced the greatest arm speed

Predictors of increased elbow torque
- Increased ball velocity
- Higher BMI
- Decreased arm slot

Protectors against elbow torque
- Increasing age
- Longer arm length
- Greater elbow circumference were independent

VAS fatigue scores increased 0.72 points per inning
Medial elbow torque increased beyond inning 3, increase of 3.84% in each inning
Pitch velocity decreased (0.28 mph per inning)
There were no differences in arm rotation or arm speed as the game progressed
Arm slot decreased with each successive inning (0.73° on average per inning)

***These findings signify a possible relationship between fatigue and injury risk.

Presentation
- Medial elbow pain during late cocking and/or early acceleration phase
- Tenderness just distal to medial epicondyle origin
  - Tendonitis (proximal) and more distal (anterior band)
  - Tendonitis (posterior) and more distal (posterior band)
• MLB & minor league teams 2010-14
• 763 forearm flexor injuries
• Mean time on the DL: 117 days
• Decline in WHIP & strike %
• Subsequent injuries:
  – 37 % shoulder
  – 36 % elbow
  – 18 % forearm
  – 19.4 % required UCL reconstruction

• 12 s pace (Rule 8.04 from the MLB)
• Significantly more muscle fatigue
• Increased risk of muscle injury was predicted in the flexor-pronator mass
• Reduced effectiveness of the flexor-pronator mass may increase strain on the UCL

Imaging

• Plain radiographs negative
• MRI
  – High signal within the flexor-pronator muscle bellies
25 yo MLB player

Treatment

- Responds well to conservative management
  - Period of rest
  - Anti-inflammatory
  - Physical therapy
  - Gradual return to throwing
- Corticosteroid injection for chronic refractory symptoms
- PRP

Pitch velocity showed a statistically significant increase (3.3%)
- Increase of 4.3° of shoulder external rotation in the experimental group.
- Injury rate was 24%
• As the throw distance increased, arm speed and shoulder ER increased.
• Arm slot decreased for each distance.
• Elbow Varus torque increased with each distance up to 37 m and then remained the same at 46 m.

PRP Injection

Many animal studies show PRP growth factors (PDGF, IGF) stimulate myogenesis and mitigate inflammation.

Positive Effect of a Autologous Platelet Concentrate in Lateral Epicondyliitis in a Double-Blind Randomized Controlled Trial

Ongoing Positive Effect of Platelet-Rich Plasma Versus Corticosteroid Injection in Lateral Epicondyliitis

A Double-Blind Randomized Controlled Trial With 2-year Follow-up
Platelet rich plasma versus steroid on lateral epicondylitis: meta-analysis of randomized clinical trials.

- 8 RCTs that involved 511 patients.
- Meta-analysis showed:
  - Steroid exhibited a better efficacy of function in the short-term.
  - PRP is more effective in relieving pain and improving function in the intermediate-term (12 weeks) and long-term (half year and one year).

Flexor-Pronator Strain + UCL

- 187 players undergoing UCL reconstruction (2002 to 2007)
  - 8 (4.3%) with combined flexor-pronator mass injury
  - Age difference statistically significant between two groups
    - Isolated UCL (20.1 yrs) vs Combined UCL/FPM (33.4 yrs)
  - Age > 30 years predicts combined injury (88%) vs isolated UCL (1%); P < 0.001
  - 12.5% with combined injury returned to sport
• Elbow Varus torque increased in pitchers:
  - increased arm rotation during the cocking phase
  - increased translational velocity during the acceleration phase
  - increased slot size at ball release.
• Elbow Varus torque is related to UCL injuries in overhead throwers.

Medial Epicondylitis

• Pathology
• Presentation
• Physical Exam
• Imaging
• Treatment

Medial Epicondylitis

• Pathologic inflammatory changes the flexor-pronator mass origin
• Often begins as micro-tearing between Pronator teres and ECR
• Develops into fibrotic and inflammatory granulation tissue - Angiofibroblastic hyperplasia
• 20% with concomitant ulnar neuritis

Krausser BS et al. JBB, 1999
Presentation

- Insidious onset medial elbow pain
- Exacerbated during throwing
- Tenderness distal and anterior to medial epicondyle
- Reproducible with resisted wrist flexion and forearm pronation (most sensitive)
- +/- Tinel's sign
Imaging

- Plain radiographs often negative
- MRI
  - Increased signal intensity within common flexor tendon on both T1 & T2 sequences
  - Common flexor tendon thickening
  - Best seen on axial and coronal

MRI

Treatment

- Initial conservative management - Up to 90% success rates*
  - Pain relief - Rest, Ice, Anti-inflammatories
  - Physical therapy - stretching and progressive isometric exercises
  - Followed by eccentric and concentric resistive exercises**

*Gabel GT & Morrey BF. JBJS, 1995
Surgical Treatment

- Reserved for refractory cases
  - 6 months of failed therapy program*

- Technique
  - Care to avoid medial antebrachial cutaneous n.
  - Debridement of inflamed/pathologic tissue
  - Secure tendinous repair
  - Plus or minus suture anchor to epicondyle

*Jobe FW & Ciccotti MG. JAAOS, 1994

Post-Operative Plan

- Brief immobilization (7-10 days)
- Gentle passive and active range of motion
- 4 to 6 weeks - resisted wrist flexion and forearm pronation
- Return to play by 4 months

The result of surgical treatment of medial epicondylitis: analysis with more than a 5-year follow-up

- Retrospective analysis of 63 elbows treated surgically
- Minimum 5 year conservative management
- 13/63 with ulnar neuritis - All received ulnar neurolysis
- Mean pain score improvement 8.6 to 2.4 (p<0.001)
- 96% (60/63) with excellent or good results
- Return to work 2.8 months
- Return to exercise 4.8 months
- 1 complicated with heterotrophic ossification

*Jobe FW et al. JSES, 2016
• Retrospective analysis of 60 patients treated surgically
• Minimum 4 months conservative management (Avg. 144 weeks)
• 20% with concomitant ulnar neuropathy
• Results after 1 year follow up:
  - MEPS (Mayo Elbow Performance Score) improved post-op from 58 to 88 (p < 0.002)
  - Pain levels (scale 0-3) decreased 2.2 to 0.6 (p < 0.0001)
  - 1 re-operation in competitive swimmer

Clinical Outcomes After Suture Anchor Repair of Recalcitrant Medial Epicondyliopathy

• Most patients returned to pre-injury sporting activities at a median of 4.5 months
• Older age at the time of surgery was predictive of better Quick DASH score and OES
• Patients who underwent surgery after a shorter duration of symptoms had better outcomes, but the difference did not reach statistical significance

• The incidence of failure requiring revision (1.5%).
• Risk factors for revision:
  - Younger age
  - Male gender
  - Nutrient obesity
  - Tobacco use
  - Inflammatory arthritis
  - The most significant risk factor for revision surgery is having ≥3 ipsilateral preop injections
Avulsions

- Skeletally immature athletes
- Direct trauma, dislocation,估值
- Chronic valgus or extension overload
- Medial epicondyle (most common) - last to fuse
- Sublime tubercle, olecranon avulsion

Retrospective review of 33 UCL injuries
- 8 with avulsion of sublime tubercle - all treated non-op
- Age: 16.9 yrs. - 5 HS, 2 College, 1 MLB

Treatment
- Brief immobilization (7-10 days at 90°)
- 6 weeks of functional bracing
- Throwing program at 8 weeks
- Return to play at 12 weeks

Presentation
- Reports sudden pain or audible "pop"
- Local soft-tissue swelling
- Loss of elbow motion
- Point tenderness along medial epicondyle
Imaging

- Plain radiographs - 3 views
  - Medial epicondyle fragment displaced anteriorly and distally
    - May be incarcerated intra-articularly (cases of dislocation)
- Advanced imaging usually unnecessary
  - CT - determine displacement
  - MRI - evaluate incarcerated fragment

Treatment

- Non-operative
  - Less than 2mm displacement
- Operative Indications (Lower threshold in competitive athletes)
  - Greater than 5mm displacement
  - Incarcerated fragment in joint
  - Open fracture
  - Gross instability
  - Ulnar nerve compression

- Arthroscopic treatment: debridement of posteromedial synovitis, fragment removal, and olecranon spur excision.
- Mean age: 15.7 (range 14-17) years.
- Time from onset of symptoms to surgery was 4.9 (3-18) mo.
  - Postoperative findings:
    - posteromedial synovitis
    - Olecranon spurs in all patients
    - Fragments in 10.
- Elbow outcome score: excellent in 11 patients and good in 2, mean score of 92 points (maximum 100 points).
- Mean preoperative DROM was 99° (10) to 137° (8) flexion.
- All elbow in their previous level of play at an avg of 3.4 mo.
- No patient developed medial instability.
Case

- 15 yr. old LHD high school pitcher felt "pop" in medial elbow while pitching
  - 4/10 dull pain, no numbness
  - ROM 30-120
  - Pronation 70
  - Supination 90-45 strength: Tender medially
  - MRI showed no major findings
  - X-ray showed no significant abnormalities

11/19/2018
No significant difference in:
• Return to the same sport (93%)
• Performance at preinjury level
• Median time to return to play
• Functional limitations
• Pain in the past 30 days
• Need for physical therapy
• ROM limitations
• Complications
References