

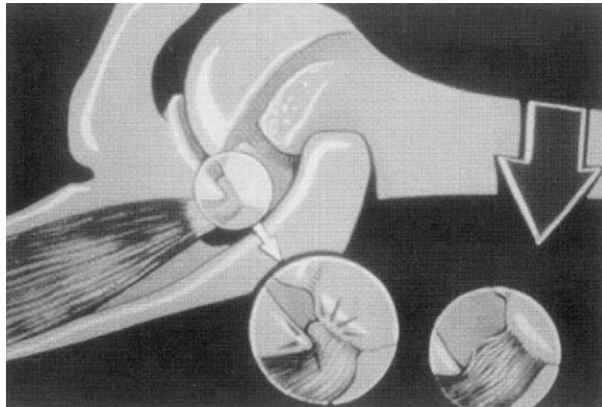
Superior Labral Anterior to Posterior (SLAP) Lesion

서울대학교 의과대학

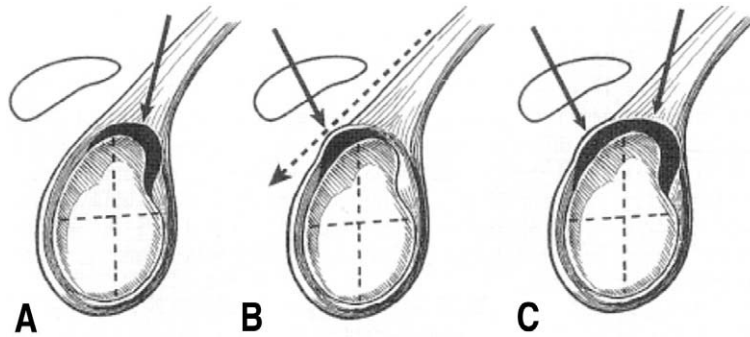
오 주 한

I. History: understandings of throwing injury

1. Psychological base (Rowe, 1973)
2. External impingement (Neer, 1972): poor result of acromioplasty in throwing athletes (Kennedy, 1978; Tibone, 1985)
3. Superior labral lesion associated with the long head of biceps (Andrews, 1985): Arthroscopic findings, repetitive tension overload
4. SLAP lesion and classification (Snyder, 1990)
5. Repetitive throwing causes anterosuperior instability and results in external impingement (Jobe, 1989)
6. Internal impingement (Walch, 1992): contact of articular side rotator cuff and posterosuperior glenoid labrum at AbER position



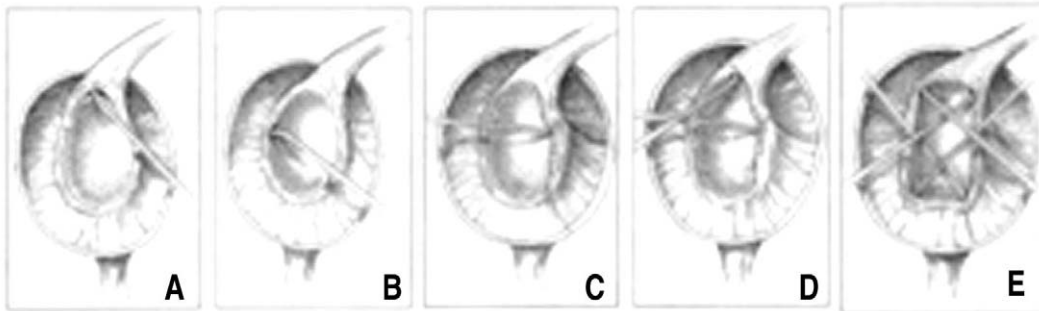
7. Anterior microinstability aggravated internal impingement (Jobe, 1996)
8. Three subtypes of type II SLAP lesion (Morgan, 1998): posterior & combined type are frequently seen in overhead athletes



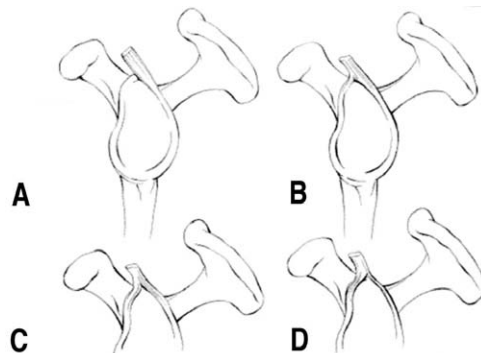
9. Glenohumeral internal rotation deficit (GIRD): tight inferior-posterior capsule in thrower, shoulder at risk, if GIRD >25 degrees (2003, Burkhart)

II. Anatomy and biomechanics

1. fibrocartilaginous ring
2. deepen the socket and attachment site for glenohumeral ligaments & biceps
3. increase surface area
4. normal glenoid labrum type



5. Types of biceps labral attachment (Vangsness, 1994)



6. Vascular supply

- 1) suprascapular, posterior humeral circumflex, and circumflex scapular a.
- 2) via capsular and periosteal vessel, not from underline bone
- 3) greater peripherally than centrally
- 4) anterior, anterosuperior and superior portion: decreased vascularity
- 5) fewest collateral vessels decreasing with age: limited ability for unrepaired SLAP lesion to heal (Prodromos, 1990)

7. inferior labrum: continuous with articular cartilage

8. normal variants

- 1) cord-like thickening rather than sheet-like structure (19%)
- 2) associated with sublabral hole (foramen) at 2 o' clock position: Buford complex (1,5%)
- 3) sublabral hole (12-73%)

9. Biomechanics of biceps tendon

- 1) humeral head depressor, especially in large to massive rotator cuff tear
- 2) secondary anterior restraint in AbER position
- 3) SLAP lesion (+): decrease this restraint and causes IGHL damage and subsequent anterior instability
- 4) But, EMG is inconclusive

III. Pathophysiology

1. Jobe' s theory (Jobe, 1996)

- 1) Normal internal impingement progressively worsens in cocking phase (AbER) of throwing athletes, and causes anterior microinstability.
- 2) Vicious cycle btw. internal impingement & microinstability
- 3) Anterior capsulolabral reconstruction (ACLR) by open surgery

2. Burkhart and Morgan (1998)

- 1) Main pathology in overhead athlete is torsional SLAP lesion
- 2) Acquired tight posteroinferior capsule and "peel-back" mechanism of the biceps labral anchor resulted in posterosuperior glenohumeral instability and "anteroinferior pseudolaxity"-drive-through sign
- 3) Treatment target: SLAP lesion & release tight posteroinferior capsule
- 4) Rotator cuff tear d/t posterosuperior microinstability and anteroinferior pseudolaxity
- 5) circle concept (Huber, 1997)

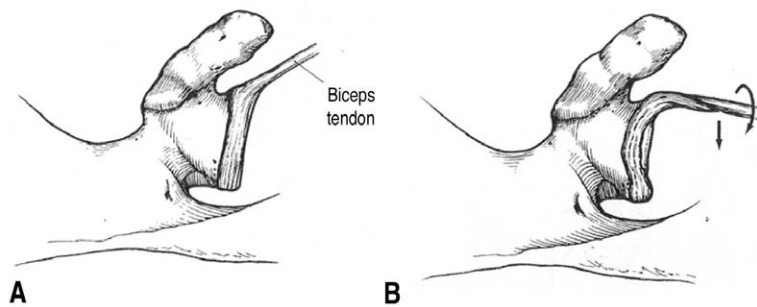
3. Burkhart (2003)

Glenohumeral internal rotation deficit (GIRD): tight inferior-posterior capsule in thrower, shoulder at risk, if GIRD >25 degrees

IV. Etiology & mechanism of injury

1. Overhead athlete

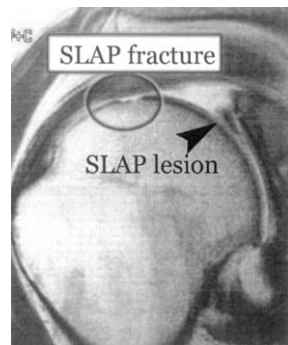
- 1) tensile overload during deceleration phase of throwing (Andrews, 1985)
- 2) peel-back sign on cocking phase: “weed-pull theory” (Conway J)-rapid, forceful repetitious back-and forth motion pulls the biceps tendon away from the glenoid rim
- 3) deceleration of throwing- \rightarrow inferior subluxation- \rightarrow traction on the long head of biceps tendon (Bey, 1998)



- 4) tight posteroinferior capsule enhance the peel-back sign: GIRD >40 in SLAP lesion
- 5)

2. Acute trauma: traction- or compression-related

- 1) Traction: sudden pull of arm (inferiorly, anteriorly, and superiorly)
- 2) Compression: fall on an outstretched hand with the arm in slight flexion & abduction or motor vehicle accident arm on the steering wheel with the elbows extended and force transmitted to the humerus
- 3) Direct blow
- 4) SLAP fracture: anterosuperior portion of humerus head



V. Clinical examinations

1. History: throwing habit, trauma, previous medical history

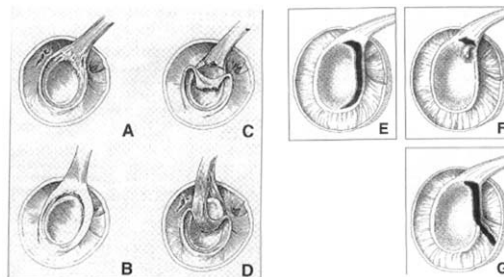
2. Symptom

- 1) posterior pain at late cocking phase-vague, inconsistent
- 2) mechanical symptom: catching, locking, popping, grinding-” dead arm”

3. Physical examination

- 1) Scapular examination: dyskinesia, winging,
- 2) AC joint: tenderness, cross body adduction test, active compression test
- 3) Biceps problem: tenderness, Speed’ s & Yergason’ s test
- 4) ROM: ER/IR at abduction 90o
- 5) Muscle power
- 6) Impingement-related examinations: Neer and Hawkins test et al
- 7) Labral lesion related examinations
 - O’ Brien test (=active compression test, flexion-adduction test)
 - Kiebler test (=anterior slide test)
 - Crank test
 - Biceps load test
 - Mimori tesst
 - Speed’ s test
 - Jobe relocation test
 - Compression-rotation test
 - Whipple test
- 8) Instability examinations
 - Lachman test (anterior/posterior draw test)
 - Sulcus sign
 - Apprehension test & relocation test

VI. Classification by Snyder



1. Type I

- 1) 11%
- 2) fraying with degeneration
- 3) intact anchor attachment

2. Type II

- 1) 41%
- 2) fraying of the edge with detachment of biceps anchor

3. Type III

- 1) 33%
- 2) bucket handle tear of meniscoid superior labrum
- 3) intact anchor attachment

4. Type IV

- 1) 15%
- 2) bucket handle tear extended into biceps tendon

5. Combined lesion

- 1) Maffet expanded the classification
- 2) Morgan subclassified into anterior, posterior and combined

VII. Radiologic and arthroscopic evaluation

1. Plain radiographs

- 1) AP: sclerosis at the base of GT: contact erosion with posterior glenoid rim
- 2) Stryker notch projection: Hill-Sachs lesion and thrower's exostosis at the posteroinferior glenoid
- 3) AC joint series for OA
- 4) supraspinatus outlet view for acromial shape and spur
- 5) axillary and West Point view: osseous Bankart lesion
- 6) not helpful for the diagnosis of internal impingement & SLAP lesion, except supraglenoid tubercle fracture on AP view

2. Ultrasound: useful for cuff, but not in labral pathology

3. CT arthrogram

4. MRI with/without enhancement

5. MR arthrogram: method of choice

- 1) distinguishing irregularity of the labral margin

- 2) extent of dye filling
- 3) combined partial cuff tear

6. Arthroscopic findings

- 1) absence of cartilage superior corner of glenoid
- 2) fraying, hemorrhage, granulation tissue, unusual deep cleft
- 3) revealing significant gap >5 mm
- 4) peel back sign

VIII. Nonsurgical treatment

A. Internal impingement

1. Enhance dynamic stabilization ability: prevent anterior translation at late cocking & early acceleration phase
2. Improve posterior flexibility
3. Avoid anterior & inferior stretching
4. Strengthening of ER/IR with scapular plane, scapular/deltoid strengthening

B. SLAP lesion

1. Type II SLAP lesions are not amenable to nonsurgical treatment
2. Restore ROM through stretching
3. Strengthening of ER/IR with scapular plane, scapular/deltoid strengthening
4. Avoid shoulder press, bench press, LD pull down

C. Considerations for surgical treatment

1. Surgeon should understand pathophysiology of throwing shoulder.
 - 1) “thrower’s shoulder paradox”: excessive ER with stable joint with capsular laxity: dynamic balance through muscle control
 - 2) laxity vs. pseudolaxity
 - 3) partial cuff tear with posterosuperior labral tear in occult instability
2. Open anterior capsuloligamentous reconstruction
3. Arthroscopic capsular placcation
4. Arthroscopic debridement with/without repair of SLAP lesion
5. Acromioplasty for throwing shoulder?

IX. Surgical treatment

1. Arthroscopic repair of SLAP lesion

- 1) debridement of glenoid rim down to bleeding bone
- 2) fixation at the articular margin
- 3) DDX. with superior sublabral recess
- 4) posterior lesion through lateral stab incision or lateral trans-cuff portal
- 5) suture anchor vs. absorbable tack

2. Thermal capsular shrinkage for the capsular laxity

3. Type I SLAP lesion

- 1) conservative debridement of frayed labrum
- 2) excise only the torn tissue with shaver
- 3) not violate anchor stability

4. Type II SLAP lesion

- 1) repair with suture anchors

5. Type III SLAP lesion

- 1) resection of unstable bucket handle labral fragment
- 2) not violate anchor stability

6. Type IV SLAP lesion

- 1) treat similarly with type III
- 2) > 30% of biceps tendon split: consider repair or tenodesis vs. excision
- 3) depends on the age and activity level

7. Surgical techniques

- 1) Transosseous repair
- 2) SureTac repair
- 3) Suture anchor repair: Single-anchor, double-suture technique by Snyder
- 4) Knotless suture anchor repair

X. Postoperative management

1. Sling for 3~6 weeks
2. First 6 weeks: regaining ROM
3. Second 6weeks: regaining strength and Proprioception
4. 3~4 months: interval throwing program
5. Average return time: 11,2 months

REFERENCES

1. **Rowe CR, Pierce DS, Clark DG:** Voluntary dislocation of the shoulder. *J Bone Joint Surg Am* 1973;55:445-460.
2. **Neer CS II:** Anterior acromioplasty for chronic impingement syndrome of the shoulder. *J Bone Joint Am* 1972;54:41-50.
3. **Tibone JE, Jobe FW, Kerlan RF, et al.:** Shoulder impingement syndrome in athletes treated by anterior acromioplasty. *Clin Orthop* 1985;188:134-140.
4. **Kennedy JC, Hawkins RJ, Krusoff WJ:** Orthopaedic manifestations of swimming. *Am J Sports Med* 1978;6:309-322.
5. **Andrews JR, Carson WG, McLoed WD:** Glenoid labrum tears related to the long head of the biceps. *Am J Sports Med* 1985;13:337-340.
6. **Snyder SJ, Karzel RP, Del Pizzo W, et al.:** SLAP lesions of the shoulder. *Arthroscopy* 1990;6:274-279.
7. **Jobe F, Kvitne R, Giangarra D:** Shoulder pain in the overhand or throwing athlete: The relationship of anterior instability and rotator cuff impingement. *Orthop Rev* 1989;18:963-975.
8. **Walch G, Boileau P, Noel E, et al.:** Impingement of the deep surface of the supraspinatus tendon on the posterosuperior glenoid rim: An arthroscopic study. *J Shoulder Elbow Surg* 1992;1:238-245.
9. **Jobe CM:** Superior glenoid impingement: Current concepts. *Clin Orthop* 1996;330:98-107.
10. **Morgan CD, Burkhart SS, Palmeri M, et al.:** Type II SLAP lesions: Three subtypes and their relationship to superior instability and rotator cuff tears. *Arthroscopy* 1998;14:553-565.
11. **Vangness CT, Jorgenson SS, Watson T, Johnson DL:** The origin of the long head of the biceps from the scapula and glenoid labrum: An anatomic study of 100 shoulders. *J Bone Joint Surg Br* 1994;76:951-954.
12. **Prodromos CC, Ferry JA, Schiller AL, Zarins B:** Histologic studies of the glenoid labrum from fetal life to old age. *J Bone Joint Surg Am* 1990;72:1344-1348.
13. **Flatow EL, Raimondo RA, Kelkar R, et al.:** Active and passive restraints against superior humeral translation: The contributions of the rotator cuff, the biceps tendon, and the coracoacromial arch. Presented at the annual meeting of the American Society of shoulder and Elbow Surgeons, 1996.
14. **Pagnani MJ, Deng XH, Warren RF, Torzilli PA, O'Brien SJ:** Role of the long head of the biceps brachii in glenohumeral stability: a biomechanical study in cadavera. *J Shoulder Elbow Surg* 1996;5:525-5262.
15. **Warner JJP, McMahon PJ:** The role of the long head of the biceps brachii in superior stability of the glenohumeral joint. *J Bone Joint Surg Am* 1995;77:336-372.
16. **Burkhart SS, Morgan CD:** The peel-back mechanism: It's role in producing and extending posterior type II SLAP lesions and its effect on SLAP repair rehabilitation. *Arthroscopy* 1998;14:637-640.
17. **Huber WP, Putz RV:** The periarticular fiber system (PAFS) of the shoulder joint. *Arthroscopy* 1997;13:680-691.
18. **Bey MJ, Elders GJ, Huston LJ, Kuhn JE, Blaiser RB, Soslowsky LJ:** The mechanism of creation of superior labrum, anterior, and posterior lesions in a dynamic biomechanical model of the shoulder: The role of inferior subluxation. *J Shoulder Elbow Surg* 1998;7:397-401.
19. **Wilk KE, Meister K, Andrews JR:** Current concepts in the rehabilitation of the overhead throwing athlete. *Am J Sports Med* 2002;30:136-151.
20. **Segmuller HE, Hayes MG, Saies AD:** Arthroscopic repair of glenolabral injuries with an absorbable fixation device. *J Shoulder Elbow Surg* 1997;6:383-392.
21. **Wright SA, Cofield RH:** Management of partial-thickness rotator cuff tears. *J Shoulder Elbow Surg* 1996;5:458-466.