Common Shoulder Problems

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Definitions

- **Limited bony contact** between the humeral head and glenoid fossa allows extended range of motion at a cost of relative instability.

- There must be a **balance** between mobility and stability to maintain proper function.
Anatomy

SSC

SS

IS

TM
Mechanical shoulder pathology

- overuse,
- extremes of motion, or
- excessive forces

Disruption of the delicate balance of the shoulder complex resulting in tears of the rotator cuff, capsule, and labrum
Mechanical shoulder pathology

- Impingement – RC injury
- Instability
- Overhead athlete (internal impingement)
IMPINGEMENT SYNDROME
**Historical perspective**

Jarjavay, 1867: first description of «subacromial bursitis»

Duplay, 1872: described the «periarthritis humeroscapularis»

Meyer, 1931: he attributed that RC tears caused by the trimming of the supraspinatus tendon underneath the acromion

Codman, 1934: described the “critical jone” of the supraspinatus tendon near the GT insertion

Amstrong, 1949: he introduced the term “supraspinatus syndrome” and proposed «total acromionectomy»

McLaughin, 1951: suggest the “lateral acromionectomy”
Etiology - pathogenesis

Narrowing of the “supraspinatous outlet” is the most frequent cause of impingement

Neer CS, 1972

Causes:

1. Anterior acromial spurs
2. Shape and slop of the acromion
3. AC joint spurs
4. Coracoacromial ligament
Etiology - pathogenesis

Three stages of impingement syndrome (Neer)

**Stage I**, characterized by subacromial edema and hemorrhage, was typical in symptomatic patients younger than 25 years of age.

**Stage II** included fibrosis and tendinitis and was more common in persons 25 to 40 years old.

**Stage III** characterized by partial or complete tendon tears typically in persons older than 40 years of age.

95% of all rotator cuff lesions to primary mechanical impingement.
Anatomy

Layer 1: superficial layer CHL
Layer 2: main portion of RC (∥ fibers)
Layer 3: oblique fibers merged
Layer 4: deep extension of the CHL
Layer 5: joint capsule
Biomechanics

Coronal plane force couple (Inman 1944): The inferior portion of the rotator cuff (below the center of rotation) creates a moment that must balance the deltoid moment.

Transverse plane force couple, (Burkhart 1994) The subscapularis tendon anteriorly is balanced against the infraspinatus and teres minor tendons posteriorly.
“Rotator cable” extends from its anterior attachment just posterior to the biceps tendon to its posterior attachment near the inferior border of the infraspinatus tendon.
Biomechanics

“Suspension bridge”, with the free margin of the tear corresponding to the cable and the anterior and posterior attachments of the tear corresponding to the supports at each end of the cable’s span.

Tear size is less important than tear location in terms of force couple and kinematic preservation.
Detachment of 1/3 or 2/3 of the SS tendon (in the crescent area) has only a minor effect on the force transmission of the RC (1% and 2%) and that not until the entire supraspinatus tendon was detached was there a significant decrease (11%) in force transmission.

In small and medium-sized RC tears, the muscle forces are effectively transmitted along the rotator cuff cable, bypassing the tear in the crescent portion of the supraspinatus.
Etiology - pathogenesis

Degenerative factors
- Proliferative and degenerative changes of the acromion, coracoacromial ligament, acromioclavicular joint, or greater tuberosity
- Intrinsic degenerative changes of the rotator cuff

Traumatic factors
- Rotator cuff (acute trauma, overuse, work...)
- Supraspinatus outlet (AC joint separation, coracoid nonunion, GT malunion....)

Degenerative factors
- Proliferative and degenerative changes of the acromion, coracoacromial ligament, acromioclavicular joint, or greater tuberosity
- Intrinsic degenerative changes of the rotator cuff

Developmental factors
Os acromiale
Coracoid malformation
Type II or type III acromial morphology

Inflammatory disease
Calcific tendinitis or bursitis
Rheumatoid arthritis
Crystal-induced arthropathy

Capsuloligamentous factors
Instability
Capsular contracture
Tight posterior capsule

Iatrogenic or acquired disorders
Hardware placement
Foreign materials
Inferior placement of the humeral prosthesis
Corticosteroid-induced tendinopathy

Scapulothoracic neuromuscular dysfunction
Chronic cervical spondylosis
Serratus anterior palsy
Trapezius nerve palsy

Entrapment syndromes
Axillary nerve
Suprascapular nerve
Etiology - pathogenesis

Two predominate mechanistic theories

**Intrinsic impingement**, theorizes that partial or full thickness tendon tears occur as a result of the degenerative process that occurs over time with overuse, tension overload, or trauma of the tendons. Osteophytes, acromial changes, muscle imbalances and weakness, and altered kinematics leading to impingement will subsequently follow.

**Extrinsic impingement**, where inflammation and degeneration of the tendon occur as a result of mechanical compression by some structure external to the tendon such as faulty posture, altered scapular or glenohumeral kinematics, posterior capsular tightness, and acromial or coracoacromial arch pathology.
Degenerative process that occurs over time with overuse, tension overload, or trauma of the tendons. Aging, healing, and vascularity may predispose to tendonosis and ultimately tendon failure.

Osteophytes, acromial changes, muscle imbalances and weakness, and altered kinematics leading to impingement will subsequently follow.
Predominate mechanistic theories

Extrinsic impingement

The Superior Shoulder Suspensory Complex (SSSC) is a bony-soft tissue ring made up by the glenoid, coracoid, and acromion processes, as well as the distal clavicle, the AC joint, and CC ligaments.
**Intrasubstance RC tears**

Horizontal partial tears of the rotator cuff (along the length of the tendon) have also been described and thought related to shear stresses.

Shear forces are probably directed to **layer four**, which is the site of development of intratendonous cuff tears. These tend to be degenerate tears of the cuff.
...the question is, which comes first, tendon degeneration or changes external to the tendon?

By the time a patient with SAIS seeks health care, the typical examination findings reveal tendon pathology in some form and the presence of one or more extrinsic factors such as osteophytes or muscle weakness.
we believe that 90 to 95 per cent of abnormalities of the rotator cuff are secondary to tension overload, overuse, and traumatic injury.

There is no objective evidence that primary extrinsic factors are involved in most disorders of the rotator cuff, as changes within the rotator cuff often occur without accompanying changes on the acromion.
Clinical examination

- Painful arc sign
- Drop arm sign
- Neer’s test
- Hawkin’s test
- Speed’s test
- Cross adduction test
- Infraspinatus strength
- Supraspinatus strength
Radiological evaluation

anteroposterior

axillary

Anteroposterior with 30° caudal tilt
Radiological evaluation

Acromial angle

Lateral acromial angle

Acromial slope

Acromial type

17%  43%  40%  3%  24%  73%
Office-based ultrasonography led to the correct diagnosis for 88% of the shoulders with a full-thickness rotator cuff tear, 70% with a partial-thickness rotator cuff tear only, and 80% of normal tendons.
Comparison of MRI and operative findings in full-thickness RC tears showed sensitivity of 85%, specificity of 83% and PPV = 99%

In partial-thickness tears the values were respectively 83%, 85, PPV = 39%
US or MRI?

Detection and Quantification of Rotator Cuff Tears. Comparison of Ultrasonographic, Magnetic Resonance Imaging, and Arthroscopic Findings in Seventy-one Consecutive Cases

Sharlene A. Teefey, David A. Rubin, William D. Middleton, Charles F. Hildebolt, Robert A. Leibold and Ken Yamaguchi


| TABLE 1 Comparison of Diagnoses Made with Ultrasonography and Magnetic Resonance Imaging with Arthroscopic Diagnoses of Rotator Cuff Tears |
|---|---|---|---|---|---|
| Diagnoses with Ultrasonography | Complete Tear | Partial Tear | No Tear | Total | Accuracy* |
| Arthroscopic diagnosis | 62/71 (87% [80%-95%]) |
| Complete tear | 45 | 1 | 0 | 46 |
| Partial tear | 4 | 13 | 2 | 19 |
| No tear | 1 | 1 | 4 | 6 |
| Diagnosis with Magnetic Resonance Imaging | Complete Tear | Partial Tear | No Tear | Total | Accuracy* |
| Complete tear | 46 | 0 | 0 | 46 |
| Partial tear | 7 | 12 | 0 | 19 |
| No tear | 1 | 1 | 4 | 6 |

*The 95% confidence interval is given in brackets.*

The overall accuracy for both imaging tests was 87%.
Rotator Cuff Tears

CLASSIFICATIONS

- **Partial thickness**
  - Articular side
  - Bursal side
  - Intratendinous

- **Full Thickness**

- Depth
- Size/Shape
- Number of tendons
- Topography
- Retraction

ATES
- Small < 1 cm
- Medium 1-3 cm
- Large 3-5 cm
- Massive > 5 cm
Partial articular side tear

Partial bursal side tear

Partial Articular Supraspinatus Avulsion Tear

Intratendinous tear
Classification of large tears based on shape and retraction

4 basic patterns

Crescent-shaped

U-shaped

L-shaped

Massive, contracted, immobile tears

Initial nonoperative care can be safely undertaken in:

- in older patients (>70 years old) with chronic tears
- patients with irreparable rotator cuff tears with irreversible changes,
- patients of any age with small (<1 cm) full-thickness tears or in
- patients with partial-thickness tears

**Early surgical treatment can be considered in**

significant (>1 cm–1.5 cm) acute tears or young patients with full-thickness tears who have a significant risk for the development of irreparable rotator cuff changes.
Calcified tendinitis supraspinatus
SIS and RC tearing appear to result from a variety of factors.

- anatomical factors of inflammation of the tendons and bursa,
- degeneration of the tendons,
- weak or dysfunctional rotator cuff musculature,
- weak or dysfunctional scapular musculature,
- posterior glenohumeral capsule tightness,
- postural dysfunctions of the spinal column and scapula and
- bony or soft tissue abnormalities of the borders of the subacromial outlet
GLENOHUMERAL INSTABILITY
Definition

- Glenohumeral laxity is the ability of the humeral head to be passively translated on the glenoid fossa.
- Glenohumeral instability is “a clinical condition in which unwanted translation of the head on the glenoid compromises the comfort and function of the shoulder.”

**Classification**

(Matsen)

**TUBS or “Torn Loose”**
- Traumatic etiology
- Unidirectional instability
- Bankart lesion
- Surgery is required

**AMBRI or “Born Loose”**
- Atraumatic: minor trauma
- Multidirectional instability may be present
- Bilateral: asymptomatic shoulder is also loose
- Rehabilitation is the treatment of choice
- Inferior capsular shift: surgery may be needed
Classification

Direction

1. Unidirectional
   - Anterior
   - Posterior
   - Inferior

2. Bidirectional
   - Anteroinferior
   - Posteroinferior

3. Multidirectional

Degree

Subtle

Frequency

Acute (primary)
Chronic
Recurrent
Fixed

Etiology

Traumatic (macrotrauma)
  Atraumatic
    Voluntary (muscular)
    Involuntary (positional)
  Acquired (microtrauma)
  Congenital
  Neuromuscular
    (Erb's palsy, cerebral palsy, seizures)
Classification

Stanmore (Bayley Triangle)

- **Polar Type I**: Significant trauma, often a Bankart's defect, usually unilateral, no abnormal muscle patterning.

- **Polar Type II**: No trauma, structural damage to joint surfaces, capsular dysfunction, no abnormal muscle patterning, not uncommonly bilateral.

- **Polar Type III**: No trauma (habitual), no structural damage to joint surfaces, capsular dysfunction, abnormal muscle patterning, often bilateral.

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**Classification Table**

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polar Type I</td>
<td>Significant trauma, Bankart's defect, unilateral, no abnormal muscle patterning</td>
</tr>
<tr>
<td>Polar Type II</td>
<td>No trauma, structural damage, capsular dysfunction, no abnormal muscle patterning</td>
</tr>
<tr>
<td>Polar Type III</td>
<td>No trauma (habitual), no structural damage, capsular dysfunction, abnormal muscle patterning</td>
</tr>
</tbody>
</table>

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**Diagnosis**

- **Phases**: Traumatic, Structural, Non-Structural
- **Less Trauma**: Polar Type III
- **Less Muscle Patterning**: Polar Type I

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**Notes**

- **Unilateral**
- **Bilateral**
- **Common**
- **Rare**
- **Evaluative**
- **Predictive**

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**References**

1st law of glenohumeral stability

The GH joint will not dislocate as long as the net humeral joint reaction force is directed within the effective glenoid arc.

- This force is the resultant of all muscular, ligamentous, inertial, gravitational, and other external forces applied to the head of the humeral head (other than the force applied by the glenoid).
2nd law of glenohumeral stability

The humeral head will remained centered in the glenoid fossa if the glenoid and humeral joint surfaces are congruent and if the net humeral joint reaction force is directed within the effective glenoid arc.

- The "effective glenoid arc" is the arc of the glenoid available to support the humeral head under the specified loading conditions.
Balance stability ratio & angle

The **stability ratio** is the force necessary to displace the head from the glenoid divided by the load compressing the head into the concavity. Clinically, the stability ratio can be sensed using the "**load and shift**" test.

- Resection of the labrum has been shown to reduce the stability ratio by 20 per cent. (Lippitt, Vanderhooft, Harris et al, 1993)

The **balance stability angle** is the maximal angle between the glenoid center line and the net humeral joint reaction force before the humeral head dislocates from the glenoid.

- A 3 mm anterior glenoid defect has been shown to reduce the balance stability angle over 25 per cent. (Matsen, Lippitt, Sidles et al, 1994)
## Factors maintaining shoulder stability

<table>
<thead>
<tr>
<th>Static Factors</th>
<th>Dynamic Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Articular version-conformity</td>
<td>Rotator cuff</td>
</tr>
<tr>
<td>Glenoid labrum</td>
<td>Coracoacromial arc</td>
</tr>
<tr>
<td>Capsule and ligaments</td>
<td>Biceps brachii</td>
</tr>
<tr>
<td>Adhesion–cohesion &amp; suction cup</td>
<td>Proprioception</td>
</tr>
<tr>
<td>Negative intraarticular pressure</td>
<td></td>
</tr>
<tr>
<td>Rotator cuff (static contribution)</td>
<td></td>
</tr>
</tbody>
</table>

no single factor is responsible for glenohumeral joint stability and no single lesion is responsible for clinical instability
**Articular version - conformity**

**Scapula:**  
- a. faces 30° anteriorly on the chest wall  
- b. tilts 3 degrees upward relative to the transverse plane  
- c. 20 degrees forward relative to the sagittal plane

**Glenoid** has a superior tilt of 5 degrees and 70° retroversion in 75% of patients.

Scapular inclination may have a contributory role in controlling **inferior** stability.
Articular version- conformity

Dias et al (1993) & Dowdy and O'Driscoll (1994) found no difference or only minor variances in apparent glenoid version between normal subjects and recurrent anterior dislocators.

Hirschfelder and Kirsten (1991) found increased glenoid retroversion in both the symptomatic and unsymptomatic shoulders of individuals with posterior instability.

Grasshoff et al (1991) found increased anteversion in shoulders with recurrent anterior instability.

When it is important to know the orientation of the cartilaginous joint surface in relation to the scapular body a double contrast CT scan is necessary.
**Articular version - conformity**

The humeral head has a surface area that is three times that of the glenoid.

In fact, the articular surfaces of the humeral head and glenoid are almost perfectly matched, with a congruence within 3 mm, with deviations from sphericity of less than 1%.

**Glenoid labrum**

1. Anchor point for capsuloligamentous structures
2. It doubles the anteroposterior depth of the glenoid from 2.5 to 5 mm and deepens the concavity to 9 mm in the superior-inferior plane.
3. Enhances stability of the joint by increasing the surface area of contact for the humeral head.
4. The labrum is analogous to a chock-block preventing an automobile’s wheel from rolling downhill
Capsule/Glenohumeral Ligaments

**SGHL** (together with the **CHL**) constrain the humeral head on the glenoid, limit inferior translation and external rotation of the adducted shoulder and posterior translation of the flexed, adducted, internally rotated shoulder.

**MGHL** limits anterior translation of the humeral head when the arm is abducted between 60° and 90°. The MGHL dominant individuals with a cord-like MGHL may be more dependent on this structure to provide a protective role against anterior instability.

**IGHL complex** acts like a hammock in preventing increased translation of the humeral head on the glenoid.

- **abduction** moves beneath the humeral head and becomes taut
- **internal rotation** moves posteriorly and limits posterior translation
- **external rotation** moves anteriorly and limits anterior translation
Adhesion-Cohesion & the Suction Cup

Neither the adhesion-cohesion nor the suction-cup mechanism consumes energy, and both provide so-called low-cost centering when the arm is at rest.

These mechanisms also have the convenient property of working in any position of the shoulder.

The suction-cup mechanism is enhanced by the slightly negative intra-articular pressure within the joint.
Muscles

Concavity compression is the primary mechanism by which the head of the humerus is centered and stabilized in the glenoid fossa to resist the upward pull of the deltoid. The cuff muscles provide stability by functioning as "compressors" than as depressors

- subscapularis muscle is the primary anterior compressor (lumbar push-off test)

- supraspinatus muscle is the primary superior compressor (supraspinatus test)

- infraspinatus is the primary posterior compressor, assisted to a degree by the teres minor (infraspinatus test)
The RC muscles they can function as head compressors in almost any position of the glenohumeral joint.

Other muscles, such as the deltoid, long head of the biceps, pectoralis, latissimus, teres major, and pectoralis major, can contribute to humeroglenoid compression in certain glenohumeral positions.

**The interplay between muscular and capsular tension**

As the humerus is passively externally rotated, the force that the subscapularis can generate drops off while the force generated by the anterior capsular ligaments increases in a complementary manner.
The Coracoacromial Arch

The centers of rotation for the humeral head, the proximal humeral convexity, the glenoid fossa, and the coracoacromial arch are all superimposed in the normal stable shoulder.

The critically important stabilizing effect of the coracoacromial arch is demonstrated by the devastating anterosuperior instability that results when an acromioplasty is performed in the presence of rotator cuff deficiency.
The biceps tends to stabilize the joint anteriorly with the arm in internal rotation, and it acted as a posterior stabilizer with the arm in external rotation.
Pathoanatomy, diagnostic imaging and related lesions
Normal labral variations (13.5-25%)

a. A cord-like middle glenohumeral ligament (MGHL)
b. **Sublabral foramen** in the anterosuperior quadrant of the shoulder.
c. The **Buford complex** (cord-like MGHL in conjunction with an absent anterosuperior labrum complex)
Pathologic lesions in shoulder instability

a. Bankart, bony-Bankart
b. PERTHES
c. ALPSA
d. HAGL
e. GLAD
f. SLAP
g. Hill - Sacks
A Bankart lesion is a tear of the anterioinferior glenoid labrum with an associated tear of the anterior scapular periosteum, with or without associated fracture of the anterior inferior glenoid rim.
Bony - Bankart lesion

A Bony - Bankart lesion is a tear of the anteroinferior glenoid labrum with an associated tear of the anterior scapular periosteum, with associated fracture of the anterior inferior glenoid rim.

Type I: 0-12.5%
Type II: 12.5-25%
Type III: >25%
An ALPSA lesion is an anterior labroligamentous periosteal sleeve avulsion. ALPSA is a variation of the Bankart lesion where the anterior inferior labrum is torn and the labrum, inferior glenohumeral ligament and intact scapular periosteum are stripped and displaced medially on the glenoid neck.

POLPSA is similar to ALPSA and is associated with posterior dislocation
An Perthes lesion is a variant of the Bankart, where the anterioinferior labrum is avulsed from the glenoid and the scapular periosteum remains intact but is stripped medially.
A HAGL lesion is humeral avulsion of the glenohumeral ligament that occurs from shoulder dislocation, with avulsion of the inferior glenohumeral ligament from the anatomic neck of the humerus (J sign).
A BHAGL is a bony HAGL, or a HAGL lesion that involves a bone fragment.
**SLAP lesion**

<table>
<thead>
<tr>
<th>Type</th>
<th>Location (clock face)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>11-1</td>
<td>Fraying</td>
</tr>
<tr>
<td>II</td>
<td>11-1</td>
<td>Tear with biceps instability</td>
</tr>
<tr>
<td>II A</td>
<td>11-3</td>
<td>Tear with biceps instability, associated with repetitive overhead motion, similar to Type X</td>
</tr>
<tr>
<td>II B</td>
<td>9-11</td>
<td>Tear with biceps instability, associated with infraspinatus tear</td>
</tr>
<tr>
<td>II C</td>
<td>9-3</td>
<td>Tear with biceps instability, associated with infraspinatus tear</td>
</tr>
<tr>
<td>III</td>
<td>11-1</td>
<td>Bucket-handle tear with intact biceps</td>
</tr>
<tr>
<td>IV</td>
<td>11-1</td>
<td>Bucket-handle tear with biceps extension</td>
</tr>
<tr>
<td>V</td>
<td>11-5</td>
<td>Bankart lesion with superior extension, or SLAP with anterior inferior extension</td>
</tr>
<tr>
<td>VI</td>
<td>11-1</td>
<td>Anterior or posterior flap tear, with tear of the bucket handle component</td>
</tr>
<tr>
<td>VII</td>
<td>11-3</td>
<td>Middle glenohumeral ligament extension</td>
</tr>
<tr>
<td>VIII</td>
<td>7-1</td>
<td>Similar to II B, but more extensive, associated with acute posterior dislocation</td>
</tr>
<tr>
<td>IX</td>
<td>7-5</td>
<td>Globally abnormal labrum, likely post traumatic</td>
</tr>
<tr>
<td>X</td>
<td>11-1+</td>
<td>Rotator interval extension</td>
</tr>
</tbody>
</table>

Type II SLAP

Additional categories of SLAP tears were described by Maffet et al, Morgan et al, Resnick and Beltran.
The GLAD lesion refers to glenolabral articular disruption, which involves a tear of the anterior inferior labrum with an associated glenoid chondral defect.
The Hill-Sachs lesion is a cortical depression in the humeral head. It results from its forceful impaction against the anteroinferior rim of the glenoid when the shoulder is dislocated anteriorly (reverse Hill-Sachs in posterior dislocation).
**Open Surgical repair: categories**

**Anatomic**

- Capsulolabral reconstruction ➔ Bankart-Perthes, Rockwood, DuToit staple capsulorrhaphy, inferior capsular shift

**Non-anatomic**

- Subscapularis procedures ➔ Putti-Plat, Magnuson-Stuck
- Bone block procedures ➔ Oudard and Trillat, Eden-Hybinette, J-graft
- Coracoid transfer ➔ Bristow, Latarget-Patte
- Osteotomy of Humerus ➔ Weber, Cautilli, Joyce and Mackell
Capsulolabral reconstruction

“Bankart repair (1923, 1939)”

- first performed by Perthes (1906)
- shave off bone from the anterior glenoid
- reconstruction of the avulsed capsule and labrum at the glenoid lip, using simple drill holes
- subscapularis, which is carefully divided to expose the capsule, is re-approximate without shortening
- osteotomy of the coracoid
Subscapularis procedures

“Subscapularis shortening Putti-Platt (1925)”
Glenohumeral osteoarthritis after Putti-Platt repair

Henrica M. van der Zwaag, MD, Ronald Brand, PhD, Willem R. Obermann, PhD, and Piet M. Rozing, PhD, Leiden, The Netherlands

Table V Distribution of shoulders with glenohumeral osteoarthritis by 3 time intervals to follow-up (n = 66)

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>10 to 20 y</th>
<th>20 to 30 y</th>
<th>30 to 40 y</th>
</tr>
</thead>
<tbody>
<tr>
<td>No arthritis</td>
<td>20 (74%)</td>
<td>4 (16%)</td>
<td>2 (14%)</td>
</tr>
<tr>
<td>Arthritis</td>
<td>7 (26%)</td>
<td>21 (84%)</td>
<td>12 (86%)</td>
</tr>
<tr>
<td>Mild</td>
<td>6</td>
<td>12</td>
<td>5</td>
</tr>
<tr>
<td>Moderate</td>
<td>1</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Severe</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

“The rate of glenohumeral arthrosis is increased in patients who have undergone a Putti-Platt procedure and is positively correlated with the length of time since surgery”
Bone block procedures

“Eden-Hybinette Procedure (1932)”

- creation of a trough through the capsule and into the anteroinferior aspects of the scapula neck.

- a tricortical iliac crest bone graft was then wedged into the trough without fixation
Coracoid transfer

“Bristow - Helfet procedure (1958)”

- coracoid tip is transferred to the anteroinferior glenoid neck and serves as a bone block

- the transferred conjoined tendon acts as a strong dynamic buttress across the anterior and inferior aspects of the joint
Humerus osteotomy

- subcapital osteotomy
- medial rotation of the head (25°)
- shortening of the subscapulananis tendon and capsule anteriorly

average loss of external rotation >5 degrees, without noticeable diminution of power or function in most patients. The results as graded by a standard rating scale were good to excellent in 90 per cent
Combination of capsulolabral techniques

- **Repair of Bankart lesion**

- **Inferior capsular shift**
  *Neer CS, Foster CR:*
  *Inferior capsular shift for involuntary inferior and multidirectional instability of the shoulder. JBJS Am 1980*

- **Reinforced cruciate repair**
  *Neer CS, Fithian TE:*
  *Reinforced cruciate repair for anterior dislocation of the shoulder. Orthop Trans 1985*

120 pt at Patras University Hospital (5% recurrences)
Clinical examination

- History

- Clinical tests
  - apprehension test
  - drawer sign
  - sulcus sign
X-Rays
CT arthrograph
MRI arthrogram
Surgical steps

Direction of the instability (under anesthesia)

beach chair position

axillary approach (Ryan-Lesley)
Subscapularis cut (leave 1/3 attached to the capsule)
The capsule is opened in “T-shape”
Repair of capsulolabral detachment

Three holes with drill 2,5mm (3:00, 5:00, 7:00)
Glenocapsular reattachment with ethibon No 2 (Mitec G II)
Inferior capsular shift
Cruciate repair
...to reinforce anterior capsule

**arm position**

Elbow flexion  90°

Shoulder lift

External rotation 10°
Subscapularis is reattached in its anatomical insertion (without shortening)

No functional limitation of external rotation
POST OPERATIVELY

- First 48 hours: Velpeau
- Till 4th week: controlled external rotation gradually to neutral position
4th to 6th week: active assisted immobilization

After 6th week: muscular strengthening
Coracoid transfer

“Latarzet procedure (1958)”

- the gold standard treatment for anterior glenohumeral instability in the presence of glenoid bone loss

- 3 stabilizing mechanisms
  - coracoid process acts as a bony extension
  - conjoint tendon act as a soft tissue sling preventing anterior subluxation
  - the capsule can be repaired to the stumb of CA ligament, thus providing a new, strong, inferior glenohumeral ligament
Coracoid transfer

“Latarjet procedure (1958)”

The Latarjet reconstruction extends the glenoid articular arc so that

1. off-axis loads are resisted by bone rather than soft tissue

2. the humerus cannot externally rotate enough to cause engagement of the Hill-Sachs lesion over the front of the graft.
Results of Modified Latarjet Reconstruction in Patients With Anteroinferior Instability and Significant Bone Loss

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Subscapularis muscle

Conjoined tendon
Accurate coracoid graft placement through use of a drill guide for the Latarjet procedure

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Conclusions

A delicate balance between dynamic and static stabilizing factors allow the arm to be placed in extreme positions for athletic and work-related activities.

This concavity-compression mechanism is dependent on the integrity of the glenoid and the coracoacromial arch, muscular compression, and restraining ligaments of the shoulder.

Loss of any of these elements due to developmental, degenerative, traumatic, or iatrogenic factors may compromise the ability of the shoulder to center the humeral head in the glenoid.
Conclusions

The questions to answer during an evaluation of a patient with suspected instability are:

(1) Is the problem in the glenohumeral joint?
(2) Is the problem one of failure to maintain the humeral head in its centered position?
(3) What mechanical factors are contributing to this instability?
(4) Are the identified mechanical factors amenable to surgical repair or reconstruction?

This evaluation is based primarily on a carefully elicited history, a physical examination of the stability mechanics, plain radiographs and MRI scan.
Conclusions

For surgical treatment of glenohumeral instability to be appropriate, the instability must be attributable to **mechanical factors** that can be modified by surgery.

The causes may be deficiencies of the glenoid concavity, deficiencies in the muscles that compress the head into the socket, and/or deficiencies in the capsule and ligaments.
INTERNAL IMPINGEMENT
Definition

Injury and dysfunction due to repeated contact between the undersurface of the rotator cuff tendons and the posterosuperior glenoid

Walch JSES 1992
Some contact between these structures is **physiologic** but **repetitive contact** with altered **shoulder mechanics** may be **pathologic**

For undefined reasons this contact in some athletes become pathologic and produces symptoms
Mechanisms

Two major theories:

• Andrew
• Burkhart & Morgan

May co-exist
Mechanism of Internal Impingement

Andrew Theory:

Repeated ABER → Dynamic stabilizers fatigue → Increase stress to anterior & IGHL → Anterior capsule laxity to allow max ABER → Increased contact of undersurface of RC and posterosuperior glenoid → Reduction of posterior & inferior translation of HH → Internal Impingement
Mechanism of Internal Impingement

Burkhart & Morgan Theory:

Repeated ABER → Tight posterior capsule → Superior translation of Humeral Head → Internal Impingement

Increased contact of undersurface of RC and posterosuperior glenoid → Internal Impingement

SLAP II and Pseudolaxity

Peel-off Mechanism

Torsional stress to biceps anchor
Internal Impingement

It is essentially an **overuse** injury associated with overhead athletes.
Internal Impingement

- Typically symptoms are present only while playing
- No symptoms with activities of daily living
- Represents about 80% of the problems seen in the overhead athletes
Consequently, these forces may lead to subacromial impingement (superior translation of humeral head from compressive forces), labral tears (torsional forces grinding the labrum), and cuff failure (large tensile forces with collagen failure).
History

- Insidious onset
- Increases as the season progresses
- Dull posterior pain
- Worse at late cocking phase
- Rarely can remember any traumatic episode
- Loss of control and velocity
Clinical Examination

Provocative tests:

- **Internal Impingement test = positive**
  (patient supine, 90 deg abduction and max external rotation. If pain experienced at the posterior part of the joint = positive, 90% sensitive)

- **Relocation test = positive,**
  (different from relocation test for anterior translation)
Relocation test of Jobe:

Pain in the posterior joint line when the arm is brought in abduction external rotation with the patient supine that is relieved when a posterior directed force is applied to the shoulder.
MRI findings
Internal Impingement – Bennett’s Lesion
Differential Diagnosis

- **SLAP lesions**
  - Pain more anterior than Internal Impingement.
  - Positive O’Brien test and SLAPrehension test. These tests are negative for internal impingement.
  - Coronal oblique MRI can help

- **Isolated posterior labrum tear**
  - The most difficult to differentiate from internal imp.
  - Both posterior pain in the abducted and ext rotated position.
  - Arthroscopy can help
Conservative Treatment

- **Rest** (complete stop of throwing is critical)
- **Rehabilitation** (physical therapy as soon as possible) to
  - improve posterior flexibility
  - improve dynamic stabilization
  - increase strength of rot cuff muscles
- Then gradual return to throwing
- Improvement of throwing technique
- +/- NSAID
- Most athletes return to sport
Surgical Treatment

- **Diagnostic arthroscopy**
  (other pathology found... SLAP, biceps tendonitis, rot cuff tears etc)

- **Arthroscopic Debridement**
  25-85% return to pre-injury activity => effective?
Surgical Treatment

- **Open/Arthroscopic Capsulolabral Reconstruction**
  - Arthrolysis of posterior capsule tightness
  - Repair of SLAP lesions
  - Repair of the rot cuff
  - Address anterior capsule laxity
    (50 - 81% pre-injury level)
Conclusions

• Internal Impingement is a relatively common problem in overhead athletes

• Difficult to treat

• Caused by repetitive contact between the undersurface of the rot cuff and posterosuperior glenoid

• **Initial treatment:**
  • Complete REST + PHYSIOTHERAPY

• **If symptoms persists:**
  • Multiple surgical techniques
  • Repair all lesions if possible