Quick Guide
- Anatomy
- Examination
- Radiological views
- Rotator Cuff
- Instability
- SLAP
- Frozen Shoulder
**Bones**

**Scapula**
- Body is formed by intramembranous ossification
- Glenoid has 2 ossific centers. Failure of inf centre formation → 1ry glenoid dysplasia
- Glenoid has thicker cartilage to the periphery & thin in centre - making it congruent
- It has a smaller surface than head → mobility.

**Acromion**
- Acromion has 2 ossific centers. Failure of fusion → os acromiale.
- Humans & chimpanzees are the only animals with an acromion
- Acromion provides a platform for a powerful deltoid but impedes repeated overhead activities

**Proximal Humerus**
- Epiphysis has 3 ossific centers → head, greater & lesser tuberosities.
- The centre of head rotation → medial & posterior to shaft

**Ligaments**

1. **Coracohumeral Ligament (CHL)**
   - Very strong thickened fold of the shoulder capsule
   - From lat border of coracoid base, as a continuation of pec minor tendon & divides into 2 bands:
     a) One band inserts into GT
     b) One band inserts into LT
   - Primary restraint to inferior translation & ER
   - Equivalent to Y ligament of bigelow at hip joint

2. **Superior Glenohumeral Ligament**
   - Arises from glenoid labrum at 1 o’clock.
   - Joins CHL & form the internal reflection of the pulley for LHB

3. **Middle Glenohumeral Ligament**
   - Courses obliquely from 2 o’clock to attach to LT
   - Outpouching of capsule above this lig. Forms the subscapular recess

4. **Inferior Glenohumeral Ligament Complex**
   - **MOST IMPORTANT** ligament in preventing anterior dislocation; it acts as a Hammock
   - Arises at 4 to 8 o’clock on glenoid
   - In ER, IGHL moves anteriorly → anterior humeral head translation; and vice versa
   - In the abducted neutral position → IGHL tightens inferior to the joint
   - In IR, IGHL moves posteriorly → posterior translations of the humeral head

5. **Coraco-Acromial Ligament**
   - Pec minor tendon separate it into 2 bands from tip and base of coracoid to the acromion tip
   - Any shoulder movement dysfunction causes strain of CAL causing it to hypertrophy, leading to spur formation, leading to impingement.

**Articulations** (5 articulations)

1. Gleno-humeral
2. Acromio-clavicular
3. Sterno-clavicular
4. Pseudo joint between the head and coraco-acromial ligament
5. Scapulo-thoracic articulation
**Glenoid inclination and retroversion**

- Retroverted ......................6°
- Inclined superiorly ..............6°
- Scapula anteversion ............30°

**NERVES**
1. Axillary n. passes into quadrilateral space with post. circumflex humeral a & v and if compressed there (Quadrilateral $)$...........................axillary palsy
2. Musculocutaneous n. ....................enters the conjoined tendon 2cm distal to coracoid
3. Suprascapular n. .........................passes below the transverse ligament & the art. above it.
   - Gives 2 branches to supraspinatus
   - Passes around the spine of scapula at the spinoglenoid notch to supply infraspinatus

**BLOOD SUPPLY** (of Humeral Head)
1. Ascending br of ant circumflex artery (main blood supply); passes lat to long head of biceps & forms **Arcuate A** as it penetrates bone & gives branches to lesser and greater tuberosities
2. Posterior circumflex artery supplies only a small area in posteroinf aspect of the humeral head

**Rotator cuff muscles are:**
- Supraspinatus..............................Bipennate (supra-scapular n.)
- Infraspinatus..............................Bipennate (supra-scapular n.)
- Subscapularis..............................Multipennate (upper & lower subscapular n.)
- Teres minor...............................Bipennate (axillary n.)
- Some add biceps tendon (LHB)

**Kinematics**
- First 30° abduction:
  - Mainly at gleno-humeral joint
  - Little motion at sterno-clavicular joint
- 30-90° abduction:
  - 2/3 of motion comes from gleno-humeral joint
  - 1/3 comes from scapulo-thoracic motion
- 90-180° elevation
  - Mainly scapulo-thoracic
  - Associated gleno-humeral ER so the greater tuberosity clears from the acromion
  - ACJ moves during the last 60° of abduction
  - SCJ moves during shrugging & protraction

**Codman’s Paradox:**
- Complete elevation in coronal plane...ER
- Complete elevation in sagittal plane....IR
**INDIVIDUAL JOINT MOTION**

1. **Gleno-humeral joint**
   1. Rotation
   2. Translation (gliding)
   3. Rolling (combination of rotation & translation)

2. **Acromio-clavicular joint** (plane, synovial joint with meniscus)
   1. Forward rotation constrained by conoid ligament
   2. Backward rotation constrained by the trapezoid lig.
   3. Axial rotation constrained by both lig

3. **Sterno-clavicular joint** (synovial joint, meniscus)
   1. protraction/retraction constrained by CCL & SCL
   2. elevation/depression constrained by subcalvius muscle
   3. rotation constrained by both

4. **Scapulothoracic articulation**
   1. protraction/retraction
   2. elevation/depression
   3. rotation

- The lack of true joint allows for the wide range of shoulder motion
- The range of glenohumeral to scapulothoracic motion is 2:1
- scapula twists at maximal arm elevation (coracoid moves up)

![Image of shoulder joint and muscles]
# Shoulder Examination Special Tests

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## Radiological Views

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Sprengel’s Deformity

Definition:
- Failure of scapular descent. It is the most common pediatric shoulder deformity

Pathology:
- Scapula is small, wide, high, and medially rotated
- Clavicle sometimes affected

Associated With
1. Omovertebral bar: fibrous or cartilagenous bar that connects scapula to spine
2. Klippel Feil
3. Scoliosis
4. Diastematomyelia

Diagnosis:
1. Lennie’s test (See later) → shoulder asymmetry .......... sometimes bilateral
2. Scapula: small, high, winged ........................................ sometimes the clavicle is affected
3. ↓ ROM & on abduction or elevation, scapula moves very little or not at all

Treatment:
Rational
- Best performed 3-6y
- Avoid injury to the accessory nerve or the brachial plexus.
- Indications:
  a. Severe limitation of motion
  b. Cosmetic

Operations
1. Schrock Green: entire scapular dissection + supraspinous and bar excision + move down the scapula and inf. pole is anchored to a rib
2. Ober’s Staged Operation: Release → skeletal traction → soft tissue anchor to bone; gradual correction gives chance for less axillary traction
3. Wittek’s Scapulotomy: cut ½ inch lat. to med.border, and move the scapula down, so the inf. pole is inserted into a Lattissimus Dorsi Pocket, and cut the excess supero-medial angle
4. Green: entire sub-periosteal dissection + omovertebral bar & supraspinous excision. Move the scapula down, reattach the muscles into inferiorizing positions + skeletal traction
5. Woodward: subperiosteal dissection of ms attached to the spinous process. Excise the bar, enlarged supraspinous part, and periosteum. Trapezius and rhomboids are reattached into a lower spinous processes.

Congenital Clavicular Pseudoarthrosis
- Thought to be ↓ pressure by the subclavian artery on the developing bone
- Mid shaft painless lump
- Right sided usually except with dextro cardia
- ttt: Heals after excision and BG
**Supraspinatus Tendinitis**

**Definition:**
- Non infectious inflammation of one or more of the rotator cuff tendons, secondary to abnormal contact and compression of the rotator cuff under the coracoacromial arch.

**Epidemiology**
- More over 40 y
- More in overhead athlete
- More in overhead workers

**Anatomical consideration:**
- Rotator cuff muscles are:
  1. Supraspinatus (SS)
  2. Infraspinatus (IS)
  3. Teres minor (TM)
  4. Subscapularis

- Types of the acromion:

<table>
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<th>According to shape [Bigliani]</th>
<th>According to thickness</th>
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<tr>
<td>Type I ....................... Flat</td>
<td><strong>Type A ..................</strong> &lt; 8 mm</td>
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<tr>
<td>Type II ...................... Curved</td>
<td><strong>Type B ....................</strong> 8-12 mm</td>
</tr>
<tr>
<td>Type III ..................... Hooked</td>
<td><strong>Type C ....................</strong> &gt; 12 mm</td>
</tr>
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- Os-Acromiale is non-united acromial ossific centre → hypermobile → impingement
- Supraspinatus outlet is bounded by:
  1. Coracoacromial arch superiorly: formed by the acromion, coracoid, and the CA ligament
  2. Acromio-clavicular joint anteriorly
- Vascular supply of the rotator cuff:
  1. Suprascapular artery.
  2. Anterior circumflex humeral artery.
  3. Posterior circumflex humeral artery.
  4. Thoraco-acromial artery.
  5. Subscapular artery.
- The critical zone = hypovascular zone of the rotator cuff
  - 1cm medial to bony attachment
  - Area of anastomosis and limited potentiality for healing
  - Vascularity of this part depends on arm movement; elevation squeeze the vv →  filling

**Biomechanics**
- Normally during abduction the rotator cuff slides under the coracoacromial arch
- Beyond 90° abd there is added ER → allow RC to occupy widest part of subacromial space.

**Aetiology:**

![Image of Supraspinatus Tendinitis](image-url)

- Outlet
  - Type II & III acromion
  - Os Acromiale
  - AC OA
  - Overhang corcoid
  - PSGI
  - Bursitis: RA, Gout, use

- Non Outlet
  - Malunited GT

- Wind up
- Cocking
- Acceleration
- Deceleration
- Follow through
Pathogenesis:
- When the arm is held persistently in abduction and then moved to and fro in IR and ER, the rotator cuff is compressed against the anterior edge of the acromion
- Abduction, flexion, and internal rotation impose the maximum stress on the rotator cuff and this position is called the impingement position
- Mainly the impingement occurs at the critical zone of vascularity; i.e. 1 cm prox to tendon insertion
- **Internal Impingement** = dynamic compression occur between the postero-superior labrum and the HH [humeral head] especially in ABER athletes
- **Rotator Interval Tear** = Tear or laxity of the interval between the Supraspinatus and subscapularis tendons
- **Subcoracoid Impingement** = overhang coracoid impinge anteriorly on head during flexion IR. Dx by CT in cross chest position. Ttt by coracoid recession and reattachment of conjoint tendon

Pathology:
1. **Tendonopathy Stage**: ................................................................. (Wear)
   - It is the mildest type of injury and occurs in the form of swelling, oedema, and frictional bursitis
   - ↑ cell apoptosis, degeneration
   - ↑ glycosaminoglycans
   - Usually self limiting
2. **Tears** .......................................................................................... (Tear)
   - Occurs as a result of prolonged insult to the rotators
   - In young age: Acute micro tears heal by scarring & fibrocartilaginous metaplasia or calcification
   - In older age: Chronic partial or complete tears
3. **Healing** .......................................................................................... (Repair)
   - Vascular reaction and granulation followed by fibrosis
   - ↑ collagen III
   - Local congestion of the healing process may contribute to the further impingement
4. **Secondary Arthropathy**:
   - Neglected large tears eventually leads to mechanical disturbance with upward migration of the humeral head and abutting against the acromion
   - Abduction is severely restricted
   - OA of the glenohumeral joint is inevitable
   - Occasionally it is rapidly destructive “**milwaukee shoulder**”

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<th>Wear &amp; pain</th>
<th>Young</th>
<th>Middle</th>
<th>Old</th>
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<tr>
<td>Tear</td>
<td>Acute micro tears</td>
<td>Chronic</td>
<td>+++ (Partial or complete)</td>
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<td>Repair</td>
<td>Rapid and Painful</td>
<td>Less painful</td>
<td>Never Heal</td>
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**Classifications**:

**Rossi Classification for partial tears & impingement**:
1. Bursal Tear
2. Interstitial Tear
3. **Articular = PASTA** (Partial Articular SS Tendon Avulsion)
4. **PSGI = Internal Impingement = Postero-Superior Glenoid Impingement**
5. Subcoracoid impingement $ (θ overhang coracoid)

**Ellman Classification of Rotator cuff Tears**
1. Transverse
2. Crescent
3. L-Shaped
4. Reverse L
5. Trapezoid
6. Massive irreparable
**Diagnosis:**

**Clinically:** ........................................................................................................................................ See Page 4 for Special Tests

1. **STAGE OF ACUTE TENDINOAPTHY**
   1. **PAIN:**
      - Antero-lateral shoulder pain
      - Insidious onset, progressive course
      - More at night
      - \( \uparrow \) with over head activity
   2. **PAINFUL ARC** between 60°-120° abduction
   3. **TENDERNES** over the anterior edge of the acromion
   4. **+VE IMPINGEMENT SIGN:** pain with F AB IR
   5. **+VE IMPINGEMENT TEST:** 10 ml Lidocaine injection into the subacromial space and repeat the previous test it becomes -ve

2. **STAGE OF CHRONIC TENDINOAPTHY**
   1. **PAIN:**
      1. Recurrent attacks of anterior shoulder pain
      2. \( \downarrow \) worse at night
      3. \( \downarrow \) by lying upright
   2. **STIFFNESS**
   3. **CREPITATION** and snapping while moving the shoulder
   4. **\( \downarrow \) ADL**
   5. **-VE ARM DROP** sign

3. **STAGE OF CUFF TEAR**
   1. **PAIN:** Refractory chronic pain
   2. **STIFFNESS**
   3. **WASTING** of supra & infraspinatus
   4. **-VE ARM DROP** .................................................................partial tear (DDx chronic tendonitis)
   5. **+VE ARM DROP** =abduction paradox ..............................................complete tear
   6. **LOST ABDUCTION** even after subacromial injection..............Complete tear
   7. Biceps tenosynovitis
   8. AC tenderness
   9. Severe gleno-humeral OA and painful restricted ROM

**PXR:**
- Early: No changes
- Later: sclerosis and cyst formation
- Late:
  1. Humeral head migration ......................<7mm subacromial space is risky
  2. AC OA
  3. Gleno-humeral OA
  4. Os Acromiale, Hooked acromion
  5. Calcification of Supraspinatus tendon

**Arthrography**
- Reveal full thickness tear
- Reveal partial thickness humeral tear

**US**
- Reveal tears but it is operator dependant

**MRI**
- The most effective method to detect:
  1. Cuff tendonopathy
  2. Cuff tears
  3. AC pathology
  4. Biceps tendonopathy
  5. Coraco-Acromial arch anatomy
**DDx**

1. Adhesive capsulitis ........................................... Frozen shoulder, MRI thick capsule
2. AC OA ................................................................. Anterior pain, local injection relief test, PXR
3. SLAP lesions vs PSGI lesion ........................................... +ve speed test
4. Bennet lesion (post extra articular ossification adjacent to labrum) secondary to labral or capsular tears ........................................... Painful F Add IR, MRI & MRI arthrography
5. POLPSA lesion (posterior ALPSA) ......................... Posterior pain & instability, MRI

**Treatment:**

- **Conservative**
  1. Activity Modification
  2. Resting sling
  3. Physiotherapy
  4. NSAIDs
  5. Local steroid inj

- **Surgical:**

  o **Indications:**
    i. Young active pt
    ii. Failed conservative ttt for 3 mo
    iii. Signs of cuff tear
    iv. Recurrence

  o **Rationale:**
    i. Decompression (acromio-plasty & bursectomy)
    ii. Recession of the coraco-acromial lig
    iii. Repair of the cuff tear
    iv. AC joint recession

  o **Techniques:**
    i. Open: via anterior approach and deltoid split,
       - Expose the coracoacromial lig, then excise the ant acromion
       - Coracoacromial recession
       - Inspect the cuff and repair any tears
       - AC resection of protrusions, and if severe OA → distal clavicular resection
       - Reattachment of the deltoid is mandatory by any mean

    ii. Arthroscopic follow the same objectives, but no deltoid is split

  o **After care:** ................................................. Sling for 4-6 wk
    i. Passive pendulum ..................... 1st wk
    ii. Passive supine flexion .......... 2nd wk
    iii. Passive over head motion .... 3rd wk
    iv. Active assisted (wall walk) .... 4th wk
    v. Passive behind back T8 .......... 5th wk
    vi. abduction & IR to 60° .......... 6th wk
    vii. Active abd & flex ............ 7th wk
    viii. Isometric strengthening .......... 8th wk
    ix. Isotonic strengthening .......... >8th wk
**Shoulder Instability**

**Definition**
- Loss of the normal joint relationship among any of its parts; or in relation to the surrounding.

**Anatomical Considerations:** (Shoulder stabilizers)

1. **Passive:**
   a. **Joint Conformity:** articular surfaces match
   b. **Joint Geometry:** Head retroversion + scapular inclination + glenoid retroversion
   c. **Finite Joint Vol:** minute + closed joint space + minimal fluid → difficult distraction
   d. **Synovial Adhesion:** high surface tension → $\uparrow$ molecular & intermolecular attraction → difficult separation between glenoid and humeral head
   e. **Synovial Cohesion:** molecular attraction makes synovial fluid molecules remain together
   f. **Labrum:** deepens the joint ~ 5-10mm, & gives GHL attachment
   g. **Ligaments:** SGHL, MGHL, IGHL, CHL
   h. **Capsule**

2. **Active:**
   a. **Rotator cuff:** pull the head back into the glenoid
   b. **LHB:** • IR $\rightarrow$ $\downarrow$ tension of LHB $\rightarrow$ $\downarrow$ ant translation
      • ER $\rightarrow$ $\uparrow$ posterior translation
   c. **Proprioception:** guards against extremes of motion
   d. **Scapular Rotators tone i.e. trapezius, latissimus, serratus, rhomboids, & levator**

**Etiology:**

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<td>Treat</td>
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<td>Rehabilitation = Inferior cap shift &amp; Interval closure</td>
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**Pathology: (Anterior Dislocation)**

- Labral tear according to the pre-mentioned type ........................................ usually antero-inferior
- Glenoid osteo-chondral fracture $\rightarrow$ inverted pear shaped glenoid ............ in bony Bankart
- Hill Sachs Lesion: Postero-lateral superior humeral impaction # ................... anterior dislocation
- Reversed Hill Sachs: same but in ................................................................. posterior dislocation
- $\pm$ soft tissue inj e.g. RC, RI, LHB, or axillary n, or any axillary plexus injury

**Classification of Labral Tears:**

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<tbody>
<tr>
<td>1]. Bony Bankart</td>
<td>Anterior Glenoid rim # + its capsular &amp; lig attachments</td>
<td>Anterior Dislocation</td>
</tr>
<tr>
<td>2]. Bankart Lesion</td>
<td>Anterior labral + IGHL avulsion + periosteal disruption</td>
<td>Anterior dislocation</td>
</tr>
<tr>
<td>3]. Perthes Lesion</td>
<td>Same but with intact periosteum</td>
<td>Anterior dislocation</td>
</tr>
<tr>
<td>4]. ALPSA</td>
<td>Anterior Labro-ligamentous Periosteal Sleeve Avulsion</td>
<td>Anterior dislocation</td>
</tr>
<tr>
<td>5]. POLPSA</td>
<td>Posterior Labro-ligamentous Periosteal Sleeve Avulsion</td>
<td>Anterior dislocation</td>
</tr>
<tr>
<td>6]. HAGL</td>
<td>Humeral Avulsion of Gleno-Humeral ligament</td>
<td>Anterior dislocation</td>
</tr>
<tr>
<td>7]. BHAGL</td>
<td>Bone Humeral Avulsion of Gleno-Humeral ligament</td>
<td>Anterior dislocation</td>
</tr>
<tr>
<td>8]. Reverse HAGL</td>
<td>Same injury occurs to the posterior stabilizers</td>
<td>Posterior dislocation</td>
</tr>
<tr>
<td>9]. SLAP</td>
<td>Superior Labrum anterior to posterior tear</td>
<td>Fall on stretched hand</td>
</tr>
<tr>
<td>10]. GLAD</td>
<td>Glenoid Labrum Articular Disruption {labrum in place}</td>
<td>Anterior subluxation</td>
</tr>
</tbody>
</table>

**Complications:**

1. Recurrence ......20%
2. Vascular ............subclavian a & v
3. Axillary plasy ....DDX **QUADRILATE SPACE** $\}$
Diagnosis:

**Epidemiology** (young active male)

**Symptoms**
- History of dislocation, if not ask about: seizure or electric shock especially in posterior dislocation
- Pain and catch è ABER (over head activity) ù**DEAD ARM** syndrome
- Recurrence 20% Hill Sachs or bony Bankart
- Complications vascular, axillary palsy

**Signs**
1. ëve apprehension test
2. Jobe relocation test
3. Jerk test
4. Load & shift - Modified load & shift
5. Sulcus sign

**Grading**

<table>
<thead>
<tr>
<th><strong>ANTERIOR-POSTERIOR GRADING SCHEME</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Go</td>
<td>Normal amount of translation</td>
</tr>
<tr>
<td>G1</td>
<td>Translation to glenoid rim</td>
</tr>
<tr>
<td>G2</td>
<td>Translation over glenoid rim</td>
</tr>
<tr>
<td>G3</td>
<td>Translation + Locking over glenoid rim</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>SULCUS GRADING SCHEME</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>Acromio-Humeral interval &lt;1cm</td>
</tr>
<tr>
<td>G2</td>
<td>Acromio-Humeral interval 1-2 cm</td>
</tr>
<tr>
<td>G3</td>
<td>Acromio-Humeral interval &gt; 2 cm</td>
</tr>
</tbody>
</table>

**PXR:**
- Views: West Point/Garth/Stryker/AP IR ëSee Page 4 for the PXR views
- Axillary or Y views for missed posterior dislocations
- Associated Hill Sachs, Reversed Hill Sachs, or glenoid fractures

**CT** For associated fractures & Posterior dislocations, Hill Sachs, Reversed Hill Sachs

**MRI** Most sensitive & specific

**DD:**
- Adhesive capsulitis painful restriction, 3 stages, limited ER
- RCT & RIT (rotator cuff & rotator interval) no dislocation event, older age, impingement

**Treatment:**

<table>
<thead>
<tr>
<th><strong>OPEN PROCEDURES</strong></th>
<th><strong>FEATURE</strong></th>
<th><strong>REMARKS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Bankart</td>
<td>Reattachment of labrum &amp; IGHL to glenoid</td>
<td>Gold Standard</td>
</tr>
<tr>
<td>2. Putti Platt</td>
<td>Subscap advancement</td>
<td>ñ ER &amp; OA</td>
</tr>
<tr>
<td>3. Capsular shift</td>
<td>Inf capsule shifts superior “Pant over vest”</td>
<td>Over tightening, Gold st for MDI</td>
</tr>
<tr>
<td>4. Magnuson Stack</td>
<td>Subscapularis transfer to greater tuberosity</td>
<td>ñ ER</td>
</tr>
<tr>
<td>5. Boyd-Sisk</td>
<td>Transfer of biceps lat &amp; posterior</td>
<td>Non anatomic recurrence</td>
</tr>
<tr>
<td>6. Staple capsulorrhaphy</td>
<td>Capsular reattachment and tightening</td>
<td>Staple migration</td>
</tr>
<tr>
<td>7. Bristow-Latterjet</td>
<td>Tip of coracoid transfer to inf glenoid</td>
<td>Nonunion, migration, labral tears</td>
</tr>
<tr>
<td>8. Trillat</td>
<td>All coracoid transfer to inferior glenoid</td>
<td>Non union</td>
</tr>
<tr>
<td>9. Bone Block osteotomy</td>
<td>Anterior bone block</td>
<td>Nonunion, migration, articular injury</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>ARTHROSCOPIC PROCEDURES</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>10. Knotted anchors</td>
<td>Reattach labrum &amp; capsule to glenoid</td>
</tr>
<tr>
<td>11. Knotless Anchors</td>
<td>Same è strong hold without knots</td>
</tr>
<tr>
<td>12. Capsular shrinkage</td>
<td>Anterior capsule radiofrequency shrinkage</td>
</tr>
</tbody>
</table>
Posterior Instability

**Ätiology:**
1. Violent jerk in abnormal position
2. Epileptic fit
3. Electric shock

**Pathology:**
- Posterior capsule stripped or stretched
- Humeral head indentation anteriorly = reversed Hill-Sachs
- ± proximal humeral fracture
- Recurrent subluxation 50% in flexion IR positions → +ve drawer, apprehension

**Clinically**
- Rare and often missed
- Pain in external rotation
1. Arm held in IR and maneuvers to ER are painful
2. +ve posterior drawer 1 hand hold spine & coracoid, & 1 hand holds the head
3. +ve apprehension test flexion, IR + axial loading on elbow → pain

**PXR**
- **LIGHT BULB** = end on appearance of the proximal humerus δ IR
- Axillary view in abduction is ideal for diagnosis
- Lateral scapular Y view also is diagnostic

**CT**
is diagnostic, assess glenoid inclination and retroversion

**MRI** is sensitive for labral, capsular, ligamentous assessment

**Treatment**
1. Muscle strengthening
2. Activity modification to avoid the vulnerable positions
3. Surgery if:
   - Uncontrollable laxity
   - Disabling condition
   - Emotionally stable patients only
   - Modalities:
     a. Post bone block with capsular repair
     b. Reversed Putti-Platt TM & IS advancement
     c. Humeral or glenoid osteotomies if glenoid retroversion is seen on CT
- After care: arm is held in spica in abduction ER for 6wk

Multidirectional Instability

**Ätiology: AMBRI** see before

**Pathology:**
- Capsule thin & lax
- RC weak
- Labrum + compliance
- Glenoid Shallow

**Clinically**
1. Little force is required for displacement, even with little stressful activities
2. Generalized laxity may be noticed
3. +ve anterior & posterior drawer 1 hand hold spine & coracoid, & 1 hand holds the head
4. +ve apprehension test flexion, IR + axial loading on elbow → pain

**Treatment**
1. Muscle strengthening
2. Activity modification
3. Inf capsular shift + interval closure rarely indicated
Slap Lesion

**Definition:**
- Superior Labral Anterior to Posterior lesion

**Epidemiology**
- Usually following fall on outstretched hand
- Young male

**Pathologic Classification**

<table>
<thead>
<tr>
<th>PATHOLOGY</th>
<th>TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>G I          Degenerative fraying</td>
<td>Debridement</td>
</tr>
<tr>
<td>G II         Detached superior labrum + biceps anchor</td>
<td>Stabilization</td>
</tr>
<tr>
<td>G III        Bucket handle sup labrum + intact biceps</td>
<td>Debridement</td>
</tr>
<tr>
<td>G IV         Bucket handle sup labrum + biceps anchor</td>
<td>Stabilization ± biceps tenodesis</td>
</tr>
<tr>
<td>G V          SLAP extends to ant labrum</td>
<td>Stabilization</td>
</tr>
<tr>
<td>G VI         SLAP extends as superior flap tear</td>
<td>Debridement</td>
</tr>
<tr>
<td>G VII        SLAP extends to MGHL</td>
<td>Stabilization</td>
</tr>
<tr>
<td>G VIII       SLAP extends to posterior labrum</td>
<td>Stabilization</td>
</tr>
<tr>
<td>G IX         SLAP extends circumferentially</td>
<td>Stabilization</td>
</tr>
</tbody>
</table>

**Diagnosis:**

**Clinically:**
- Bicepital groove tenderness
- +ve Speed’s test
- +ve Yergeson’s test
- +ve Crank test
- +ve O’Brien’s test

**PXR:**
- For associated lesions

**MRI**
- Diagnostic

**Treatment:**
- NSAIDs
- Activity modification
- Physiotherapy & ms strengthening
- Surgical stabilization & reattachment of the detached labrum

---

**Buford Complex:**
- Antero-sup labrum is absent + cord like MGHL

**Sublabral Hole:**
- Antero-sup labrum exists without osseous attachment

**Biceps Subluxation:**
- Usually associated é subscap tears, or transverse humeral lig tear
- Palpable click felt é abd ER
- ttt: strengthening, release, groove deepening, or tenodesis

**Bicepital tendinitis and tears**
- Usually secondary to RC disease
- Tender bicipital groove é IR & ER + speed & Yerguson
- ttt: tenodesis (trans-osseous, Key-hole technique, anchors)

---

**Snapping Scapula**

- Is painful scapulo-thoracic crepitus associated with arm elevation
- Many causes:
  1. Traumatic non & mal united scapular fractures
  2. Inflammatory subacromial bursitis
  3. Tumors: osteochondroma of subscapular fossa
  4. Scapulo-thoracic dyskinesia
- Pain is relieved by manual stabilization of the scapula
- PXR: scapular tangential Y view to exclude osteochondroma
- Treatment:
  - Scapular strengthening
  - NSAIDs
  - Local injections
  - Arthroscopic bursectomy
  - Medial border excision
Adhesive Capsulitis

Frozen Shoulder

Definition
- Must be reserved for a condition é progressive idiopathic painful restriction of shoulder movements ð fibrovascular proliferation and subsequent fibrosis, which resolve spontaneously

Epidemiology
- 40-60y
- More in females

Aetiology:
1. DM
2. Hyper lipidaemia
3. Trauma
4. Chest or breast surgery
5. Neurosurgeries
6. Prolonged immobilization
7. Thyroid disease
8. Dupuytren’s disease

Pathology: .......................................................................................................................... 3 phases (6-9 mo each)
- Fibrovascular infiltration followed by wide spread fibrosis at:
  o Rotator interval .............................. RI
  o Coraco-Humeral ligament .............. CHL
  o Anterior capsule ........................... AC

<table>
<thead>
<tr>
<th>PHASE</th>
<th>PATHOLOGIC FEATURES</th>
<th>CLINICALLY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Active</td>
<td>Inflammatory fibrovascular infiltration of RI, CHL, AC</td>
<td>Painful</td>
</tr>
<tr>
<td>2. Freeze</td>
<td>Wide spread fibrosis at RI, AC, CHL</td>
<td>Marked stiffness</td>
</tr>
<tr>
<td>3. Thaw</td>
<td>Fibrosis cease and fibrovascular tissue production</td>
<td>Regain ROM &amp; pain</td>
</tr>
</tbody>
</table>

Diagnosis:
Clinically:
- Symptoms:
  1. Progressive pain after trivial trauma, usually more at night
  2. ⊳ ROM as the pain ameliorates
  3. When pain disappears → ROM is regained
- Signs:
  1. Wasting of shoulder ms
  2. Mild tenderness
  3. Marked limitation of passive and active movements

XRR:
- Late disuse osteopenia  and  exclude other causes

MRI:
- Thickened anterior capsule and RI

DD:
other conditions must be excluded first before diagnosis of frozen shoulder
1. Infection .............................................................. at first 2 days may be not evident
2. Trauma .............................................................. Pain starts maximum then decrease
3. Disuse stiffness .................................................. prolonged immobilization, pain with motion only
4. RSD ................................................................. Trophic and vasomotor changes

Treatment:
1. NSAIDs + Reassurance
2. Regular pendulum exercises
3. Steroid injection
4. Manipulation UGA: Flexion¹ → ER² → Abd ER³ → Abd IR⁴ → Cross Chest⁵ → inj → early ROM
5. Distension therapy: 200ml saline inj under pressure (both methods rupture the capsule)
6. Open or arthroscopic release of RI, CHL, AC

Frozen Shoulder Triad
1. Painful restricted motion
2. Triphasic history
3. Normal PXR
Complex Regional Pain Syndrome (CRPS)

- An abnormal sympathetic firing 2ry to minor injury
- Synonyms: Reflex Sympathetic Dystrophy (RDS) = Sudeck’s Atrophy = Causalgia

Aetiology:

1. Minor trauma out of proportion
2. Surgery
3. Myocardial infarction
4. Brain & cord lesions
5. Infections
6. Repetitive trauma e.g. carpal tunnel.

Pathology:

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute Stage</td>
<td>Alldynia &amp; trophic changes &amp; cool cyanotic skin</td>
</tr>
<tr>
<td>Langford Old Class</td>
<td></td>
</tr>
</tbody>
</table>
1. Minor Causalgia
2. Minor Traumatic Dystrophy
3. Major Causalgia
4. Major Trauma Dystrophy
5. Shoulder Hand
| New Class | 
CRPS Type I (RSD)
CRPS Type II (Causalgia)

Diagnosis:  
weeks to years é remission and exacerbation

I. Pain – The hallmark is pain and ROM

1. Severe, constant, burning or deep aching pain.
2. Allodynia: All tactile of the skin are painful even a light breeze
3. Hyperpathia: Repetitive tactile stimulation e.g. tapping pain + prolonged after-sense
4. MS Trigger Points = Myofascial Pain $ = point-tender spots in the ms & ms spasms
5. Paroxysmal lancinating pains & sharp pain jabs in the affected region
6. Dysesthesias: Either warm or cold perception of touch or even without touch

II. Skin: All may é changes in the room temperature, especially cold environments

1. Shiny, edematous: Pitting brawny, é tying bands around the limb (done for comfort)
2. Vasomotor Changes: Chromatic changes; white mottled, red, or blue appearance
3. Sudomotor Changes: é sweating or chilling of the skin
4. Pilomotor Changes: Goose Flesh
5. Hair & Nails initially grows coarse and then thins out → brittle (1st fast growth= RDS)
6. Rash: Scales, ulcers and pustules µβ life-threatening recurring infections → amputation

III. ROM &:

1. Associated pain
2. Disuse Atrophy
3. Direct of CRPS on ms
4. Tremors and jerking
5. Cramps: sudden incapacitating
6. Dystonia: é ms tone → ms relaxation

IV. Spreading Symptoms:

<table>
<thead>
<tr>
<th>Maleki Spread Patterns</th>
<th>Community Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mirror-Image Type</td>
<td>Spread to the contralateral limb</td>
</tr>
<tr>
<td>Independent Type</td>
<td>Spread to a distant region of the body</td>
</tr>
</tbody>
</table>

Investigations:

- Patchy Osteoporosis on PXR
- Triphasic Tc is specific → diffuse tracer uptake
- Sympathetic stellate ganglion block

Treatment:

1. Sympathetic Block [stellate ganglion]
2. Active ROM exercises
3. Vasodilators
4. Steroids.
5. Treatment of the cause
Winging Scapula

**Causes:**

1. Bony abnormality: (scapula, ribs, spine)
   a. Osteochondroma
   b. Malunited fracture
2. Muscle:
   a. Contracture
   b. Dystrophy (FSHD)
   c. Elasto-fibroma-dorsi (female, 50y, may be bilateral)
3. Intra-articular pathology
4. Nerve injuries:

<table>
<thead>
<tr>
<th>NERVE</th>
<th>Affected MS</th>
<th>Winging Direction</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long thoracic</td>
<td>Serratus</td>
<td>Medial (⊖ protraction)</td>
<td>Transfer of sternal pec major to inf pole</td>
</tr>
<tr>
<td>Spinal accessory</td>
<td>Trapezius</td>
<td>Lateral (⊖ retraction)</td>
<td>Lateral transfer of rhomboid &amp; levator</td>
</tr>
<tr>
<td>Dorsal scapular</td>
<td>Rhomboideus</td>
<td>Infero-lat</td>
<td></td>
</tr>
</tbody>
</table>

**Types:**

1. Classic winging: the medial border moves away from the posterior chest wall
2. Rotary winging: the inferior angle moves away from the midline as compared to the other side
3. Dynamic winging: usually nervous and occurs with movement
4. Static winging: usually bony structural causes
5. Scapular tilting: superior or inferior border moves out from the chest wall

Little Leaguer’s Shoulder

- Salter Harris I slipped epiphysis of the humeral head
- PXR: wide proximal humeral physis
- Ttt:
  a. Rest
  b. Activity modification
Shoulder Arthroplasty

**Anatomical considerations:**
- Humeral head is a 140° arc of a sphere with a radius of ~ 25mm (radius of TSA is 44mm)
- Head:
  1. Thickness (BC) .......................... 15-23 mm (determined by either we need to RC lever arm, or tension on the RC if needs a repair)
  2. Retroversion ................................. 30°
  3. Neck shaft inclination (α) .................. 45° to the horizontal plane
  4. Offset:
     - Lateral offset (FH) .................. > 50mm (head thickness)
     - Vertical offset (ED) ............ > 10mm (head thickness)
     - Posterior offset: rotation of a modular head over the stem in some designs
- Glenoid (curvature radius < 2-3 mm larger than the head)
  1. Retroversion on scapula ............ 6°
  2. Inclined superiorly .............. 6°
  3. Scapula anteversion .............. 30°

**Indications:**
1. Unremitting pain
2. Uncontrolled loss of function
3. Traumatic:
   - Four part fracture
   - Three part fracture: GT involvement in the elderly
   - Head split fracture
   - Dislocation + OA
4. Inflammatory: if failed conservative treatment in OA & RA
5. Tumors of the proximal humerus
6. AVN

**Contra-indications:**
1. Active infection
2. Severe bone loss
3. Mild symptoms and pathologies
4. Functional loss of RC
5. Paralyzed RC or deltoid

**Alternatives:**
1. Open debridement .......................... young mild OA
2. Arthroscopic debridement .................. Poor candidate for arthroplasty
3. Soft tissue balance ........................ IR contracture
4. Humeral head resection .................. good salvage in infection, failed arthroplasty
5. Arthrodesis ............................. Paralytic conditions

**Types**
1. Humeral head replacement
2. Total shoulder arthroplasty
   a. Unconstrained: NeerII, isoelastic, bipolar, ...
   b. Semiconstrained
   c. Constrained .................................. failure rate
      i. Ball and Socket
      ii. Reversed ball and socket ....... for cuff arthropathy; e.g. NeerIII, DeltaIII
**Head replacement vs Total replacement**

**Total Arthroplasty Is Done For:**
1. Glenoid incongruity
2. Good RC, or small tears
3. Good bone stalk

**C/I**
1. RC insufficiency → Sup Glenoid Stresses → failure
2. Glenoid insufficiency (Eroded by OA, #)

**Head Replacement is done for**
1. Intact glenoid
2. Large RC tears

**Operative Technique**

**Approach**
- Semi-setting position é shoulder out of the table to allow for extension
- GA + interscalene block
- Delto-pectoral approach is done
- Avoid coracoid osteotomy → avoid Musculo-cutaneous nerve injury
- Free subacromial space from bursal adhesion
- Preserve coraco-acromial arch except if severe impingement
- Preserve LHB
- Release pec major insertion if needed
- Identify the axillary nerve by TUG TEST
- Release subscapularis & capsule together; starting from most lateral aspect of LT

**Humeral prepartion**
- Excise all osteophytes & loose bodies is far beneficial in:
  a. ↑ excursion of the soft tissue
  b. Give an exact idea about the normal head
  c. Prevent over resection of the head; not to jeopardize the axillary n, and RC
- Dislocate the shoulder by ER + Ext; this is facilitated by release of inferior & post-inf capsule
- Determine the precise location of post RC insertion to avoid its inj during head resection
- Note superior head is eroded i.e. head centre is lower than normal
- Head cut is done & avoid excessive removal by 30°-40° ER & cut is done parallel (or by using epicondyles as a reference to horizontal)
- Lat fin of stem must be 5-10mm post to post edge of bicipital groove
- Superior end of osteotomy must exit above the insertion of post cuff
- ↑ cut retroversion ........................................ for post instability
- ↑ cut retroversion ........................................ for anterior instability
- Do the canal reaming & make a Slot by narrow ronguer for lat fin (↑ incidence of GT#)

**Stem application**
- Trial is done; keeping the fin in the made slot, to adjust the retroversion
- Height is adjusted éin ≈ 8-10mm (if less ....GT impingement)
- Posterior offset is adjusted in some modular implants
- Soft tissue balance is adjusted to be within:
  o 50% translation of humeral head
  o 40° ER with arm at side
- Trial removed, 2 drill holes are done at ant. humeral neck; and pass non absorbable suture within these holes for subscapularis repair
- Cementation without pressurization (to avoid cement extrusion into the weak humerus)
- Introduce the stem with its fin in the slot as mentioned

**Glenoid** if needed only
- Humeral head retractor is applied and head is retracted posteriorly
- Excise all the labrum and soft tissue around the glenoid
According to the prosthesis technique preparation of the glenoid is done
- Apply cement first and pressurized by an edge of a gauze ball, into the holes or keel bed
- Another cement pulse is applied by a syringe; followed by the PE and hold it till it set
- Apply the stem into the medulla, & test for stability and soft tissue balance as mentioned

**Rehabilitation**

Three Phases:
1. Phase I: local heat, PROM, AAROM...................... (0-6wk)
   - Sling
   - Passive elevation & rotation
   - AAROM elevation & ER (IR is postponed to protect the subscap till 6wk)
   - Pendulum
   - Pulley exercises
   - Stick excercises
   - Wrist and hand exercises, is begun on the first day after surgery.
   - Avoid pushing up from bed or chair
2. Phase II: starts AROM & exercises .............................. (6-10wk)
   - Remove the sling
   - Start AROM elevation & rotation
3. Phase III: ms stretching + resistive exercises .......... (10wk)
   - Isometric elbow
   - Unrestricted activity is permitted
   - Avoid participation in contact sports till 6mo
   - Exercises ~ five times a day for 10 min

**Complications**

**INTRAOPERATIVE COMPLICATIONS**
1. Humeral shaft fracture ........................................... 1%
2. Axillary nerve inj
3. Malpositioning of components.

**POSTOPERATIVE COMPLICATIONS**
1. Glenoid loosening
2. Tuberosity nonunion or malunion
3. Instability
   - Anterior instability .................................. ð too small humeral head
   - Posterior instability ............................. ð malpositioning of the components.
   - Inferior instability ............................... ð loss of humeral height after prox humeral fractures.
4. Rotator Cuff Tear (2%)
5. Infection (< 0.5%). Staphylococcus aureus or gram-positive organisms Implant
6. Loosening Dx by a change in implant position or progression of radiolucent lines.
7. Heterotopic Ossification
8. Stiffness
9. Periprosthetic Fracture