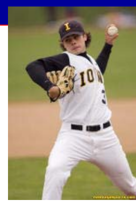
Detroit Regional Sports Medicine Symposium
July 18, 2018

Surgical Management of UCL Injuries of the Elbow



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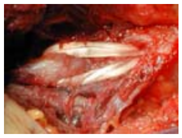

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AAOS

I (and/or my co-authors) have something to disclose.

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"My Academy" app;

Printed Final Program; or

AAOS Orthopaedic Disclosure Program on the AAOS website at http://www.aaos.org/disclosure

Disclosures

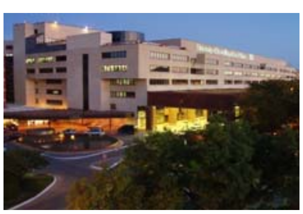
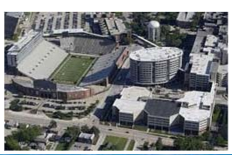
- *Educational Grant support:* ConMed, Smith and Nephew, Arthrex
- *Consultant:* ConMed; Sportsmed Innovate
- *Editorial Board:*
  - Orthopaedic Journal of Sports Medicine
- *Committees:*
  - Program Committee: AOSSM
  - Council of Delegates: AOSSM
  - BOS Fellowship Committee : AAOS (Chair)

University of Iowa

- *Iowa city, Iowa*
- *University Town*
- *Metropolitan area ~ 250,000*


10 Minutes from Univ. Iowa Hospitals

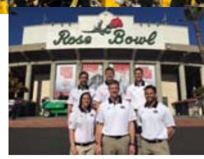

University of Iowa Hospitals


900 inpatient beds; 128 critical care beds; 36 MOR; 12 ASC ORs
36,000 admissions in 2017; 60,000 ER visits
1 million outpatient visits in 2017

University of Iowa Sports Medicine

- *23 University Teams*
- *~800 athletes*
- *Big Ten Conference*



Iowa Connection

Epidemiology:

- *Several fold increase in MCL injuries last decade*
- *More pitchers throwing harder*
- *Estimated that 1/3 MLB pitchers*
    - 20% minor league
- *Specialization at earlier age*
- *Highest increase in youth throwers*
    - >8mos / yr – risk ↑ ≥ 500%
    - More than 100 innings / yr
    - Increasing evidence of MCL injury with ↑ fatigue

Fleisig Sports Health 2012
Olsen AJSM 2006

Pathophysiology

- *The anterior bundle is the primary restraint to valgus stress*
- *Repetitive stresses can cause micro-attenuation or frank rupture*

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Pathophysiology

- *Stress of Throwing:*
  - Late cocking phase-early acceleration phase - forces may exceed tensile strength of MCL
  - 3000 deg/second from flex to ext

Conway JE, Jobe FW *JBJS Am* 1992;74:67-83.

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History:

- *Acute*
  - Often with "pop"
  - Immediate pain and swelling
  - Loss of velocity and control
  - Pain in late cocking / early acceleration of throwing
- *Chronic / Attritional*
  - Vague onset
  - Medial pain in late cocking / early acceleration
  - Difficulty warming up
  - Decreased velocity and control – gradual
  - Thought due to micro-trauma over time

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Medial sided elbow pain

- *Differential diagnosis:*
  - MCL injury
  - Medial epicondylitis
  - Ulnar neuritis
  - Postero-medial impingement
  - Stress injury (youth)
    - Medial epicondyle
    - Olecranon

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Physical examination

- *Swelling (acute)*
- *Diminished ROM*
  - Lost extension common
- *Tender over MCL*
- *Evaluate for ulnar n. subluxation or Tinel's*
- *Flexor / Pronator strain - Medial epicondylitis*
- *Posteromedial impingement*

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Medial Provocative Testing

- *Medial UCL injury*
  - Pathologic laxity is often 2-3 mm, hard to feel
  - Provocative tests: stress ligament to assess for pain.
    - Milking maneuver

Video B. Wolf personal file

Image: Dugas, Andrews, *The Athlete's Elbow, 2001*

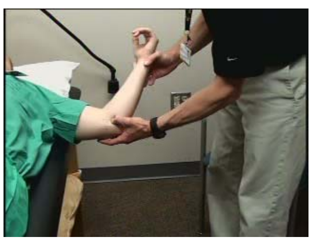
Medial Provocative Testing

- *Valgus stress test (sitting)*
  - Forearm pronation
  - Stabilize arm

Video B. Wolf personal file

Medial Provocative Testing

- *Moving valgus stress test*
  - Supine to stabilize shoulder
  - Arm in ABER position ("slot")
  - Vary Flexion
  - Resistance of throwing motion
  - Pain over UCL



Video B. Wolf personal file

Bruce JR J Am Acad Ortho Surg 2014
O'Driscoll SW AJSM 2005

Posteromedial impingement

- *Valgus Extension Overload*
  - Often with more chronic MCL issues
- *Valgus - extension*
  - Medial olecranon and olecranon fossa pain

Video B. Wolf personal file

Must evaluate ulnar nerve

- ~40% MCL injuries have associated ulnar n. issues / symptoms
  - Ulnar neuritis – from injury
  - Subluxating or perched ulnar n.
  - Tinel's
  - Subluxation demonstrated in supine ABER / valgus position

Video B. Wolf personal file

Imaging

- **Plain films (AP and Lat):**
  - Traction osteophyte or avulsion of sublime tubercle
  - Calcification of ligament
  - Loose bodies – olecranon fossa area – posteromedial
  - Spurring medial olecranon
  - Capitellum: OCD lesions
  - Physes – closed appropriately

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Plain films

Sublime tubercle avulsion , traction injury and overgrowth

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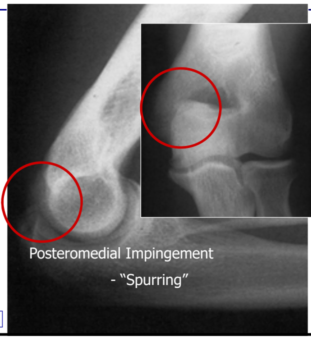
Posteromedial impingement

- *Posterior elbow bony or soft tissue impingement*
  - Windshield wiper effect of valgus force on elbow
  - Synovitis
  - Spurring / bony overgrowth
  - Can be associated with MCL insufficiency



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Advanced imaging

- *Stress radiographs of elbow*

Images: Bruce et al, JAAOS '14
Harada M, et al JSES '14

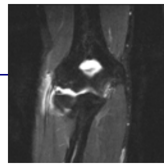
- *Ultrasound of MCL*
  - Dynamic laxity

Image: starkmandown.wordpress.com

Ultrasound

- *The UCL is thicker in the throwing elbow*
  - 6.15 mm vs. 4.82 mm
- *On average .8 mm laxity over non-dominant arm*
  - 4.56 mm vs. 3.72 mm
  - Ciccotti AJSM '14
- *Ultrasound can assess stability dynamically*
- *Can be very helpful augment to MRI info*
  - Partial tear situation
  - s/p UCL surgery

MRI



- *Some debate on use of intra-articular contrast with MRI*
  - Pros:
    - Better visualization of partial tears
    - "T" sign at sublime tubercle
    - May pick up cartilage injury better
  - Cons
    - Less ability to see bony edema patterns
    - More invasive
    - Often takes longer to schedule

MCL Injury classification

- *Grade 1: partial injury, fluid along ligament, edema within ligament, no significant fiber tearing*
- *Grade 2: partial injury, some fiber tearing, thinning of ligament, no complete disruption*
  - 2A: Acute partial
  - 2B: Chronic partial – may be healed
  - Wide range of % of fibers torn - high grade versus low grade partial injury
- *Grade 3: complete tearing across ligament fibers*

MRI:

Low GR Partial Tear

High Grade Tear

Complete Tear

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Treatment options:

- *Stop playing sport*
- *Play with pain*
- *Rest, bracing, Rehabilitation*
- *Platelet Rich Plasma*
- *Repair*
- *Reconstruction*

Image B. Wolf personal file

Rest and Rehabilitation

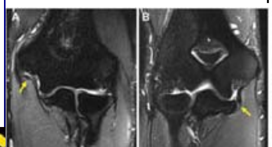
- *Probably more success in setting of partial tear*
- *+/- bracing*
- *Can strengthen and balance the rest of the body while resting the arm*
- *Possible to return to play when pain free*
- *Usually takes 4-8 weeks minimum to gauge whether this is going to work*
- *Rettig - 42% return to play in 31 throwing athletes*
  - Included both partial and complete tears
- *Probably > than 40% in younger patients with partial tears*

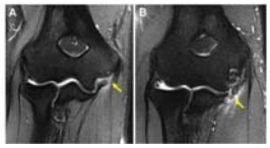
Non-operative treatment

- *Noonan et al AJSM '16*
  - 43 elbows Pro bball
  - 8 complete tears → surgery
  - 35 partial
    - 4 grade I – fibers intact
    - 8 IIA -partial tears
    - 23 IIB- chronic healed partial tears
- *26/31 players (84%) success with non-operative treatment - returned to the same level of play*
  - 9/10 position players
  - 17/18 pitchers
- *7/7 that had surgery returned to same level*
  - 3 failed rehab→ surgery
  - 3 started rehab, had MRI→ surgery
  - 1 early surgery w/o rehab

Tear Location is Important

- *Schickendantz et al AJSM 2017*
  - 32 pro pitchers treated non-operatively
  - 11/32 failed
    - 9/11 had distal tears
  - 17/21 successful non-op had proximal tears





Plasma Rich Plasma

- *May improve likelihood of non-operative treatment to work in partial tears*
- *One or two injections done under U/S around and into MCL – near injury site*
- *30 / 34 return to play - 88%*
  - Podesta et al AJSM '13
- *32/44 (73%) good/excellent and return to play 23% failed*
  - Dines et al AJO '16
- *Rehabilitation program (Podesta, Yokum - AJSM '13)*
  - Gentle ROM of elbow weeks 0-2
  - Initiate strengthening around 3 weeks
  - Initiate some valgus stretch and loading at 5-6 weeks
  - Increased strength work and interval throwing program at 8-10 weeks
  - Return to play at 12-14 weeks

Indications for Surgery

- *Failure of non-operative treatment*
- *Desire to return to high level throwing*
- *Symptomatic Full thickness or partial UCL tear in throwing sport*
  - Repair
  - Reconstruction

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What about non-throwers?

- *Football QB – non op works well*
  - Dodson et al
- *Non-throwing athlete*
  - Non-operative treatment is preferred
  - Sports with high elbow stress and consider surgery:
    - Wrestling
    - Football – Off Lineman
    - Golf
    - Softball – less common than baseball
    - Gymnastics – repetitive valgus stress

Positioning

- *Supine :*
  - Hand table
  - Use arm positioner if also doing arthroscopy

Image B. Wolf personal file

Positioning

- *Prone – my preference*
  - F. Savoie
  - Support for humerus
  - Common position for elbow arthroscopy
  - Internally rotate shoulder for MCLR
  - Padded Mayo stand
  - Keeps elbow in varus
  - Visualization

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Primary repair

- *Previously disregarded*
- *Option for avulsion injury*
- *Less than 20-25 yo*
- *Suture anchor repair*
  - Sublime tubercle
  - Medial epicondyle
- *Good option for non-thrower w/ avulsion that fails non-operative*

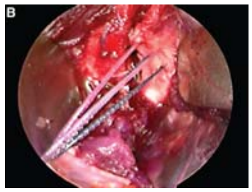


Image from Savoie AJSM '08

Primary repair

- *Savoie AJSM '08*
  - 60 primary repairs
    - Suture anchors
    - Prox or distal avulsions
    - All 15-20 yo
    - 134 reconstructions during same time frame
- *93% good to excellent*
- *58/60 return to sport by 6 months*
- *85% were overhead throwers or overhead sports athletes*

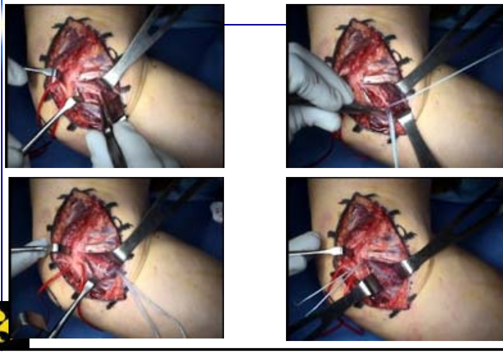
Image B. Wolf personal file

Primary repair "+"

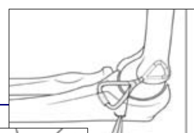
Image: Cain, Mathis AJO 2016

- *Dugas et al*
  - Unpublished
  - 40 elbows @ 1 year
  - ave age 17.7
    - 30 baseball
    - 23/30 pitchers
  - Mostly avulsive tears
    - 19 prox
    - 17 distal
    - 4 mid substance
- *Primary repair with "internal brace"*
  - Suture anchor repair
  - Augment with suture tape
- *39/40 able to return to same level of play*
  - Ave 5.6 mos
- *KJOC 93/100*

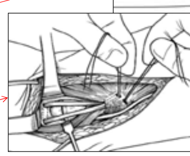
UCL Repair



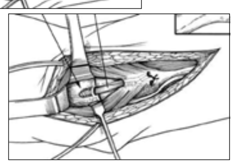
MCL Reconstruction



- *Modified Jobe Technique*
  - ASMI technique
- *Docking Technique*



- *Interference screws techniques*
  - Dane TJ



- *Suspensory buttons*

Images: Bruce et al JAAOS '14

Reconstruction- Graft options

- *Palmaris autograft*
  - Ipsilateral / contralateral
  - Can be doubled
- *Gracilis*
- *Allograft*

Images B. Wolf personal file

Graft options

- *Majority of literature - autograft recon.*
- *Allograft*
- *Savoie, Morgan et al, JBJS '13*
  - Large series with allograft gracilis or Semitendinosis


Medial Ulnar Collateral Ligament Reconstruction Using Hamstring Allograft in Overhead Throwing Athletes

- *116 throwers*
  - 93% good/excellent
  - 88% return to throwing at same or higher level


Image: MTFsports

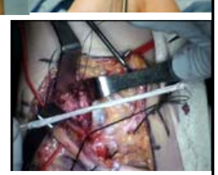
Graft options

- *Previous trend towards larger grafts*
  - No biomechanical advantage known with larger grafts w/ docking technique
    - Semi T
    - Palmaris
    - Gracilis
    - Prud'homme et al AJSM '08


Image B. Wolf personal file
Palmaris graft

Graft harvest


- *My preference is palmaris*
- *0 Fiberwire / Krackow stitch*
  - 0 Fiberloop
  - Doubled if small (<3.2mm)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Diagnostic arthroscopy

- *Based on MRI/exam*
  - Loose bodies
  - Posteromedial impingement
- *Start anterolateral*
  - View medial
  - Stress test
- *Posterior*
  - Posterolateral and trans-triceps portals

Valgus stress test

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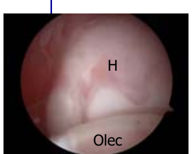
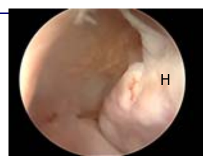
Posteromedial overload





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Approach

- *10 cm over medial epicondyle*
  - 6 cm distal
  - 4 cm proximal
- *Spare medial antebrachial cutaneous nerve if possible*
  - Sits on antebrachial fascia

Images B. Wolf personal file

Ulnar nerve options

- *Leave alone*
  - Stable in groove
  - No pre-op symptoms
- *Transpose*
  - Subluxating / perched nerve
    - Will get irritated with surg.
  - + Symptoms with throwing / injury
  - ++ Tinel's

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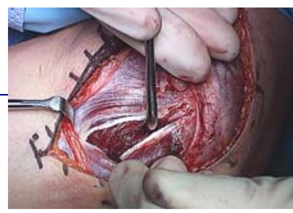
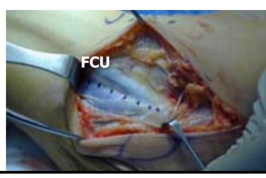
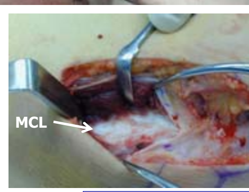
Docking technique



- *Muscle split through FCU raphe*
  - Small elevators
- *Blunt retractors*





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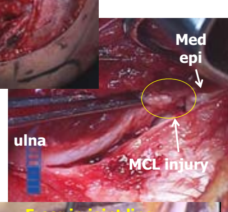
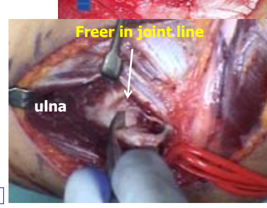
Exposure

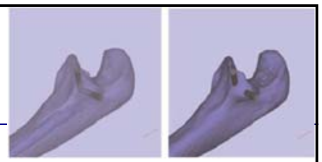




- *Longitudinal split in native MCL*
  - Assess native MCL damage
  - Identify joint line
    - Important for determining position of ulnar tunnels

Images B. Wolf personal file

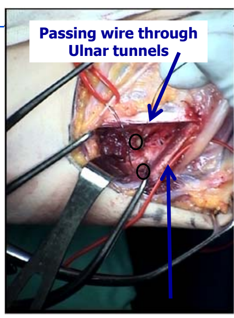
Docking Technique



Images: Byram AJSM '13
Vido: B. Wolf personal file

- *Ulnar tunnels*
  - 8-10mm bone bridge
  - Size 3 ball burr
  - 3.2-3.5mm Drill
    - Converging guides available
  - Small curettes to connect holes
  - Passing wire or kits

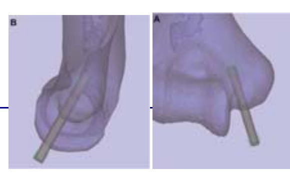
Ulnar tunnels



Joint line

Image and Video B. Wolf personal file

Humeral Tunnels



Images and video: Rohrbough et al & B. Wolf personal file

- *Anterior/central portion of medial epicondyle footprint*
  - Size 4 ball burr
  - 4.5 -5.5 mm drill
  - 15-20 mm depth
- *Tunnel Angle: 30° posterior and 15° lateral*
- *Superior Suture exit tunnels*
  - Dental burr
  - 1.8mm drill

Humeral graft passage

- *Graft passing:*
  - 28g Luque wire
  - Commercial Passing kits


Images: Byram AJSM '13 Video: B. Wolf personal file

Docking

- *Measure 2^{nd} limb*
  - 0-fiberwire w/ Krackow stitch or looped stitch
  - 10-15mm of each limb into tunnel
- *Repair native MCL split deep to reconstruction*
  - Side to side
  - Repair avulsions

Image and Video: B. Wolf personal file

Complete Docking


Images and Video: B. Wolf personal file

Ulnar Nerve

- *Finish transposition*
  - “subfascial”
  - Loose Sling from strip of medial IM septum
  - Fascia of flexor / pronator wad / extra graft

Images: B. Wolf personal file

Postoperative management

- *Brace weeks 0-6*
  - Initially locked @ 45-90°
  - Increase extension 15 degrees / week
  - Goal full ROM at 6 wks
- *Light strengthening @ 6th wk & d/c brace*
  - Begin shoulder rehab at week 6

Image: B. Wolf personal file

Postoperative management

- *Vigorous strength training begun at 12 weeks (elbow and shoulder)*
- *Throwing (tossing) program begun at 3 ½ - 4 mos… maybe longer*
- *Competition at 9-14 months…..*

Images: B. Wolf personal file

Outcomes

- *Cain, Andrews AJSM 2010*
  - 84% return to play in 1281 athletes
- *Dodson, Altchek - AJSM 2006*
  - 90% return to play at same or higher level
- *Jones, Altchek - AJSM 2014*
  - 93% excellent outcomes using KJ score in ages 15-18
- *Saper, Andrews – OJSM '18*
  - 90% RTSP ave age 18 yo.

- *Watson AJSM '14*
- *Systematic review*
- *1386 patients*
  - 79% return to play
  - 18.6% complication rate
    - 13% ulnar neuropathy
    - 4% Docking
    - 19% Modified Jobe
    - 10% IF screw fixation

Thank you

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UI Sports Medicine
University of Iowa Health Care

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Image: B. Wolf personal file