HIGH-YIELD SHOULDER & ELBOW TOPICS

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CBJD
THE CENTER FOR BONE & JOINT DISEASE

1. Rotator Cuff Tears

- Epidemiology
  - age >60: 28% have full-thickness tear
  - age >70: 65% have full-thickness tear
  - Risk factors: age, smoking, hypercholesterolemia, family history
  - Acute SIT tears: > 40 with shoulder dislocation
  - late cocking/early acceleration>internal impingement>PASTA
- MRI
  - sagittal images: muscle atrophy
  - medial biceps subluxation: subscap tear
  - tangent sign: line between spine and coracoid: SS grade III atrophy
  - 55% of asymptomatic pt 60+ will have RCT on MRI

- Rotator cuff repair
  - acute or chronic full-thickness tears
  - bursal-sided tears >3 mm (>25%) in depth
  - partial articular-side tears>50%.
  - PASTA with >7mm of exposed bony footprint between the articular surface and intact tendon represents significant (>50%) cuff tear
  - rate-limiting step for recovery is biologic healing of RTC tendon to greater tuberosity: 8-12 weeks
  - WC: higher postop disability and lower satisfaction

Table 3. Goutallier (A) and Fuchs (B) classification of fatty degeneration of the RTC muscles.

A. Classification for fatty degeneration of RTC muscles on CT scan. Grading (Goutallier *et al.*)[23]	
Grade 0	No fatty streaks
Grade 1	Some fatty streaks
Grade 2	More muscle than fat
Grade 3	As much muscle as fat
Grade 4	Less muscle than fat
B. Classification for fatty degeneration of RTC muscles on CT scan and MRI. Grading (Fuchs *et al.*)[24]	
No or some fatty streaks	Normal muscle
More muscle than fat	Moderate degeneration
As much muscle as fat or less muscle than fat	Advanced degeneration

Overview of Physical Exam of Rotator Cuff	
Cuff Muscle	Special Tests
Supraspinatus	o Drop arm test o Pain with Jobe test
Infraspinatus	o ER lag sign
Teres minor	o Hornblowers
Subscapularis	o Excessive passive ER o Belly press o Lift off o IR lag sign

https://www.orthobullets.com/shoulder-and-elbow/3043/rotator-cuff-tears

https://www.pagepress.org/journals/index.php/rr/article/view/rr.2010.e1/1907

Rotator Cuff Tears

- Tendon Transfers
  - Pectoralis (subscap)
    - under the conjoined tendon
  - Latissimus Dorsi (post/sup RC)
    - Thoracodorsal N. (C6-C8)
    - young laborer
    - brace in 45° abd and 30° ext rotation
    - radial nerve at risk (3cm medial to tendon insertion on humerus)
  - Lower Trapezius (post/sup RC)
    - Spinal Accessory N. (CN XI)
    - requires Achilles tendon allograft for increased excursion
- Complications
  - Repair Failure
    - failure of cuff tendon healing and suture pullout from tissue
  - Risk Factors
    - age >65
    - large tear >5cm
    - muscle atrophy
    - DM, tobacco
    - tear retraction medial to glenoid
  - Infection (<1%)
    - P. acnes (delayed or indolent cases)
  - Pneumothorax
    - due to regional anesthesia
    - smokers/COPD due to hyperinflated lungs

2. Traumatic Anterior Shoulder Instability (TUBS)

- Traumatic Unilateral Dislocations with a Bankart Lesion Requiring Surgery
  - recurrence rate corelates with age at dislocation (90% recurrence if <20)
  - Hill-Sachs defect is "on track" and will NOT "engage" if width of HS defect < glenoid articular track width
- Associated Injuries
  - HAGL
    - in patients slightly older than Bankart
    - associated with high recurrence rate if missed and not repaired
    - indication for open repair
  - Bony Bankart
    - "critical bone loss" 13.5-25%
    - require bony procedure to restore stability
- Axillary Nerve
  - Transient Neuropraxia (5%)
- Rotator Cuff Tears
  - 80% of TUBS patients > 60
- Anterior static shoulder stability
  - Anterior band of IGHL: (main restraint) arm in 90° of abd and ext rot
  - MGHL: 45° of abduction and external rotation
  - SGHL: static restraint with arm at the side

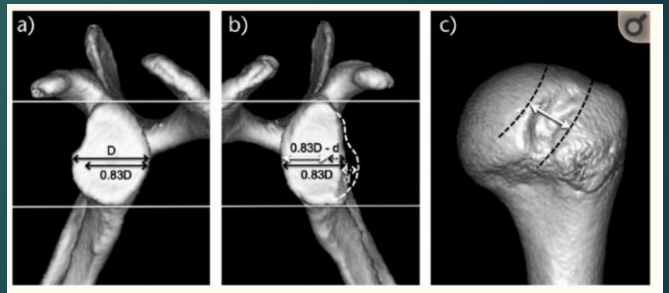


Fig. 18

Drawing of the glenoid track: a) on the 'en face' view of the intact glenoid, 83% of the glenoid width is obtained (0.83D); b) on the involved side, there is a defect (d; white dotted double-headed arrow). The width of the glenoid track is obtained by subtracting 'd' (black dotted double-headed arrow) from 83% value (0.83D - d; white double-headed arrow); c) this glenoid track width (0.83D - d) is applied to the posterior view of the humeral head. In this case, the HSL stays in the glenoid track, making this lesion an 'on-track' HSL.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5590004/

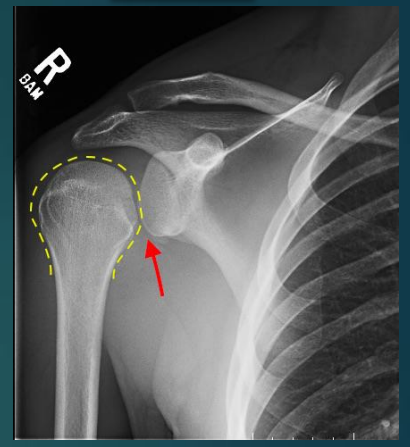
Traumatic Anterior Shoulder Instability (TUBS)

- Surgical Management
  - Arthroscopic Bankart +/- capsular shift
    - relative indications
      - first time dislocation with bankart lesion in athlete younger than 25
      - > one dislocation after non-op treatment
      - <20% glenoid bone loss
  - Latarjet
    - > 20-25% bone loss ("inverted pear")
    - increase glenoid track, sling effect, CA lig capsule recon
  - Remplissage
    - "off track" engaging Hill-Sachs defect >25-40%
    - post capsule and infraspinatus sutured into the Hill-Sachs lesion
- Putti-Platt & Magnuson-Stack (historic)
  - loss of external rotation>posterior glenoid loading>post capsulorrhaphy arthropathy
- Complications
  - recurrence
    - unrecognized bone loss
    - less than 3 anchors
    - <20, lig laxity, contact sports, male
    - seizure disorder
  - Nerve Injury
    - Axillary and Musculocutaneous

3. Posterior Shoulder Instability & Dislocation

- Mechanism
  - Trauma
  - Microtrauma
    - lineman, weightlifters, overhead athletes
    - flexed, adducted, internally rotated arm position
  - Seizure and electric shock
- Anatomy
  - posterior band of IGHL (restraint in internal rotation)
  - subscapularis (dynamic restraint in external rotation)
  - SGHL & Coracohumeral ligament
    - primary static stabilizer to post translation with arm in flexion, adduction, and internal rotation

- Provocative Tests
  - Jerk Test
    - arm in 90° abd, int rot, elbow bent, apply axial force and add arm to forward flexed position
    - "clunk" positive for post subluxation
    - 97% sensitive for post labral tear when combined with Kim Test
  - Kim Test
    - pt. seated, arm at 90° abd, flex shoulder to 45° forward flexion while applying axial load on the elbow and post-inf force on upper humerus (pain=positive test)
- Imaging
  - AP (lightbulb sign)
  - Axillary
  - Velpeau



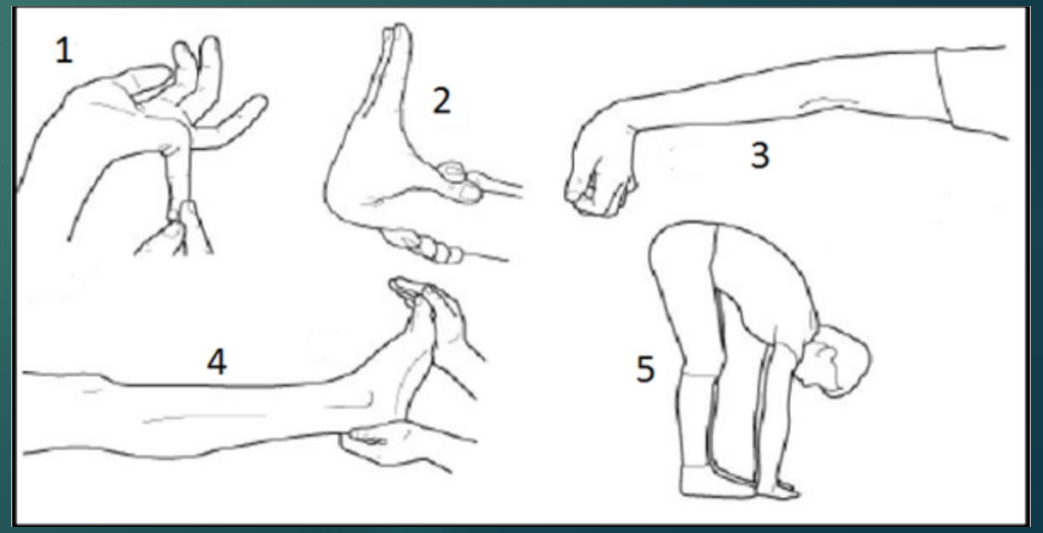
https://jetem.org/posterior-shoulder-dislocation/

https://www.orthobullets.com/shoulder-and-elbow/3038/shoulder-imaging

Posterior Shoulder Instability & Dislocation

- Treatment
  - reduction and immobilization in external rotation for 4-6 wks
  - Posterior Labral Repair
    - in cases of recurrent instability despite PT course
    - Negative Beighton Score (0-3)
  - Posterior capsular shift and rotator interval closure
    - Positive Beighton Score (4-9)
  - Open Reduction
    - <6 moths chronic dislocation
    - Reverse Hill Sachs <40%
      - McLaughlin (subscap transfer)
      - Modified McLaughlin (lesser tuberosity transfer)
- Hemiarthroplasty
  - chronic dislocation >6 months
  - >40% reverse Hill Sachs
- Complications
  - Stiffness
  - Recurrence
  - DJD

BEIGHTON SCORE



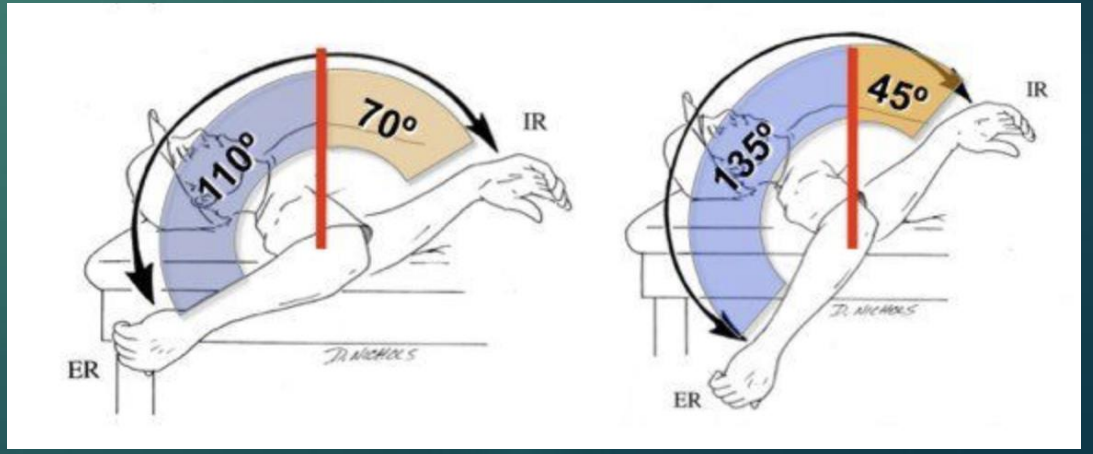
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5946643/

4. Multidirectional Shoulder Instability (MDI)

- Overview:
  - AMBRI: Atraumatic, multidirectional, bilateral, rehabilitation, inferior capsular shift
  - microtrauma or generalized ligamentous laxity (ED/Marfan)
  - Hallmark Findings of MDI
    - patulous inferior capsule on MRI (IGHL anterior and posterior bands)
- Physical Exam
  - instability in 2 or more planes to be defined as MDI
    - Sulcus Sign (> 2+)
    - apprehension/relocation test
    - ant/post load and shift (2+ or more)
    - +Neer and +Hawkins in pt. < 20
  - Breighton's criteria > 4/9
- Treatment
  - Dynamic Stabilization PT
    - 3-6 month regimen
    - vast majority of patients
    - dynamic stabilizer strengthening/closed kinetic chain exercises
  - Operative
    - inferior capsular shift superiorly
    - plication of redundant capsule
    - rotator interval closure (results in decrease in ROM in ext rot with the arm at the side)
    - address labral pathology
- Complications
  - Recurrence

5. Glenohumeral Internal Rotation Deficit (GIRD)

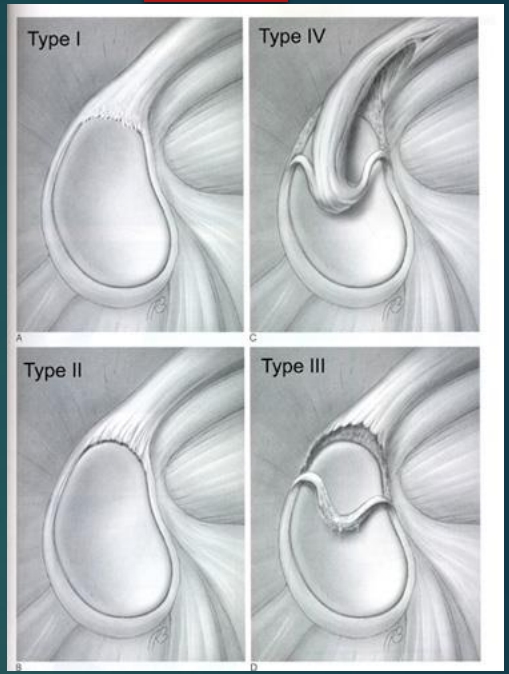
- Overview
  - overhead athletes (pitchers)
  - during late cocking/early acceleration phase
  - tightening of posterior capsule with anterosuperior HH translation in flexion, posteroinferior capsular tightness leads to posterosuperior translation of HH in ABER
  - associated with internal impingement: GT > postsup glenoid > posterosuperior RC
  - articular sided partial RC tears
  - SLAP lesions ("peel-back mechanism) during late cocking due to postsup HH translation and change in biceps vector force
- Presentation
  - Altered GH ROM
  - GIRD < external rotation gain (ERG)=normal kinematics
  - GIRD > (ERG)=deranged kinematics
- Treatment
  - rest from throwing + PT (sleeper stretch) x 6 months (90%)
  - Posterior capsular release



https://mikereinold.com/gird-glenohumeral-internal-rotation-deficit/

6. SLAP Lesion

- Overview
  - overhead athletes/GIRD/FOOSH
  - SLAP lesion > increased strain on anterior band of IGHL > instability
  - Biceps attachment to labrum is posterior to 12 o'clock position (50 lab/50 tub) Ia
  - Antero-superior labrum > poorest blood supply
  - Anatomic Variant > Buford complex
- Presentation: mechanical symptoms
- Exam: O'Brien's Test, Crank Test, Speed's
- Imaging
    - MRI arthrogram: T2 signal intensity between the superior labrum, lateral to glenoid rim, and posterior to the biceps> paralabral cyst
- Treatment
  - Nonop: rotator cuff strengthening, scapular dyskinesia, GERD
  - OP: controversial
    - Debridement
    - Repair vs Tenodesis/Tenotomy
      - Type II: traditionally repaired in overhead athletes
      - Tenotomy/Tenodesis >40
    - Decompress any cysts
    - Peel back test: 90 ext rot/abd
- Rehab
  - week 1-4: passive and active assisted flexion in the scapular plane (avoid biceps exercises, extremes of abduction and external rotation)
- Complications:
  - Stiffness, suprascapular nerve injury, SLAP repair failure (>36)



https://www.orthobullets.com/shoulder-and-elbow/3053/slap-lesion

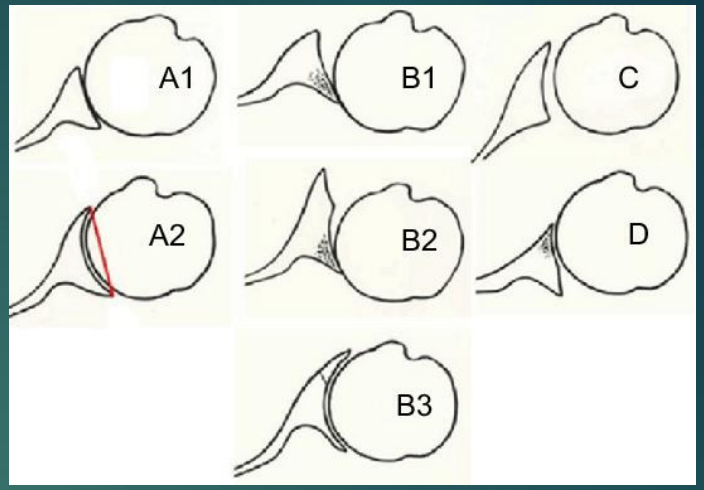
7. Adhesive Capsulitis

- Overview
  - 40-60, females, DM, tyroid
  - Fibroblastic proliferation > TYPE III collagen > essential lesion (coracohumeral ligament and rotator interval)
  - external rotation deficit (most common finding)
  - loss of axillary recess on MRI
- Treatment
  - PT/HEP (GENTLE to point of pain stretching), cortisone, NSAIDS
  - MUE
  - Arthroscopy (>3 months conservative)
    - capsular, rotator interval, subacromial
    - assess and document pre and post procedure ROM
- Arthroscopic Release
  - Rotator Interval Release
    - from area just anterior to biceps tendon to superior edge of subscapularis
  - Coracohumeral ligament release
  - Posterior capsular release > increase IR and cross body adduction
- Complications
  - Residual Stiffness
  - Axillary Nerve (inferior capsular release)
  - Brachial plexopathy, proximal humerus fractures, GH dislocation, rotator cuff tears (MUA)

8. Suprascapular Neuropathy

- Overview
  - C5-C6 superior trunk
  - Suprascapular Notch
    - supra and infraspinatus weakness
    - labral tear ganglion cyst
    - deep diffuse posterolateral shoulder pain, pain with palpation of the suprascapular notch, posterior scapula atrophy
    - MRI + EMG/NVC
    - PT trial if no structural lesion on MRI
    - Surgical nerve decompression at SS notch if MRI positive
  - Spinoglenoid notch
    - infraspinatus weakness ONLY
    - posterior labral tear CYST
    - spinoglenoid ligament
    - spinoglenoid notch ganglion
    - traction injury (volleyball players)
    - normal supraspinatus strength with infraspinatus atrophy
    - posterior shoulder capsule stretching
    - arthroscopic cyst decompression and labral repair
    - spinoglenoid ligament release

9. Total Shoulder Arthroplasty



- Contraindications
  - insufficient glenoid bone stock
  - rotator cuff arthropathy
    - isolated supraspinatus tear without retraction is an acceptable condition to proceed with TSA
    - incidence of full thickness rotator cuff tears in patients getting a TSA is 5% to 10%
  - deltoid dysfunction
  - irreparable rotator cuff
    - "rocking horse" phenomenon
  - active infection
  - brachial plexus palsy
- Glenoid
  - Walch Classification: A1, A2, B1, B2, B3, C, D
  - Peg design superior to keel
  - Retroversion: partial correction or augmented glenoid component
- Humeral component
  - Press Fit or Cemented
  - 25-45 degrees of retroversion
  - Avoid overstuffing
    - top of the humeral head should be 5 to 8 mm superior to the top of the greater tuberosity

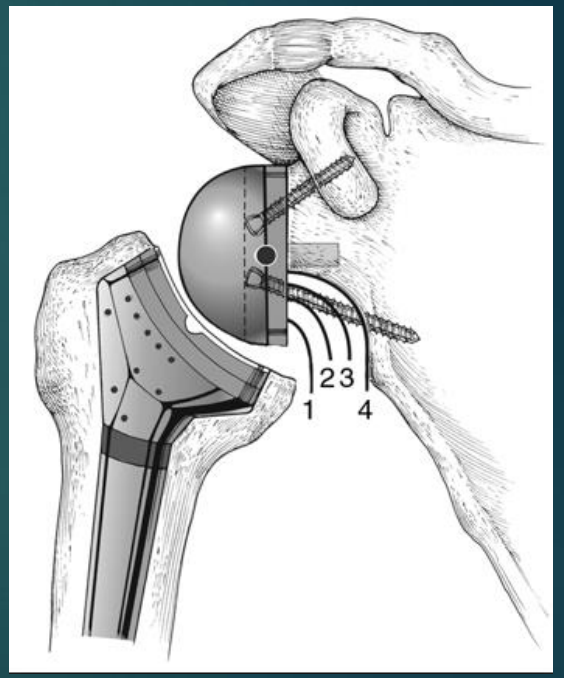
https://www.researchgate.net/figure/Modified-Walch-classification-Notes-A1Centered-humeral-head-with-minor-erosion-A2_fig2_323361294

Total Shoulder Arthroplasty

- Complications
  - Glenoid component loosening
    - most common cause of TSA failure
    - insufficient glenoid bone stock
    - rotator cuff deficiency
  - Subscpularis Failure
    - anterior instability
  - Infection
    - P. acnes
      - most common cause of indolent infections and implant failures
      - 1-2% after primary TSA
      - anaerobic culture bottles, keep for 10-14days (mean time to detection 6 days)
- Neurologic injury
  - axillary nerve is most commonly injured
  - musculocutaneous nerve can be injured by retractor placement under conjoint tendon
- Rehabilitation
  - Limit passive external rotation and pushing out of chair due to risk of tear and pull-off of subscapularis
    - treatment of subscapularis pull-off is early exploration and repair of tendon
- Outcomes
  - good survival at 10 years (93%)

10. Reverse Shoulder Arthroplasty

- Contraindications
  - Axillary nerve palsy/deltoid deficiency
- Biomechanics
  - Increase in deltoid moment arm
    - Distalization and medialization of center of rotation
  - Loss of external rotation
    - latissimus, teres major, or lower trapezius transfer
- Complications
  - Dislocation
    - 2-3.4%
    - proximal humeral bone loss
    - deltoid disfunction, loss of deltoid wrapping
  - irreparable subscapularis
  - fixed glenohumeral dislocation preop
  - failed prior arthroplasty
  - proximal humeral nonunion
- Scapular notching
  - Grammont design, superiorly placed glenoid component, insufficient inferior tilt
  - Sirveaux Classification of Scapular Notching
    - Grade 1: Scapular Pillar
    - Grade 2: Inferior Screw
    - Grade 3: Beyond inferior screw
    - Grade 4: Central post



http://shoulderarthritis.blogspot.com/2017/04/scapular-notching-is-it-about-notch-or.html

11. Total Elbow Arthroplasty

- Indications
  - RA (Larsen 3-5)
    - longest survivorship
    - 90% at 15 years
  - Advanced primary OA
  - Fracture (>70, unreconstructible)
- Contraindications
  - Charcot, infection
  - Olecranon osteotomy (relative)
  - Patient younger than 65 (relative)
- Design
  - Semiconstrained or Linked components
    - Cooonrad-Moorey
    - "sloppy hinge", anterior flange
    - best results of all designs
    - 5-10 lbs lifelong lifting limitation
- Complications
  - Infection (8%)
    - staph epi (encapsulating)
  - Aseptic Loosening (6%)
  - Bushing Wear
  - Ulnar Neuropathy
  - Triceps Insufficiency

Table 1

Larsen Grading System for Rheumatoid Arthritis

Stage	Description
1	Involves the soft tissues and has near-normal radiographs
2	Presents with periarticular erosions and mild cartilage loss; there may be evidence of soft-tissue swelling and osteopenia on radiographs.
3	Radiographs show marked joint space narrowing.
4	Progresses to advanced erosions penetrating the subchondral bone plate
5	Radiographs show advanced joint damage and loss of articular contour.

Data from Trail IA: Arthroplasty in synovial-based arthritis of the elbow, in Williams GR Jr, Yamaguchi K, Ramsey ML, Galatz LM, eds: *Shoulder and Elbow Arthroplasty*. Philadelphia, PA, Lippincott Williams & Wilkins, 2005, pp 381-339.

https://www.orthobullets.com/shoulder-and-elbow/3084/elbow-arthritis

12. Medial UCL Injury (Valgus Instability)

- Overview
  - Elbow dislocation
  - Repetitive valgus stress during late cocking and early acceleration > microtrauma to anterior band of UCL > rupture
- Anatomy
  - Anterior oblique: main valgus stabilizer, medial epicondyle to sublime tubercle, isometric
  - Posterior oblique: tighter in flexion, not isometric
- PE
  - Milking Maneuver
  - Moving Valgus Stress Test (70-120°)
    - 100% sensitive, 75% specific
- Imaging
  - MR-arthrogram ("T-sign")
- Treatment
  - PT (1st line treatment)
    - 6 week throwing holiday
    - Flexor pronator strengthening
    - Improvement of throwing mechanics
  - Operative
    - MCL anterior band ligament recon
    - multiple techniques (palmaris, gracilis, or allograft)
- Complications
  - Ulnar Nerve, MABC, fracture, stiffness

13. Distal Biceps Avulsion

- Overview
  - men, 40, dominant arm, eccentric load
  - anabolics, tobacco, mechanical impingement (during pronosupination)
  - Long Head: supination, proximal insertion, apex of tuberosity
  - Short Head: flexion, distal insertion
  - Rupture: 50% supination, 30% flexion
  - MRI: elbow flexion, shoulder abduction, forearm supination
  - Olecranon osteotomy (relative)
  - Patient younger than 65 (relative)
  - Partial Tears: radial fibers on tuberosity
- Operative Treatment
  - Single Incision: LABCN, PIN, superficial Radial Nerve (3-6months)
  - Double Incision: HO, synostosis
- Fixation Options
  - Native biceps force to rupture = 200N
  - suture button (400N) > suture anchor (380N) > bone tunnel (310N) > interference screw (230N)
  - combination technique (suture button + interference screw) stronger than single technique
- Delayed repair
  - Repair in hyperflexion
  - Achilles allograft

- Nicholson, Gregory P. *Orthopaedic Knowledge Update:* Shoulder and Elbow 4. American Academy of Orthopaedic Surgeons, 2013.
- Miller, Mark D., and Stephen R. Thompson. *Miller's Review of Orthopaedics*. Elsevier, 2016.
- Shoulder & Elbow High-Yield Topics." *Orthobullets*, www.orthobullets.com/topic/dashboard?id=3&specialty=3&expandLeftMenu=true