Shoulder Dislocation and Instability

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Objectives

• Brief History & Epidemiology
• Principles
  – Mechanism of Injury
  – Signs and Symptoms
  – Radiographic Studies
  – Associated Injuries
  – Rationale of Treatment
  – Classification
• Anatomy
• Current Treatment Options
• Rockwood’s Pearls + Pitfalls
• Complications
Brief History + Epidemiology

- Documented in Egyptian tombs as early as 3000 BC, with reduction maneuver resembling Kocher technique

- Hippocrates detailed the oldest known reduction method (Hippocratic Method)

- Most common joint dislocation
- Most mobile joint in the human body
- Bimodal incidence of dislocation
  - (20-30 yrs, M:F=9:1) vs. (61-80 yrs, F:M=3:1)
Principles

• Mechanism of Injury
  – 95% are acute traumatic insult
  – **Anterior** (Abduction, ER, Extension)
    • 95% of all dislocations
  – **Posterior** (Adduction, IR, Flexion, Axial Load)
    • 4% of all dislocations
    • EtOH, Epilepsy (Seizures), Electric Shock
    • If seizure, look for bilateral
  – **Inferior** (Luxatio Erecta)
    • 0.5% of all dislocations
    • Hyperabduction or Axial force on overhead arm
  – **Superior** (Rare)
  – **Intrathoracic** (Rare)
Signs and Symptoms

• **Anterior**
  – Abduction + ER + Pain, thus limited Adduction + IR
  – "Squared off" shoulder (loss of deltoid contour)
  – Head palpable anteriorly
  – NVS check (Axillary motor/sensory, distal pulses)

• **Posterior**
  – Adduction + IR + Pain, thus limited Abduction + ER
  – Prominent Coracoid process
  – Posterior shoulder is full, head palpable beneath Acromion
  – NVS check (Axillary motor/sensory, distal pulses)

• **Inferior**
  – Arm is fully abducted with flexed elbow or behind head
  – Head palpable on lateral chest wall
Clinical Presentation of Instability

• Detailed history
  – Age, Gender, Occupation
  – Hand Dominance, Sporting Level
  – HPI, PHx, PSx, Allergies, Meds

• HPI
  – Pain (PQRST)
  – Instability (Frequency, Severity, Positions)
    • Mechanism (Timing, Energy, Position, Degree of Instability)
    • Voluntarily vs. Non-Voluntarily
    • Weakness, Numbness, Tingling. (NVS during instability)
Clinical Presentation of Instability

• O/E
  – Look, Feel, Move = compare to NORMAL side !!
  – Generalized Laxity
    • Hyperextension (Elbow, MCP, Knee), Hyperflexion (Wrist)
  – Special Tests (try to reproduce Pain +/- Instability)
    • **Drawer** (stabilize girdle, push into head, translate Ant/Post ➔ positive if reproduces Pain or Instability)
    • **Sulcus** (downward traction on shoulder ➔ positive if produces a sulcus/dimple)
    • **Apprehension** (supine for Ant, prone for Post)
      – e.g. (Ant = Abd + ER), if causes apprehension and relieved by reduction then positive
      – **Fulcrum** = apprehension test with posterior-to-anterior force to exacerbate the feeling of instability
      – **Relocation** = apprehension test with anterior-to-posterior force to reduce the feeling of instability
      – **Crank** = sitting, same as apprehension but apply a posterior-to-anterior force to exacerbate the feeling of instability
Radiographic Studies

- True AP
- Lateral = “Y” sign
- Axillary
- Velpeau Axillary
- West Point
- Garth (AP Oblique)
- Stryker Notch

- CT +/- 3D
  - Bony anatomy
- MRI +/- Arthrogram
  - Soft tissues, Muscles
  - Rotator Cuff Tears (100% Sen, 95% Spe)
  - Labrum Tears (88% Sen, 93% Spe)
  - Bone edema

- U/S
  - RCT
  - Joint Effusion
West Point view for the identification of a **glenoid rim lesion**. This x-ray is taken with the patient in the prone position. The beam is angled approximately 25 degrees to provide a tangential view of the glenoid. In addition, the beam is angled 25 degrees downward to highlight the anterior and posterior aspects of the glenoid. In this fashion, the entire glenoid rim can be clearly visualized.

Apical oblique (Garth) view for the identification of a **glenoid rim lesion**. This x-ray is taken with the beam angled approximately 45 degrees to provide a tangential view of the glenoid. In addition, the beam is angled 45 degrees downward to highlight the anterior inferior aspect of the glenoid. As such, a bony defect in the anterior inferior aspect of the glenoid can be easily visualized.
**Stryker notch view** for humeral head defects. The patient is in the supine position with the arm flexed to 120 degrees so that the hand can be placed on top of the head. The x-ray beam is then angled approximately 10 degrees. The x-ray can clearly reveal the presence of any osseous defects (arrow).
Associated Injuries

• **Soft Tissue**
  – Rotator Cuff Tears
  – Labral Tears (Bankart = Anteroinferior)

• **Bony**
  – Humeral head # (surgical > anatomic neck)
  – Tuberosity #
  – Gelnoid #
  – **Impression Fractures**
    • Ant Dislocation = Posterolateral Head Defect
      – Hill-Sachs Lesions
    • Post Dislocation = Anteromedial Head Defect
      – Reverse Hill-Sachs lesions

• **Neurological**
  – Axillary nerve
    (Neuropraxia > Axonotmesis > Neurotmesis)
  – Brachial Plexus
  – Radial nerve (originates from posterior cord, same as Axillary nerve)

• **Vascular**
  – Axillary artery (up to 10% with inferior dislocations)
Associated Injuries

- **1st time shoulder dislocation**
  - Incidence of humeral head defect = 40%
- **Recurrent instability/dislocation**
  - Incidence of humeral head defect = 60%
- **Rotator Cuff Tears**
  - Overall 15% for all dislocations
  - Increases with age (>40 yo = 35%, >60 yo = 80%)
- **Neurological Injury**
  - 5-25% clinically relevant
  - Monitor for 3 months, if no return then do EMG
  - If disappears post-reduction consider exploration
Rationale for Treatment

• 1\textsuperscript{st} time dislocation
  – Rate of recurrent instability = 25-50%
  – Factors affecting likelihood of recurrent instability
    • Age MOST important
      – < 20 yrs = incidence of recurrent = 55-95%
      – > 40 yrs = incidence of recurrent = <6%
    • Level of Sporting (if age is constant)
      – Non-athletic = incidence of recurrent = 30%
      – Athletes = incidence of recurrent = 80%
    • Compliance
    • Associated Injuries
Rationale for Treatment

• **TUBS**
  – Traumatic
  – Unidirectional
  – Bankart Lesion
  – Surgery is often necessary

• **AMBRI** (general systemic laxity, goal to strengthen dynamic stabilizers)
  – Atraumatic
  – Multidirectional or
  – Bilateral
  – Rehabilitation is the primary mode of treatment
  – Inferior capsular shift is often preformed during surgery
Classification

- **Severity**
  - Subluxation vs. Dislocation
- **Duration**
  - Acute (24-36 hrs) vs. Chronic
- **Occurrence**
  - Single vs. Recurrent
- **Mechanism**
  - Traumatic vs. Atraumatic
- **Direction**
  - Ant, Post, Inf, Sup, Intrathoracic, Multidirectional
Anatomy

- **Static Stabilizers**
  - Glenoid, Humerus
    - Glenoid + Scapula anteverted 30-40 degrees
    - Humeral head retroverted 30-40 degrees
    - Coracoacromial Arch
  - Ligaments
    - Superior, Middle, Inferior, Coracohumeral
  - Glenoid Labrum
    - Deepens glenoid surface by 1cm (50% more contact area)
  - Capsule
    - Loose in most ranges, but at extremes it tightens, acts as constraint

- **Dynamic Stabilizers**
  - Synovium
    - Osmotic action removes free fluid, causing negative pressure
  - Rotator Cuff Muscles
    - Supraspinatus, Infraspinatus, Teres Minor, Subscapularis
    - Contracts against displacing forces and moves humeral head medial
  - Biceps Tendon
    - Under tension it stabilizes the joint anteriorly
Current Treatment Options

- Close Reduction
  1. Pre-reduction NVS status
  2. Muscle relaxation (analgesia + sedation)
     - +/- Intra-articular analgesia (lidocaine)
  3. Reduction Maneuvers
     - Hippocratic, Modified Hippocratic, Kocher, External Rotation, Stimson, Milch Technique, Scapular Rotation
  4. Immobilization
  5. X-ray confirmation
  6. Post-reduction NVS status
  7. Rehab
Current Treatment Options: **Closed Reduction Techniques = ANTERIOR**

The **Hippocratic** method (A) uses inferior traction on the arm against the countertraction provided by the foot on the thorax. Do not place the foot in the axilla, as this could cause damage to the underlying neurovascular structures. A **modified Hippocratic** technique (B) uses a hand-held sheet around the thorax to provide countertraction.

**Stimson technique** for closed shoulder reduction. With the patient in prone position, **weight (5-10 lbs)** is hung from the wrist to distract the shoulder joint. Eventually **(10-20 minutes)**, with sufficient fatigue in the shoulder musculature, the joint can be easily reduced.
Current Treatment Options: **Closed Reduction Techniques = ANTERIOR**

**Scapular rotation**
- Success rates >90% in experienced hands
  - **Prone**
    - Apply manual traction of 5-15 lbs of hanging weight to the wrist
    - After relaxation, rotate the inferior tip of the scapula medially and the superior aspect laterally
  - **Seated**
    - Assistant provides traction + countertraction by pulling on the wrist with one hand and bracing the upper chest with the other
    - After relaxation, rotate the inferior tip of the scapula medially and the superior aspect laterally

**External rotation**
- Supine/Seated, adduct the arm and flex elbow to 90 degrees
- Slowly rotate the arm externally
- Translate head Anterior-to-Posterior
- Slow abduction + IR when in joint

**Kocher technique**
- Supine, Humerus traction, Adducted + ER + Flexion
- If reduction does not occur with this maneuver, the arm is then IR + adducted
Current Treatment Options: **Closed Reduction Techniques = ANTERIOR**

**Milch Technique**
- Prone, arm off the bed (fig 1)
- Elbow flexed (fig 2)
- Traction + Flexion + ER shoulder + Abduction
Current Treatment Options: Closed Reduction Techniques

• **Posterior dislocation**
  – Gentle, prolonged axial traction on the Humerus
  – Add gentle Posterior-to-Anterior pressure while coaxing the humeral head over the glenoid rim
  – Slow ER may be needed

• **Inferior dislocation**
  – Gentle axial traction on the Humerus + Abduction
  – Countertraction across the ipsilateral shoulder
  – Following reduction, slowly adduct the arm
  – Buttonholing of the humeral head through the capsule usually requires open reduction
Current Treatment Options: Immobilization

• Type
  – Simple sling, Shoulder Immobilizer
  – 30 degrees ER better than 30 degrees IR
    (Itoi E et al, 2003, Japan)
    • 30% recurrent dislocations with IR immobilization
    • 0% with ER immobilization

• Duration
  – No good evidence
  – 3 months was required to restore normal collagen structure in primate capsule studies

• Overall goal
  1. Static Stabilizers healing and strengthening
  2. Dynamic Stabilizers healing and strengthening
Current Treatment Options: Rehab

• **Phase I**
  – Rest and Immobilization (30 degrees ER)
  – Pain control with NSAID and Ice applied to the shoulder

• **Phase II**
  – Isometric strengthening
    • Length of muscle and joint angle does NOT change = Static exercises
  – Isotonic strengthening
    • Tension remains constant while muscle length changes = Fixed resistance
  – Begin exercises with shoulder in adducted, forward- flexed position, progressing to abducted position

• **Phase III**
  – Endurance building along with strengthening exercises
  – Goal: the patient reaches 90% strength in the injured shoulder compared with the uninjured shoulder

• **Phase IV**
  – Increase activity to sport- or job-specific activities
Current Treatment Options: Operative

• **Anterior Instability**
  
  – **Indications:**
    1. Failed nonoperative
    2. Recurrent dislocation at young age
    3. Irreducible dislocation
    4. Open dislocation
    5. Unstable reduction
    6. 1\textsuperscript{st} time YOUNG dislocation with HIGH demands (TUBS)
  
  – **Surgical Options:**
    • Arthroscopic
    • Open with soft tissue repair
    • Open with bony augmentation
## Current Treatment Options: Operative

### Advantages and Disadvantages of Arthroscopic Stabilization for Anterior Shoulder Instability

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
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<tbody>
<tr>
<td>Improved cosmesis</td>
<td>Technically demanding</td>
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<tr>
<td>Shorter operative time</td>
<td>Difficult in revision cases</td>
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<tr>
<td>Shorter hospital stay</td>
<td>Difficult with altered anatomy</td>
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<tr>
<td>Decreased morbidities</td>
<td>Cannot address bony defects</td>
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<td>Decreased complications</td>
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<td>Lower cost</td>
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- Healing time of repair is NOT different between groups
- Labral repairs (suture anchors, sutures) – excellent results with repair
- Rotator Cuff Repair – good to excellent results
- Capsule repairs or tightening (Thermal Capsulorrhaphy) – mixed results
Current Treatment Options: Operative

- Anterior Approach (Deltopectoral)
  - Landmarks (Coracoid process and Deltoid insertion)
  - Deltoid (Axillary n.) and Pectoralis Major (Medial + Lateral Pectoralis n.)
  - Cephalic Vein defines interval
  - Conjoint tendon (Coracobrachialis + Short Head of Biceps) retracted medially to protect Musculocutaneous n.
  - Subscapularis tendon split
    - Putti-Platt Procedure = Subscapularis imbrication
      - 55-85% success with 9-35% recurrent instability
      - Loss of strength + ER + Arthritis + Post Sublux
    - Magnuson-Stack Procedure = Subscap transfer
      - 90-97% success with 5% recurrent instability
      - Loss of ER + Arthritis + Post Sublux
  - Capsule incised
    - Labral Bankart Procedure (Sutures, Suture Anchors)
      - 88-94% success with 0-8% recurrent dislocation
    - Capsulolabral Reconstruction (Imbrication)
      - 92-96% success with 0-4% recurrent dislocation
Current Treatment Options: Operative

- Bony Procedures
  - Bristow procedure
    - Coracoid tip with conjoint tendon transfer thru subscapularis to anteroinferior glenoid rim
    - 82-97% success, 0-6% recurrent dislocations
    - Loss of ER + arthritis + graft nonunion + screw issues
  - Latarjet procedure
    - Coracoid process (large piece) transfer to glenoid neck
    - 88-93% success, 2-10% recurrent instability
    - Loss of ER + arthritis + graft nonunion + screw issues
  - Eden-Hybbinette Procedure
    - Iliac crest bone graft attach to anterior glenoid
    - 75-85% success, 4-33% recurrent instability
    - Arthritis 47-89%

- Impression Fractures
  - >40% Surface Area Involvement
    - Young Patients = Graft
    - Older Patients = Hemiarthroplasty / Resurfacing
Current Treatment Options: Operative

- **Posterior Instability**
  - **Indications:**
    - Failed nonoperative
    - Irreducible dislocation
    - Open dislocation
    - Unstable reduction
  - **Surgical Options:**
    - Arthroscopic
    - Open Anterior Procedure
    - Open Posterior Procedure
Current Treatment Options: Operative

- **Arthroscopic**
  - Capsular repair/capsulorrhaphy, Labral repair
    - 86-96% success, 0-7% recurrent instability

- **Open Anterior Procedure**
  - Deltpectorile approach
  - Capsular release and transfer to remove redundancy + imbrication
  - RCT repair
  - McLaughlin Procedure, Neer Modification (reverse Hill-Sachs repair)
    - Transfer of subscap tendon into lesion

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**FIGURE 34-31** McLaughlin operation. In the presence of a large anterior humeral head lesion, the subscapularis tendon can be transferred into the defect. A subsequent modification by Neer transfers the lesser tuberosity with the attached subscapularis tendon.
Current Treatment Options: Operative

- **Open Posterior Procedures**
  - Posterior approach
  - Infraspinatus (Suprascapular n.) and Teres Minor (Axillary n.)
  - Posterolateral acromion extend to axilla
  - Deltoid fibers can be split from acromion to Teres minor
  - Infraspinatus can be incised + reflected medially
  - **Watch out for Quadrilateral space**
    - Axillary n. + Posterior Circumflex a.
    - Teres minor, Humerus, Teres Major, Long Head Triceps
  - **Capsule**
    - Imbrication, Capsulorrhaphy
      - 80-92% success, 11-23% recurrent instability
  - **Bone (if Glenoid retroversion > 30 degrees)**
    - **Open wedge glenoid osteotomy**
      - 82% success, 12-17% recurrent instability
      - Anterior Subluxation, Coracoid Impingement, Glenoid Fracture, Arthritis
Current Treatment Options: Operative

• Posterior Glenoid Osteotomy
Current Treatment Options: Operative

**Multidirectional Instability**
- **Indications:**
  - Failed nonoperative
  - Pain + Disability (>6 months) despite rehab protocol
  - Open dislocation
  - Unstable reduction

- **Surgical Options:**
  - **Arthroscopic**
    - Thermal/Suture Capsulorrhaphy
    - 88-94% success, 2-12% recurrent instability
  - **Open Anterior/Posterior Procedure**
    - Capsulolabral Reconstruction (Inferior/Anterior/Posterior)
    - 85-97% success, 3-26% recurrent instability
Rockwood’s Pearls + Pitfalls

1. Must get 3 views of shoulder (AP, Lat, Axillary)

2. Close Reduction with Slow, Gentle, Sustained maneuvers

3. (Motor + Sensory) Axillary n. function tested, pre/post reduction

4. Voluntary vs. Involuntary Instability

5. Always consider a RCT, especially for >40 yo, consider MRI

6. AMBRI ➔ strengthen dynamic stabilizers +/- surgery
   TUBS ➔ physio + surgery

7. Prior to surgery ➔ Examination under Anesthesia

8. Surgery should address direction of instability

9. Appropriate rehab protocol, with initial immobilization followed by progressive strengthening, and patient education
Complications

• Infections
  – < 0.25%, pre/post-operative abx, if hematoma consider evacuation

• Neurologic Injury
  – Mostly Neuropraxia, 3-8% incidence, Axillary/Musculocutaneous n.

• Stiffness
  – Putti-Platt and Magnuson-Stack procedures
  – Excessive tightening with Capsulolabral repairs
  – Prolonged immobilization, Poor compliance with physio

• Arthritis
  – Putti-Platt and Magnuson-Stack Procedures

• Hardware Complications
  – Screws, Staples = (migration, loosening, broken, incorrect placement)

• Chronic Dislocation
  – Missed fracture/dislocation, Missed during other medical mgmt (seizure)
  – Severe degeneration (RA, OA)
  – Treat based on symptoms and function (nonoperative vs. operative)

• Vascular Injury
  – Axillary a., Posterior circumflex a.
• EXTRA Information

• Acute Dislocation
  – Close Reduction using Traction-Countertraction
  – Intra-articular lidocaine

• Nonoperative Treatment (immobilization in slight ER)
  – (<30 yrs = 3 wks) – (30-40 yrs = 1-2 wks) – (>40 yrs = 1 wk)
  – After phase of immobilization, start limited movement (6-9 wks)
    • Anterior (up to 30º ER, 60º abd)
    • Posterior (up to 60º flex, 30º IR)
  – Strengthening exercises (Isometric → Isotonic → Dynamic)
  – Return to sports in 6 months