관절와 상완 관절의 불안정증의 병태 생리와 분류
Pathophysiology and Classification of Glenohumeral Instability

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Factors maintaining the Shoulder Joint Stability

1. Static stability factors

1) Articular conformity
2) Articular version
3) Glenoid labrum
4) Negative intraarticular pressure
5) Adhesion-cohesion
6) Capsuloligamentous structures
7) Rotator cuff

2. Dynamic stability factors

1) Rotator cuff
2) Long head of biceps brachii
3) Scapular rotators
4) proprioception

Pathophysiology of Glenohumeral (GH) Instability

1. Articular version abnormality

1) Excessive glenoid retroversion
   : In most cases, eccentric articular surface wear
   : Infrequently, a variant of glenoid dysplasia
   : contributing factor to post. instability

2. Bankart lesion

1) Detatchment of the capsulolabral complex from the glenoid rim & scapular neck
2) Bankart variant: ALPSA (Anterior Labroligamentous Periosteal Sleeve Avulsion) lesion
3) First time patients c traumatic ant. shoulder dislocation: 97% isolated Bankart lesion without intracapsular injury (Tayler & Arciero, Am J Sports Med, 1997)
4) Recurrent complete dislocation requires an additional pathoanatomic components (capsular plastic deformation or stretch)

3. Hill-Sachs lesion

1) Ant. dislocation: 〉80%, Ant. subluxation: 25%
2) Atraumatic instability that did not respond to conservative therapy: 60% (Werner et al, Arthroscopy, 2004)
3) The small Hill-Sachs lesion : not major contributor to recurrent ant. instability
4) 〉30% Hill-Sachs lesion: Recurrent ant. instability, even with capsular repair (by Rowe et al)

4. Glenoid bony loss

1) Repetitive overhead activities may load GH joint asymmetrically & lead to posterior glenoid erosion (Gupta & Lee, JSES, 2005)
2) 78% chronic ant. GH instability patients: osseous lesion of glenoid (bony Bankart or wear related to repeated instability) (Edwards et al, Arthroscopy, 2003)
3) 〉 25% bony loss of glenoid surface: bony reconstruction (Bigliani et al, Am J Sports Med, 1998)
4) Bone loss to convert normal glenoid to 'Inverted pear configuration'
   : Particular risk for Redislocation after surgery
   : recommend a coracoid process transfer (Latarjet procedure) (Burkhart &DeBeer, Arthroscopy, 2000)
5) Overall aim of any reconstructive procedure directed at larger defects
   : to deepen the socket & support the capsule

5. Capsular injury

1) Intrasubstance injury
   : 55% of ant. dislocation → demonstrated capsular rupture by arthrography (by Reeves)
   : 15% of ant. dislocation → labral detatchment & ant. capsular rupture (Symeonides, JBJS (Br), 1972)
   : Experimental Stress-Strain data at failure of IGHLC (Bigliani et al, J Orthop Res, 1992)
   → before failure, significant plastic deformation occurred
   → may be acquired through submaximal trauma (single or repetitive) without causing rupture or detatchment

: When ant. shear force overcomes capsular tensile strength or rotator cuff cannot effectively contract
→ Ligament may fail on ultrastructural level
: Joint capsule of instability patient
→ the amount of stable & reducible cross-links (which is abundant in remodeling tissue) ↑
(Rodeo et al, Am J Sports Med, 1998)
→ Histologic changes,(denuded synovial layers, subsynovial edema, cellularity ↑, vascularity ↑)
(McFarland et al, Am J Sports Med, 2002)
: Age-related attrition of rotator cuff tissue is greater than in capsular tissue
→ such that ant. dislocation commonly results in rotator cuff tear, potentially leading to capsular injury in older patients

2) HAGL (Humeral Avulsion of the Glenohumeral Ligament) lesion
(by Wolf et al, Arthroscopy, 1995)
: Traumatic ant. instability who show no signs of Bankart lesion
: Thickened, rolled edge of capsular defect
: Typically found in the inf. pouch of the shoulder below the level of subscapularis muscle
: Associated GH abnormalities : most common form; Rotator cuff tear(〉 90%; subscapularis tear)
: Bony HAGL (BHAGL) lesion (Bach et al, JBJS (Br), 1988)
→ bony avulsion of humeral neck
: HAGL lesion should be repaired anatomically

3) Repetitive injury
: Overhead athletes (pitchers, throwers, swimmers, voleyball players, tennis players, etc)
→ relating to instability(repetitive stresses → lead to microtrauma)
: The cumulative effect of repetitive subfailure strain causes irreversible stretching of IGHL
→ shoulder instability (Pollock et al, JSES, 2000)
: Repetitive rotational motion of the GH joint may also contribute to instability

6. Capsular laxity

1) Intrinsic capsular laxity
: The degree of laxity varies among individuals
: It is unclear if constitutional laxity is a risk factor for clinical shoulder instability
: Asymptomatic shoulder can exhibit a range of rotational or translational motion comparable to that of symptomatic instability shoulder.
: Asymptomatic subluxation or even dislocation may occur in 'Normal shoulder' at the time of anesthesia

2) Inherited Disorders of Collagen
: relatively rare

: most associated collagen disorder: Ehlers-Danlos syndrome (EDS)
→ Laxity ↑, problem with wound healing, vascular anomalies

Classification of Glenohumeral (GH) Instability

1. Classification according to 5 factors

1) Direction (방향)
(1) Unidirectional: Anterior, Posterior, Inferior
(2) Bidirectional: Anteroinferior, Posteroinferior
(3) Multidirectional

2) Degree (정도)
(1) Dislocation (탈구)
(2) Subluxation (아탈구)

3) Mechnism (발생 기전)
(1) Traumatic (외상성)
(2) Atraumatic (비외상성)
(3) Acquired (repetitive microtrauma, 후천성)
(4) Congenital (선천성)
(5) Neuromuscular (근신경성): Erb' palsy, Cerebral palsy, Seizures

4) Frequency (빈도)
(1) Acute (급성)
(2) Chronic (만성) : Recurrent, Fixed
(3) Habitual

5) Voluntariness (수의 여부)
(1) Involuntary (불수의성)
(2) Voluntary (수의성)

2. Classification by Thomas & Matsen (JBJS (Am), 1989)

1) TUBS (Traumatic, Unidirectional, Bankart, Surgery)
: Patients with traumatic etiology
: usually have unidirectional instability
: often have obvious Bankart lesion
: frequently require surgery when the instability is recurrent

2) AMBRII (Atraumatic, Multidirectional, Bilateral, Rehabilitation, Inferior capsular shift, Interval closure)
: Patients with atraumatic etiology
: often have multidirectional laxity
: that is frequently bilateral
: and usually responds to a rehabilitation program
: However, should surgery be performed, the surgeon must pay particular attension to performing an inferior capsular shift & closing the rotator interval

3. Classification by Rockwood (Orthop Trans, 1979)

1) Type 1: Traumatic subluxation without previous dislocation
2) Type 2: Traumatic subluxation after a previous dislocation
3) Type 3A: Voluntary subluxation in patients with psychiatric problems
4) Type 3B: Voluntary subluxation in patients without psychiatric problems
5) Type 4: Atraumatic involuntary subluxation

4. Classification by Gerber & Nyffeler (CORR, 2002)

1) Static instability (Class A)
(1) Static Superior Subluxation (Class A1)
(2) Static Anterior Subluxation (Class A2)
(3) Static Posterior Subluxation (Class A3)
(4) Static Inferior Subluxation (Class A4)

2) Dynamic instability (Class B)
(1) Chronic, Locked Dislocation of the shoulder (Class B1)
(2) Unidirectional Instability without Hyperlaxity (Class B2)
(3) Unidirectional Instability with Hyperlaxity (Class B3)
(4) Multidirectional Instability without Hyperlaxity (Class B4)
(5) Multidirectional Instability with Hyperlaxity (Class B5)
(6) Unidirectional or Multidirectional Instability with Voluntary Reduction (Voluntary Instability) (Class B6)

3) Voluntary dislocations (Class C)

5. Classification of Posterior instability

1) Posterior dislocation
(1) Acute posterior dislocation

(2) Chronic (locked) posterior dislocation

2) Recurrent posterior subluxation

(1) Volitional

(2) Psychogenic

:learned

(3) Dysplastic

: Glenoid retroversion

: Humeral head retrotorsion

(4) Acquired

: Soft tissue deficiency

: Bony deficiency

: Scapulothoracic dysfunction

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