

METHODICAL INSTRUCTION OF PRACTICAL EMPLOYMENT ON A THEME: «INJURIES AROUND THE SHOULDER: SCAPULA FRACTURE, CLAVICLE FRACTURE, INJURIES OF THE ACROMIOCLAVICULAR JOINT AND STERNOCLAVICULAR JOINT, PROXIMAL HUMERUS FRACTURES, DISLOCATION OF SHOULDER»

Actually of theme: Scapula fractures are relatively uncommon. 80-95% of scapula fractures have associated injuries. The associated injuries may be multiple and/or life-threatening. As a result, diagnosis and treatment of scapular injuries may be delayed or suboptimal. Long-term functional impairment may occur. As more focus is placed on the proper management of scapular injuries, functional outcomes should improve. Fracture clavicle. Most common fracture in children. Malunion is a rule, but no functional disability. Proximal humerus fractures is common in elderly patients and it accounts for 4 to 5 per cent of all fractures. Since 80% of the fractures are minimally displaced early motion of the shoulder is the mainstay of treatment to prevent stiffness of the joint. Shoulder joint is vulnerable for dislocation more often than any other joint in the body. The extreme mobility it enjoys, jeopardises its stability.

Recurrent anterior dislocation of the shoulder is a very common complication of anterior dislocation of shoulder and accounts for greater than 80% of dislocations of the upper extremity. However surgery is the treatment of choice and is indicated if the patient has more than three episodes of RDS. Among the various causes mentioned above supraspinatus tendinitis is the one that is commonly encountered and this gives rise to the impingement syndrome.

General purpose: to be able independently clinically and roentgenologic to diagnose scapula, clavicle, proximal humerus fractures, injuries of the acromioclavicular joint and sternoclavicular joint, dislocation of shoulder, rotator cuff tear and rupture of biceps tendon. To conduct transporting immobilization, to carry out medical immobilization, to work out a plan of a next functional and physical therapy medical treatment.

The educational purposes

A=1 (The first level of mastering)

To familiarize with a clinical and radiological features fractures scapula, clavicle, proximal humerus fractures and injuries of shoulder. To know about principles of diagnostics, treatment and preventive maintenance of damages of these localization.

A=2 (The second level of mastering)

To know clinical and radiological features fracture scapula, clavicle, proximal humerus fractures and dislocation of shoulder, joints of clavicle. To master methods of complex conservative treatment of injuries and diseases of the segments of the of the upper extremity, to define indications and ways of surgical treatment of these injuries and also to know and be able to use transport immobilization.

A=3 (The third level of mastering)

To be able to carry out the differential diagnosis fracture and fracture - dislocation proximal humerus and injuries of shoulder: rotator cuff tear and rupture of biceps tendon, injuries of the acromioclavicular joint and sternoclavicular joint, dislocation of shoulder. To know clinical complication-recurrent anterior dislocation of the shoulder and others. Regional conditions of shoulder: adhesive capsulitis, supraspinatus tendonitis, impingement syndrome.

To seize methods of diagnostics of fracture - dislocations on the basis of symptoms which are characteristic for dislocations and fracture of a different kind, ways of reposition and the further treatment.

To seize methods of diagnostics internal and intraarticate injuries of shoulder and differential criteria which allow to distinguish a dislocation and fracture, to choose tactics treatment which depending on a condition of the patient and complications.

To be able to carry out definitions of a level of fracture of humerus on the basis of typical deformations which are caused under action of muscles by displacement fragments. To estimate the general condition of the patient depending on injuries of other organs and systems. To be able to carry out plaster immobilization depending on character of injuries. To define indications and ways of surgical treatment of injuries of the injuries around the shoulder.

A=4 (The fourth level of mastering)

On the basis of a clinical material and use of sources of the basic and additional literature to know principles rehabilitation patients which depending on character of damages and possible complications. To capture diagnostics of complications: frozen shoulder, impingement syndrome. To know the method of their prophylaxis and medical treatment.

Interdisciplinary integration:

Subject (discipline)	To know	To be able
<p>1) Preliminary (normal anatomy, operative anatomy, topographical anatomy, histology, clinical biochemistry, pathophysiology radiology, neurology).</p>	<ol style="list-style-type: none"> 1) Anatomical constitution scapula, clavicle, proximal humerus 2) Structures of acromioclavicular and sternoclavicular joints, shoulder joint, rotator cuff, a place an attachment ligaments, their role in stabilization of a joint. 3) Muscles, their function and a role in displacement of fragments. 4) Anatomy-topographical features of region around the shoulder. A substantiation rational operative procedures (access). 5) Features of blood supply. 6) Reparative regeneration of bony soft tissues around the shoulder. Their features depending on character of injuries 7) Laboratory investigations 	<p>To defined displacement fragments humerus, clavicle, fractures, dislocation of shoulder on the basis of the clinical and radiological data. Access to vessels and nerves of shoulder region. Roentgenologic anatomy of bones scapula, clavicle, proximal humerus. Roentgenologic signs of fractures. Terms of immobilizations, consolidations and losses of capacity at the fractures. Results of electrophysiology researches denervation muscles. Results of laboratory investigations</p>
<p>The following (which provided)</p>	<ol style="list-style-type: none"> 1) Terms immobilization, union, disability. 2) Preventive maintenance of possible complications and ways of their prevention 	<p>To defined symptoms of rotator cuff tear and rupture of biceps tendon, frozen shoulder, impingement syndrome. To carry out rehabilitation which depending on character of damages and possible complications</p>
<p>Intrasubject integration (themes of the given discipline with which it is integrated).</p>	<ol style="list-style-type: none"> 1) Indication and methods of conservative medical treatment, external immobilization/Indication and choice of methods, implants to the surgical treatment 	<ol style="list-style-type: none"> 1) To measure of active and passive motions in the shoulder. 2) To measure of the upper arm length, cause of changes. 3) To carry out transporting and medical immobilization. To know rules of application of POP casts Reduction and support fractures. Functional cast bracing by Sarmiento. 4) To define place of skeletal traction which depending on character fractures.

The plan and organizational structure of employment.

Basic stages of employment and their functions	Educational purposes in levels of mastering (memorizing)	Quality monitoring and training	Materials of methodical support (maintenance)	Hour, minute
1. Preparatory stage				
1. Organization of employment	The teaching and educational purposes of employment before group of students are established	Opening speech of the teacher	Methodical instruction	2-3
2. Definition of the educational purposes and motivation				3-5
3. The control of an initial level of knowledge, skills				10
2. Basic stage				
Forming of professional abilities and skills. To seize knowledge of radiological inspection of patients with scapula, clavicle, proximal humerus fractures, acromioclavicular and sternoclavicular joints, shoulder joint injures, symptoms of rotator cuff tear and rupture of biceps tendon.. To know indications and ways of conservative and operative treatment of these injures: a) To pay attention to the mechanism of a trauma. To define change of tissues at survey and palpation. b) To be able to measure relative and anatomic length of a segment c) To be able to interpret roentgenograms scapula, clavicle, proximal humerus acromioclavicular and sternoclavicular joints, shoulder joint. d) Formations of the diagnosis e) Treatment: substantiation of methods of treatment, the indication and ways of surgical treatment, principles of rehabilitation.		The written control, express-questioning.	Test tasks Thematical patients	30
		Inspection of patients, theoretical interviews	roentgenograms tables, pictures, structural-logical charts, video materials.	20
		Studying of roentgenograms in an educational room.	E d u c a t i o n a l rooms, structural departments, clinics.	30
		Discussion	Educational room	
3. Final stage				
5. For examination on an investigated theme it is recommended to solve situational tasks		Thematic situational tasks, independent work, discussion. Individual analysis of control practical skills.	Educational room Results of inspection reports, protocols, reference card for independent work with literature Recommended literature	20
6. Summarizing (theoretical, practical, organizational estimation)				10
7. Task home work				Concluding remarks of the teacher

1) Materials of the control over maintenance of a preparatory stage of employment

Questions, task, tests etc.

A=1

1. Shoulder girdle: scapula, clavicle, proximal humerus
2. Structure of acromioclavicular and sternoclavicular joints, shoulder joint.
3. Muscles around the shoulder: function.

A=2

1. Place an attachment ligaments, muscles their anatomic and functional role.
2. Features of blood supply proximal humerus
3. Structures of a joints
4. Morphological structure of synovial.

A=3

1. Degree failure of blood supply proximal humerus, which depending on character of the fractures, development of complications and ways of preventive maintenance.
2. Functional features structures around the shoulder and their role in maintenance of function of a the shoulder
3. Structure. Function synovial bursas and their value in maintenance of function of a joint.
4. Conditions of occurrence and difference between reactive and septic inflammation.

A=3

1. Rational anatomy-topographical accesses (procedures) to the shoulder, proximal humerus.
2. To measure of active and passive motions in the shoulder, the upper arm length.
3. Definition of force of muscles.
4. Materials of maintenance of self-preparation of students.
5. Control questions. The written control (levels of mastering of a material).

A=1

Kinds of displacement fragments in depending on character of injures.

Classification scapula, clavicle, proximal humerus fractures and injures of the shoulder.

A=2

Mechanogenesis of injures.

Clinical features of the above-stated injures.

Features of a clinical of the complicated fractures.

Medical treatment of patients (conservative or operatively).

A=3

To carry out differential diagnostics at scapula, clavicle, proximal humerus fractures and injures of the shoulder. To proved tactics of conservative treatment

To carry out differential diagnostics dislocation of the shoulder, displacement of the clavicle, muscles injures, to proved tactics of treatment in depending on degree of the injures.

Indications to operative treatment, their principles.

Terms of immobilization extremity, union, terms of disabled.

A=4

Techniques and methods of reduction dislocation of shoulder.

Anatomical predisposition of the avascular necrosis proximal humerus, recurrent dislocation of the shoulder, impingement syndrome, treatment.

Radiology and CT scan, MRI. Malunion, nonunion clavicle, proximal humerus, treatment.

Complication. Joint stiffness. Myositis ossificans. Preventive maintenance of possible complications and ways of their prevention Treatment

2) Materials of the control over maintenance basic stage of employment.

Roentgenograms, MS KT, MRI

Thematical patients

Measuring tape

Skin marking pencil

Goniometer

3) Materials of the control over maintenance final stage of employment.

Situational tests and tasks, roentgenograms

Concrete tasks of employment:

1. To learn the mechanism of fractures; typical displacements fragments of fractures .
2. To learn the clinical signs of fractures.
3. To interpret roentgenograms at the indicated fractures.
4. To conduct differential diagnostics injures of region the shoulder.
5. To execute transporting immobilization extremity. To carry out uniinstantly reposition of fractures with displacement fragments of surgical neck of humeral bone
6. To impose medical short-term immobilization in a sling and swathe bandages.
7. To work out a plan of functional and physical therapy medical treatment of patients.
8. To define indication to the surgical methods of medical treatment of fractures.
9. To defined symptoms of rotator cuff tear and rupture of biceps tendon.
10. To learn of possible complications and ways of their prevention of injures.

Task 1. For verification of initial level of knowledges from a normal anatomy, radiotherapy, traumatology and orthopedics give an answer for such questions: anatomic structure region the shoulder. Name the muscles of humeral segment, places of their attachment and function.

Task 2. On the basis of study of basic literature from the theme of employment give writing answers for such questions:

1. Describe the clinical signs of scapula, clavicle, proximal humerus fractures without displacement and with displacement of bone fragments. Causes for displacement.
2. Clinical features. Conduct differential diagnostics with dislocation, subluxation, bruise, sprain, strain. Clinical manifestations due to neurovascular injuries.
3. Classification, types of fractures.
4. Character of displacement of bone fragments proximal humerus.
5. Types of bandages, that are used for transporting immobilization.
6. Indications to conservative medical treatment and operative treatment, their principles.
7. Terms of immobilization extremity, terms of disabled.
8. The social and labour rehabilitation patients with fractures.

Task 3. Investigation.

1. To capture the receptions of clinical inspection of patients with fractures. To be able to interpret roentgenograms.
2. To conduct differential diagnostics of damages of region of humeral joint.
3. Taking into account a clinical diagnosis work out a plan of medical treatment of patients (more conservative or operatively).
4. Principles of rehabilitation of patients with injuries around the shoulder and reason of disabled.

Execution sequence:

1. During collection of anamnesis pay attention to the mechanism of injuries, complaint of patient (presenting symptoms), position of extremity.
2. Review of position of sick (from the front, behind, above, the sides), extremity, during inspection: Attitude. In diseases of the shoulder, the position adopted is usually flexion, adduction and medial rotation. Wasting of the supraspinatus or infraspinatus muscles. Wasting of deltoid or rotator cuff muscles. Presence of deformation, its character, slight swelling, contours of humeral joint.
3. Palpation: presence of pain in place of injuries, tenderness, crepitus fragments Abnormal mobility between fracture, swelling shortening.

4. Possibilities of active and passive motions in a humeral joint, their amplitude. Examination of shoulder abduction, flexion extension, adduction, rotations (limitations of joint movements, localization of pain and determination of axis. Special tests for structures around the shoulder
 - Abbott-Sander's Test—for biceps tendon.
 - Apley's superior and inferior scratch test—for supraspinatus tendinitis
 - For shoulder joint—subluxation or dislocation
 - Apprehension test.
 - Painful arc sign—subacromial bursitis.

Examination of cervical spine.

6. Neurovascular examination of the upper limbs
7. Interpretation of roentgenograms, CT Scan and MRIgrams.
6. Differential diagnostics and diagnosis.
7. Plan of medical treatment.
8. Ground of diagnosis, plan of medical treatment with a teacher.

Task 4. For verification of capturing you material of practical employment decide tasks.

The contents of employment.

INJURIES AROUND THE SHOULDER

Scapula Fracture

Frequency: Scapula fractures account for 1% of all fractures, 3% of shoulder girdle injuries, and 5% of all shoulder fractures. Approximately 50% of scapula fractures involve the body and spine. Fractures of the glenoid neck constitute about 25% of all scapula fractures, whereas fractures of the glenoid cavity (glenoid rim and fossa) make up approximately 10% of scapula fractures. The acromial and coracoid processes account for 8% and 7%, respectively.

Associated injury patterns commonly involve the ipsilateral upper extremity and thorax.

Frequencies of associated injuries are as follows:

- Rib fractures – 25-45%
- Pulmonary injury (eg, hemopneumothorax, pulmonary contusion) – 15-55%
- Humeral fractures – 12% (5-10% sustain a brachial plexus injury)
- Skull fractures – 25%
- Central neurologic deficits – 5%
- Major vascular injury – 11%
- Splenic injury requiring splenectomy – 8%

Etiology: Typically, scapula fractures result from high-energy trauma. Direct forces are most common, but indirect mechanisms also can be responsible. An

example of an indirect force is a fall on an outstretched arm that causes the humeral head to impact on the glenoid cavity.

Clinical: Typically, physical examination reveals swelling, tenderness, crepitus, and ecchymosis over the scapular region. Perform a careful neurovascular examination to rule out arterial injury or brachial plexopathy.

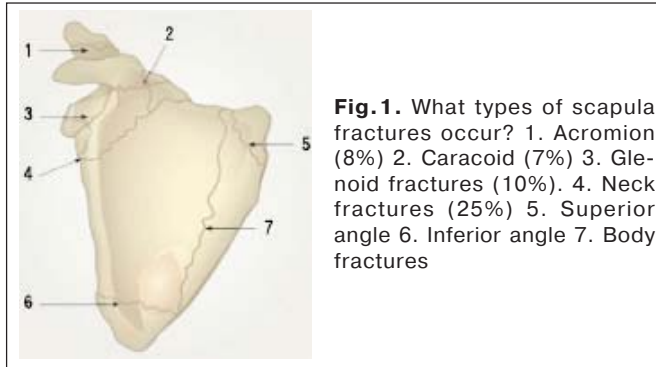


Fig. 1. What types of scapula fractures occur? 1. Acromion (8%) 2. Coracoid (7%) 3. Glenoid fractures (10%) 4. Neck fractures (25%) 5. Superior angle 6. Inferior angle 7. Body fractures

Management: Medical therapy for patients with scapula fractures generally is the same as that of any trauma patient. Perform fluid resuscitation, stabilize cardiopulmonary system, and treat life-threatening injuries prior.

Most scapula fractures can be treated with closed treatment. More than 90% of scapula fractures have minimal displacement, primarily because of the thick, strong support provided by the surrounding soft tissues. Treatment is symptomatic. Short-term immobilization (5-6 months) in a sling and swathe bandage is provided for comfort. In some cases, such as intra-articular fractures, close radiographic follow-up is necessary to ensure that unacceptable displacement does not occur.

Surgical management for significantly displaced fractures:

- 1) unstable fractures of scapula – glenoid fractures+ double disruptions of the superior shoulder suspensory complex (SSSC) in which 1 or more elements of the scapula are significantly displaced (fracture clavicle or displacement acromion part of clavicle) (fig.2).
- 2) displaced fractures of the glenoid cavity (glenoid rim and fossa),
- 3) significantly displaced fractures of the glenoid neck.

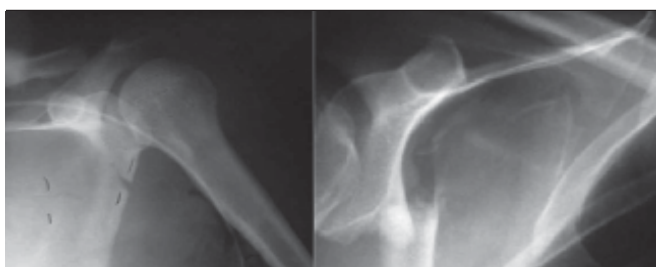


Fig.2. Stable and unstable fractures of neck scapula

FRACTURE CLAVICLE VICLE

The term clavicle is derived from the Latin root *Clavis* meaning *Key*.

THE CLAVICLE SPEAKS

- first bone to ossify in the body
- ossify from two primary centre.
- only long bone in the body lying horizontal
- only long bone ossifying from a membrane
- only link between the appendicular and axial skeleton
- the most common bone to be fractured in children.

FUNCTIONS OF CLAVICLE

1. To increase the arm strength mechanism.
2. It protects the neurovascular bundle consisting of subclavian vessels and brachial plexus.
3. It gives attachments to important muscles around the shoulder.
4. It braces the shoulder back during rest and motions.

Mechanism of Injury

Direct due to fall on the point of the shoulder. This is the most common mode of injury accounting for 91% of the cases.

Direct trauma over the clavicle due to RTA, etc.accounts for 8% of the cases.

Indirect Fall on the outstretched hands accounts for 1% of the cases.

Sites of Fracture

- 80% of the fracture clavicle occurs at the junction of middle and outer third (Fig. 2)
- 12% at middle part of the clavicle
- 7% Lateral end fracture is uncommon.
- 1% medial end of the clavicle

Clinical Features

Patient presents with pain, swelling, deformity and inability to raise the shoulder. Rarely patient may present with pseudoparalysis of the affected arm.

Radiology (fig.3)

The following views are recommended:

1. Routine AP view of the clavicle.
2. Lordotic view if the fracture is doubtful.
3. Distal clavicle requires special radiography technique.



Fig.3. Fractures clavicle middle third

Treatment

Conservative methods

Fracture clavicle treated by Fig of '8' bandage, rings of Delbe, cuff and collar sling for undisplaced fractures. To counter the above two detrimental forces, the shoulder should be braced back and the arm should be supported up. Malunion is a rule, but no functional disability.

Years classification:

2-12 yrs - Fig of 8 bandage (2-3 week), tightened after 3 days and later 1 week.

12 years to maturity - Commercially available fig of 8 harness.



Fig.4. Conservative methods: fig of '8' bandage, rings of Delbe

Surgery is rarely indicated and is considered in the following situations: open fractures, injury to neurovascular bundle, if the fracture is threatening to penetrate the skin, fracture near acromioclavicular joint and displaced epiphysis in children, nonunion.

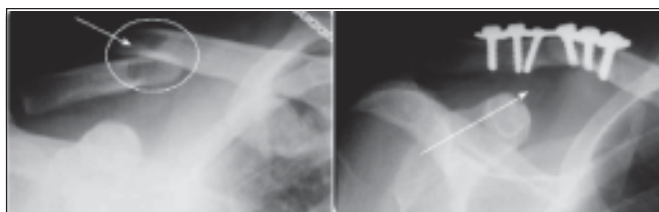


Fig.5. Open reduction and IF with plate and screws

Complications of fracture clavicle

Neurovascular injury may be immediate due to direct force or delayed due to a very large callus. The structures commonly injured are subclavian vessels and the medial cord of the brachial plexus through which the ulnar nerve is derived. This occurs in fractures of the middle one-third of the clavicle.

Malunion is very common due to difficulty in holding the fracture fragments in position because of the distracting forces already explained. It causes only a cosmetic problem and does not usually impair function. Hence no treatment is required.

Nonunion It is rare and requires open reduction, internal fixation with plate and screws and bone grafting.

INJURIES AROUND THE SHOULDER INJURIES OF THE ACROMIOCLAVICULAR JOINT

Acromioclavicular joint is a diarthrodial joint with a fibrocartilaginous disc between the two bones (similar to a meniscus).

THE ACROMIOCLAVICULAR JOINT

Plane joint. Permit gliding rotation between the clavicle and the scapula. Structural integrity depends on the intrinsic capsular element, the superior acromioclavicular ligament and the extrinsic coracoclavicular ligament which forms a hood over the interval between the coracoid process and the acromion

Incidence is 12%.

Male:Female ratio is 5:1.

Mechanism of Injury

Direct force This is the most common mechanism of injury as in RTA, assault etc.

Indirect force is due to fall on the outstretched hands.

Downward indirect force through the upper extremity This is relatively rare.

Clinical Features

Patient complains of pain, swelling, and difficulty in raising the arm up. On examination there is tenderness and the lateral end of clavicle is prominently felt.

Rockwood classification

- I - Sprain of acromioclavicular ligament only
- II - Acromioclavicular ligaments and joint capsule. Disrupted coracoclavicular ligaments intact. 50% vertical subluxation of clavicle.
- III - Acromioclavicular ligaments and capsule disrupted. Coracoclavicular ligaments disrupted. Acromioclavicular joint dislocation with clavicle displaced superiorly and complete loss of contact between clavicle and acromion.
- IV - Acromioclavicular ligaments and capsule disrupted. Coracoclavicular ligaments disrupted. Acromioclavicular joint dislocation and clavicle displaced posteriorly into or through trapezius muscle (posterior displacement confirmed on axillary radiograph)
- V - Acromioclavicular ligaments and capsule disrupted. Coracoclavicular ligaments disrupted. Acromioclavicular joint dislocation with extreme superior elevation of clavicle (100 to 300% normal). Complete detachment of deltoid and trapezius from distal clavicle.
- VI - Acromioclavicular ligaments and capsule disrupted. Coracoclavicular ligaments disrupted. Acromioclavicular joint dislocation with clavicle displaced inferior to acromion and coracoid process.



Fig. 6. Rockwood classification

Radiology

The following views are required:

1. AP view with 15° cephalic tilt to prevent overlap of the spine of scapula on routine AP views.
2. Lateral view - axillary view of the shoulder.
3. Stress radiographs - to differentiate from type II and type III by suspending a weight of 10 to 15 lbs around the wrist.



Fig. 7. Clinical shows acromioclavicular joint dislocation. AP view radiographs

Radiology

The following views are required:

1. AP view with 15° cephalic tilt to prevent overlap of the spine of scapula on routine AP views.
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3. Stress radiographs - differentiate from type II and type III by suspending a weight of 10 to 15 lbs around the wrist.

Management

Type I Rest, ice bags, etc.

Type II Sling for 10 to 14 days, adhesive strapping, elastic strapping, cast or harness. Surgery is required for persisting pain.

Type III *Conservative*—sling and harness.

Surgical methods include

1. Acromioclavicular repair.
2. Coracoclavicular repair.
3. Dynamic muscle transfer - by transferring the coracoid process.

Types IV, V, VI Require open reduction, internal fixation, repair and reconstruction.

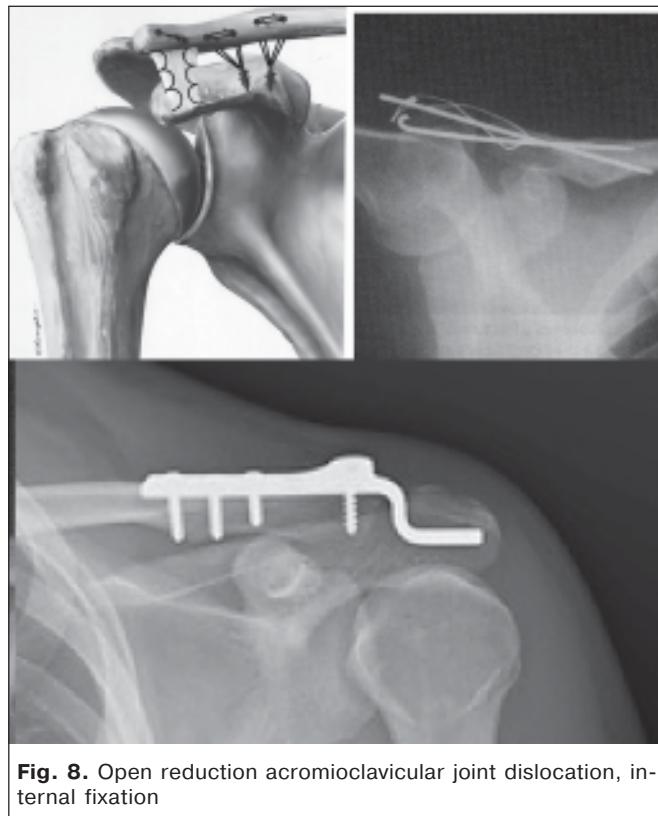


Fig. 8. Open reduction acromioclavicular joint dislocation, internal fixation

Complications

1. Associated fracture clavicle.
2. Coracoclavicular ossification.
3. Osteolysis of distal clavicle.
4. Complications after surgery like infection, etc.
5. Complications after non-operative treatment like joint stiffness, etc.

INJURIES OF STERNOCLAVICULAR JOINT

Saddle joint and represent the only bone to bone connection of the upper limb to the trunk. To absorb the shock transmitted from the arm to the shoulder. Fibrocartilaginous disc between clavicle and the manubrii, interclavicular and costoclavicular ligaments along with the anterior and posterior sternoclavicular ligaments. The intra-articular disc ligaments and the capsular ligaments strengthen me to a great extent

Mechanism of Injury

This is the least commonly dislocated joint because of the strong ligaments.

Direct force rarely causes this injury.

Indirect force this is the most common mode of injury.

Incidence is about 3%.

Causes

Road traffic accident (RTA) is responsible for 80% of the cases, sports related injuries account for the remaining 20%.

Classifications

Anatomical classification

- Anterior dislocation
- Posterior dislocation

Clinical Features

Patient complains of pain and swelling. Medial end of the clavicle is prominent in anterior dislocation. Affected shoulder is short. Lateral compression test is positive.

Radiology

1. AP view is often difficult to interpret.
2. Special 90° cephalocaudal views - this helps to see the medial ends of both the clavicles.
3. Tomograms
4. CT scans and MRI - elp to study the position of clavicle with respect to sternum and soft tissues respectively.

Management

Mild sprain The treatment method consists of ice, sling, pain killers, etc.

Subluxation The treatment methods are ice (first 12 hrs), warmth (24-48 hrs), clavicle strap, Fig of '8' and excision of medial end if pain persists.

Dislocation The treatment of choice is closed reduction followed by fig of 8, clavicle strap, sling, etc. If it fails, open reduction and internal fixation using K-wire is done.

PROXIMAL HUMERAL FRACTURES

This is common in elderly patients and it accounts for 4 to 5% of all fractures.

Mechanism

- Fall on outstretched hands is the classical history.
- Blow on the lateral side of the arm is the other mode of injury.

Classification

Neer has proposed a classification for fractures of the proximal humerus based on this 4-segment concept. Four segments are described with respect to proximal humerus. They are the

1. Anatomical neck
2. Greater tuberosity
3. Lesser tuberosity

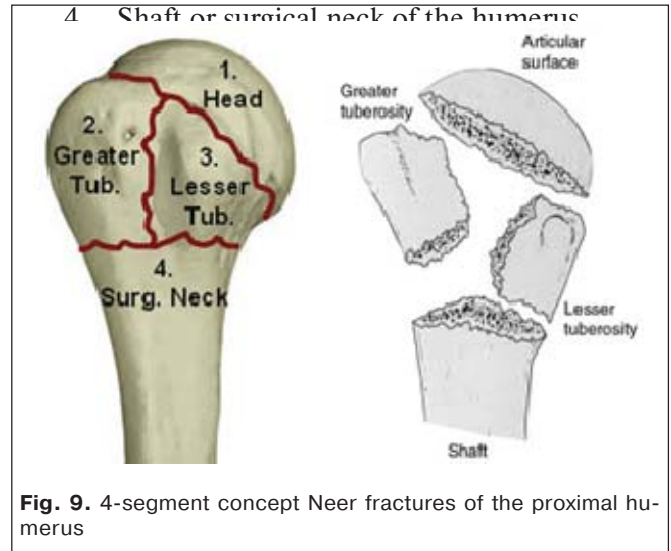


Fig. 9. 4-segment concept Neer fractures of the proximal humerus

Muscle Forces Action on 4 Major Segments

1. Greater tuberosity: supraspinatus, external rotators are attached here and displace the fracture segments.
2. Lesser tuberosity - subscapularis inserted here which generates a deforming force.
3. Shaft - gives attachment to pectoralis major.
4. Anatomical neck.

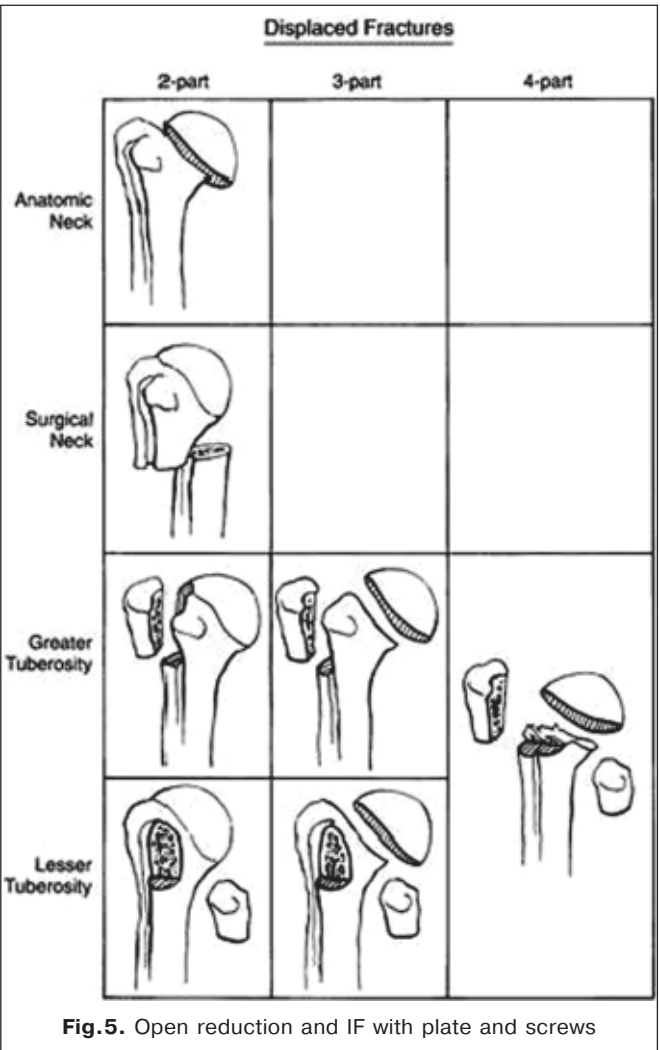


Fig.5. Open reduction and IF with plate and screws

Earlier the number of fracture lines were taken into account to label the proximal humerus fractures as two part, three part and four part. But now the number of “displaced segments” is taken into consideration than the earlier “number of fracture lines”.

These above muscles pull the fracture fragments in different directions leading to widespread displacements and angulations. When any of the 4 major segments is displaced more than 1 cm or angulated more than 45°, fracture is considered displaced. 80% of the fracture displacement is minimal and only 20% of the fracture displacement is significant

A one-part fracture is fracture with minimal displacement.

A two-part fracture is where one segment is displaced in relation to the other.

A three-part fracture is where two segments are displaced in relation to the other two.

A four-part fracture where all four major segments are displaced.

These above fractures when associated either with anterior or posterior dislocation of shoulder, are called two-part fracture dislocation, three-part fracture dislocations etc

Radiology and other Investigations

1. Trauma series consists of AP view and lateral view of shoulder joint in scapular plane.
2. CT scan.

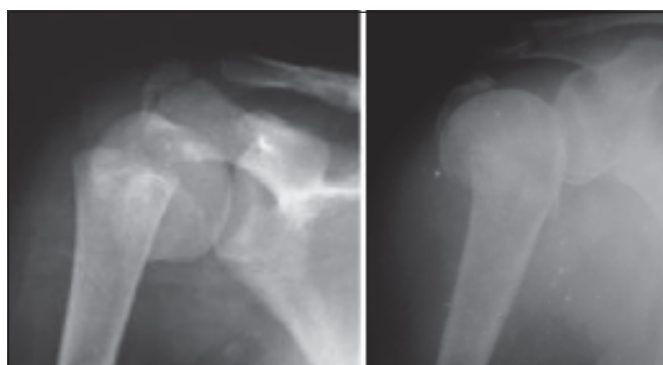


Fig. 11. Proximal humeral fracture (adduction and abduction type).

Management

Conservative methods. Since 80% of the fractures are minimally displaced - sling and harness(3weeks) and early motion of the shoulder is the mainstay of treatment to prevent stiffness of the joint.

Pendulum exercises, elevation, pulley, external and internal rotation and wall climbing exercises are some of the recommended methods.

Surgery The treatment depends upon whether the injury is two part, three part, etc. or is just a plain fracture or fracture associated with dislocation.

Table 1: Summary of treatment followed in proximal humeral fractures

1. *Two-part fracture*
 - a. Anterior neck OR + IF (risk of AVN is high)
 - b. Shaft
 - Impacted and angulated → Disinsection and correction
 - Unimpacted → Closed reduction if reducible. Tension-band wiring if unreducible or T-plate
 - Comminuted → overhead skeletal traction
 - c. Greater tuberosity If > 1cm displacement, OR + IF
 - d. Lesser tuberosity, requires OR+IF
2. *Three-part fracture*
 - Needs open reduction and replacement of the humeral head with Neer’s prosthesis or a AO T-plate can be used for fixing the fracture fragment
3. *Four-part fracture*
 - Invariably require OR + IF
 - When fracture is associated with dislocation:
 - Anterior dislocation with proximal humeral fractures*
 - a. 2 part - Closed reduction is successful
 - b. 3 part -requires OR + IF
 - c. 4 part - OR + IF + tuberosity repair

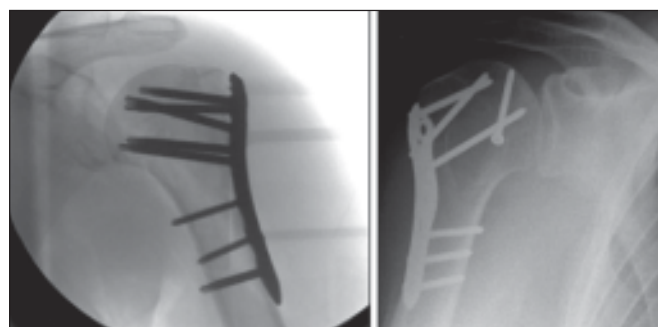


Fig. 12. Proximal humerus fracture after plate and screws fixation

- Posterior dislocation with proximal humeral fractures*
 - a. 2 part: associated with avulsion of lesser tuberosity Closed reduction sufficient
 - b. 3 part: Requires OR + IF
 - c. 4 part: Risk of AVN is high and needs early prosthetic replacement (Neer’s prosthesis)

Complications

1. Joint stiffness is due to periarticular fibrosis.
2. Malunion is due to the varying muscle forces
3. Avascular necrosis is seen in fracture of the anatomical neck.
4. Nonunion of surgical neck
5. Myositis ossificans due to vigorous massage and treatment.

GLENOHUMERAL JOINT

Multiaxial ball and socket joint. The most mobile joint in the body.

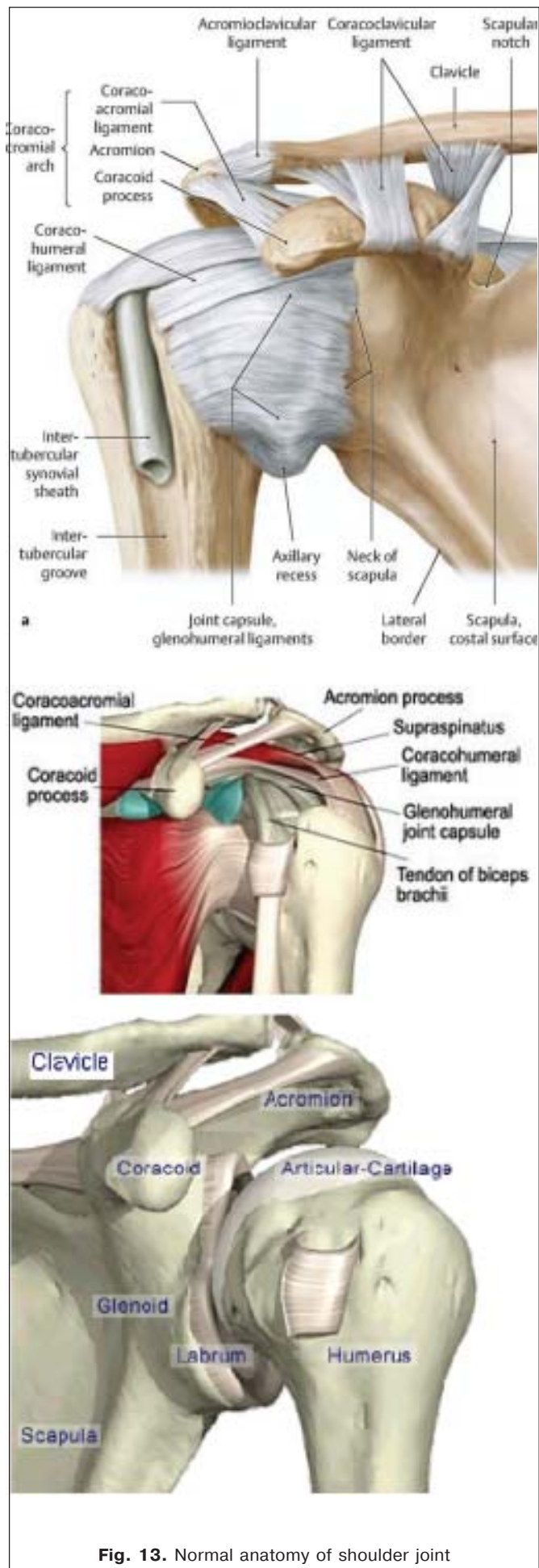


Fig. 13. Normal anatomy of shoulder joint

Joint made up of:

- a. **Humeral head** It is approximately one-third of a sphere and is oriented at 45° from the long axis of the shaft and retroverted 30°. The indistinct anatomical neck consists two important landmarks, the lesser tuberosity anteromedially and the greater tuberosity superolateral separated by the bicipital groove
 The shallow shaped glenoid cavity is retroverted approximately and inferiorly angulated 5° from the long axis of the scapula
- b. **Labium** It is a fibrocartilage which is triangular in cross-section and is attached to the outer perimeter of the glenoid. It increases the contact area by 70% and also helps us in my stability
- c. **Ligaments** The fibrous capsule gets attached peripherally to the margins of glenoid cavity and anatomic neck. Three intrinsic capsular ligament tailed the glenohumeral ligaments which reinforce. The coracohumeral ligament assists the capsule in supporting the arm.
- d. **Rotator cuff** This is the name given to four inter-related muscles, infraspinatus, supraspinatus, subscapularis, and teres minor. By their coordinated activity they provide help in the finer adjustments of the humeral head within the glenoid cavity.
- e. **Bursae** To provide smooth movements I am aided by numerous bursae of which subdeltoid or subacromial bursa is the most important. I can carry out various activities like flexion, extension, adduction, abduction, internal and external rotation and circumduction witherne, thanks to the anatomy which designed for us.

DISLOCATION OF SHOULDFR

Shoulder joint is vulnerable for dislocation more often than any other joint in the body. The extreme mobility it enjoys, jeopardises its stability. The shoulder has an “Achilles point” at the inferior part of the capsule providing the joint with a potential weak spot, so much so that 99% of anterior shoulder dislocation occur here. 95% of the shoulder dislocation is anterior and the remaining 5% is posterior. Associated fracture (30% of cases) - eg humeral head, greater tuberosity, clavicle, acromion.



Fig. 14. Anterior dislocation of shoulder joint, X-ray view

Table 2: Comparative study between ant and post dislocation of shoulder

	Anterior Dislocation	Posterior Dislocation
1. Classification Traumatic injuries	<ol style="list-style-type: none"> 1. Sprains 2. Acute subluxation 3. Acute dislocation 4. Recurrent dislocation 5. Unreduced dislocation 	<ol style="list-style-type: none"> 1. Sprains 2. Acute subluxation 3. Acute dislocation 4. Recurrent dislocation 5. Unreduced posterior dislocation
Atraumatic	<ol style="list-style-type: none"> 1. Voluntary or habitual 2. Involuntary 3. Congenital 	<ol style="list-style-type: none"> 1. Voluntary 2. Involuntary 3. Congenital
Based on anatomical location of humeral head	<ol style="list-style-type: none"> 1. Subcoracoid' 2. Subglenoid' 3. Subclavicular 4. Intrathoracic 	<ol style="list-style-type: none"> 1. Subacromial 2. Subglenoid 3. Subspinous
2. Mechanism of injury	<ul style="list-style-type: none"> ▪ <i>Direct force</i> Blow from the posterior aspect of the shoulder ▪ <i>Indirect force</i> - due to Abduction + External rotation + Extension injury (common) 	<ul style="list-style-type: none"> ▪ <i>Direct force</i> Blow from the anterior aspect of the shoulder ▪ <i>Indirect force</i> - due to Internal rotation + Ad-duction + Flexion injury (common)
3. Clinical features for diagnosis Clinical tests for diagnosis	<ul style="list-style-type: none"> ▪ Severe pain ▪ Arm is held in abduction and external rotation ▪ Adduction is restricted - Normal contour of shoulder is lost and there is anterior shoulder fullness - Posterior aspect is flat - Coracoid process is not identified - Axillary nerve injury may be present 	<ul style="list-style-type: none"> ▪ Severe pain ▪ Arm is in position of adduction and internal rotation. - Abduction (active and passive) is restricted. - Normal contour of shoulder is lost. - Anterior aspect is flat. - Posterior shoulder fullness present. - Coracoid process is more prominent.
4. X-ray views taken: 1) Routine X-rays in AP view in internal and external rotations 2) AP view in plane of scapula. 3) Axillary lateral view. 4) True scapula lateral view CT imaging MRI scanning can be used to more precisely visualise soft tissue and rotator cuff injury.	<ul style="list-style-type: none"> ▪ Bankart's lesions (Labral defect anterior). ▪ Hill-Sachs lesion (posterolateral defect in the head of the humerus seen in 100% of cases). ▪ Erosions of rim of glenoid 	<ul style="list-style-type: none"> ▪ Anterolateral defect. ▪ Vacant glenoid sign The 'rim sign' – Widening of the glenohumeral space Where the anterior glenoid fossa looks empty -Daylight sign (complete gap) ▪ The 'trough' sign – a vertical line made by the impression fracture of the anterior humeral - similar to Hill-Sachs lesion and is found on the of the head of the humerus ▪ Lightbulb sign – The head of the humerus in the same axis as the shaft producing a lightbulb shape ▪ Internal rotation of the humerus
5. Techniques of reduction	<p>I Closed: 3 methods</p> <ol style="list-style-type: none"> 1. <i>Hippocrates method</i> Reduction with foot in the axilla 2. <i>Stimson's gravity method:</i> Patient is in prone position with weight attached to the wrist. Gravity helps in reduction 3. <i>Kochers method</i> Most effective and commonly followed method. <p>II Open reduction: This is Indicated in failed dosed reduction, soft tissue interposition, greater tuberosity fracture displaced > 1 cm after reduction and large glenoid rim fractures</p>	
6. Complication	<p>Unreduced dislocation Traumatic osteoarthritis Axillary nerve damage <i>Regiment badge test</i> - area of anaesthesia around the deltoid due to injury to the axillary nerve, weakened or paralysed deltoid muscle Brachial plexus, radial and other nerve damage. Axillary artery damage (more likely if brachial plexus injury is present - look for axillary haematoma, a cool limb and absent or reduced pulses).</p>	<p>Recurrent dislocation Unreduced dislocation Traumatic osteoarthritis</p>

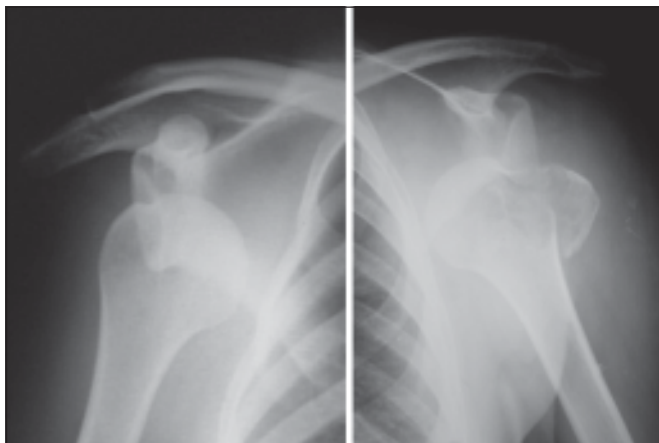


Fig. 15. Radiograph showing anterior dislocation of shoulder displaced without and with greater tuberosity fractures

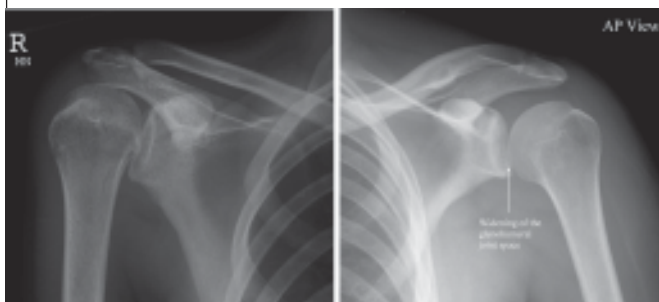


Fig. 16. Radiograph showing posterior dislocation of shoulder

Neurovascular assessment should be before and after reduction repeated.

- o Check the radial pulse to assess for vascular injury.
- o Check sensation in the regimental badge area on the lateral aspect of the shoulder over the deltoid muscle. This tests for axillary nerve damage. Contraction of the deltoid during attempted abduction can also be palpated.
- o Assess radial nerve function: test for thumb, wrist and elbow weakness on extension as well as reduced sensation on the dorsum of the hand.
- o The rotator cuff is frequently damaged and should be examined after reduction.

Management

Muscle spasm tends to occur soon after dislocation and makes reduction more difficult.

Closed reduction is usually adequate.

Adequate analgesia and relaxation are usually essential. Local analgesia may be obtained by injecting 20 ml of 1% lidocaine into the joint. Sedation with an opiate and benzodiazepine may be used. General anesthesia more effective. Emergency departments should have their own protocols.

Koehere Method in reduction

(Mnemonic TEAM Describes the Various Steps)

- Traction in line of humerus
- External rotation of the arm
- Adduction of the arm
- Medial rotation of the arm

*** Theodor Kochers, Switzerland.** Described the method in 1970.

The shoulder is then immobilised in a sling.

A post-reduction X-ray should be taken. This can confirm adequate reduction but may also show associated injury that was not previously obvious.

Quick facts

Anterior dislocation shoulder

- Commonest dislocation.
- Subcoracoid and subglenoid account for 99% of cases.
- Capsular injury in 30%. Labral lesion in 60%.
- Prompt reduction required. Kocher's method is the best.
- Check for axillary nerve injury before reduction.
- Immobilisation for 3-4 weeks and relative immobilisation for further 3 weeks.
- Prolonged rehabilitation.
- Avoid provocative positions for 6 weeks.
- A fracture dislocation will probably require surgery.



Fig. 17. Reduction anterior dislocation of shoulder - Koehere method

RECURRENT ANTERIOR DISLOCATION OF THE SHOULDER (RDS)

This is a very common complication of anterior dislocation of shoulder and accounts for greater than 80% of dislocations of the upper extremity. Age at the time of initial dislocation is an important prognostic factor, recurrence rate being 55% in patients 12-22 yrs old, 37% in 23-29 years, and 12% in 30-40 years old.

Causes

- Failure to immobilize the shoulder for 3 to 4 weeks after initial dislocation.
- Size and nature of damage at the time of initial dislocation.
- Greater the trauma, lower the incidence.
- Younger the patient, less is the recurrence.

Mechanism of Dislocation

In some individuals the dislocation can be predictable and can be avoided. In others the

mechanism is unpredictable and thus makes it a very disabling problem. *The usual mechanism of dislocation is external rotation in abducted position.*

Pathological Anatomy

No single deformity is responsible for recurrent dislocation of shoulder. Three important reasons have been cited and they have been called the essential lesions:

Triad of Essential Lesion

Hill-Sachs lesion is a posterolateral defect in the head of the humerus. This is produced due to the impact of the posterolateral part of the head of the humerus against the sharp anterior margin of the glenoid rim.

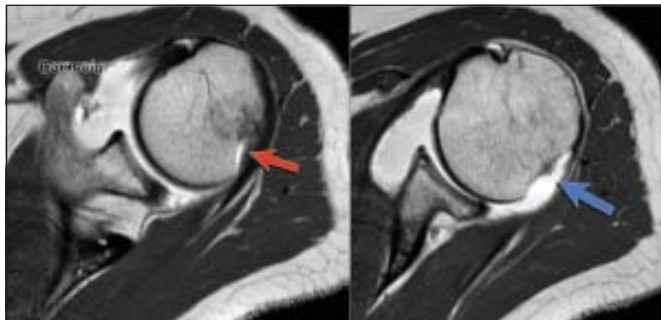


Fig. 18. MRI: Hill-Sachs lesion in posterolateral part of the head of the humerus

Bankart's lesion This was first described by Perthes as defect in the anterior part of the glenoid labrum and also the anterior capsule. If this defect does not heal properly or heals in elongated position it results in RDS.

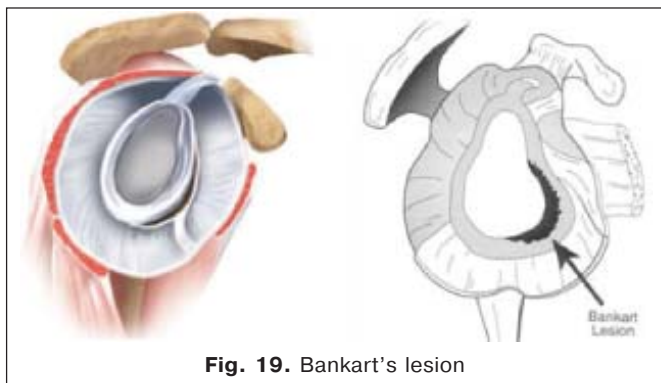


Fig. 19. Bankart's lesion

Erosion of anterior rim of glenoid cavity

External rotation of the shoulder in abducted position pops out the head of the humerus from the glenoid cavity due to the lax anterior capsular structures. The posterolateral defect now comes in contact with glenoid rim and is levered out of the socket, producing dislocation. Since no single factor is responsible for every recurrent dislocation, no single operative procedure can be applied to every patient.

Clinical Features of recurrent dislocations

Usually patient gives history of a previous episode of traumatic dislocation. After that there could be one or two instances of repeated dislocations during abduction.

There could be wasting of deltoid, supraspinatus and infraspinatus muscles. Three tests help to identify instability of the shoulder prone to develop RDS:

1. **The sulcus test** With the arm hanging at the side stabilise the scapula from behind and pull the humerus down. A large gap appears beneath the acromion. This suggests inferior laxity and is a test for superior glenohumeral and coracohumeral ligaments.
2. **The apprehension test** This is a provocative test where if the arm is placed in abduction, extension and external rotation and if a force is applied, patient becomes apprehensive and resists the provocation.
3. **Relocation test** The joint can be dislocated and relocated back into its position by manual pressure.

Treatment

Surgery is the treatment of choice and is indicated if the patient has more than three episodes of RDS. All the surgeries aim at correction of the essential lesions or prevent external rotation of the arm.

- o **Bankart's operation** - detached anterior structures (labrum) are attached to the rim of the glenoid cavity with suture.
- o **Bristow's operation** - transplantation of coracoid process with its attachments to the anterior rim of glenoid.
- o **Putti-Platt's operation** - subscapularis tendon and capsule is overlapped and tightened

REGIONAL CONDITIONS OF THE SHOULDER

FROZEN SHOULDER

(Syn: adhesive capsulitis)

Paradoxically shoulder joint privileged as the most mobile joint in the body has its nemesis because of this very advantage. Its mobility makes it very vulnerable to problems which ultimately "freezes" its movements. Unable to come to terms with the paucity of liberal movements hitherto enjoyed, the hapless patient resigns himself or herself to suffer the agony in silence!

It is defined as a clinical syndrome characterised by *painful restriction of both active and passive shoulder movements* due to causes within the shoulder joint or remote (other parts of the body).

HISTORY Dupley first described it in 1872 and called it as *humeroscapular peri-arthritis*. In 1934 Codman coined the term 'frozen shoulder', and in 1945 Neviaser gave the name 'adhesive capsulitis'.

Causes

Shoulder causes

Problems directly related to shoulder joint which can give rise to frozen shoulder are tendinitis of rotator cuff, bicipital tendinitis, fractures and dislocations around the shoulder, etc.

Nonshoulder causes

Problems not related to shoulder joint like diabetes, cardiovascular diseases with referred pain to the shoulder which keeps the joint immobile, reflex sympathetic dystrophy, frozen hand shoulder syndrome, a complication of Colles' fracture can all lead to frozen shoulder. The reason could be prolonged immobilisation of the shoulder joint due to referred pain, etc.

Pathology

1. During abduction, and repeated overhead activities of the shoulder, long head of biceps, and rotator cuff undergo repeated strain. This results in inflammation, fibrosis and consequent thickening of the shoulder capsule which results in loss of movements. *If the movements are continued, then the fibrosis gradually breaks, movements return but never come back to normal.*
2. Prolonged activity causes small scapular and biceps muscles to waste faster, load on joint increases and degenerative changes sets in. Capsule is fibrosed and shoulder movements are decreased.

Clinical Features

There are three classical stages in frozen shoulder.

Stage I (stage of pain) Patient complains of acute pain, decreased movements, external rotation greatest followed by loss of abduction and then forward flexion. *Internal rotation is least affected* This stage lasts for 10 to 36 weeks.

Stage II (stage of stiffness) In this stage pain gradually decreases and the patient complains of stiff shoulder. Slight movements are present.

Stage III (stage of recovery) Patient will have no pain and movements will have recovered but will never be regained to normal. It lasts for 6 months to 2 years.

Treatment

Stage I In this stage long-acting once a day NSAIDs are usually preferred as this condition usually runs a long course (10-36 weeks). Intra-articular steroids may help.

Stage II In this stage since the pain will have reduced considerably, exercises both active and passive are gradually begun followed by physiotherapy, ultrasound and shoulder wheel exercises. Manual of manipulation of the shoulder.

Stage III In this stage active and passive exercises, physiotherapy consisting of short wave diathermy, ultrasound, etc. are continued.

ROTATOR CUFF LESIONS

Pine adjustments of the humeral head within the glenoid is achieved by coordinated activity of four interrelated muscles arising from the scapula and is called *rotator cuff*.

Note Rotator cuff comprises supraspinatus, infraspinatus, subscapularis and teres minor.

In the movement of abduction, supraspinatus steadies the head from above, infraspinatus depresses the head, subscapularis steadies the head in front paralleling the action of the infraspinatus. *This combined action allows the deltoid muscle to swing up the arm from a steady fulcrum irrespective of the position of the scapula.*

Rotator cuff lesion is a problem which is commonly associated with supraspinatus tendon.

Acute injury is less frequent than chronic disease but may follow bouts of forcefully raising the arm against resistance, as occurs in weight lifting, for example. In addition, falling forcefully on the shoulder can cause acute symptoms.

Clinical Features: inability to move or lift the arm sufficiently, especially during abduction and flexion motions. Pain at night when lying directly on the affected shoulder, pain when reaching forward (e.g. unable to lift a gallon of milk from the refrigerator).

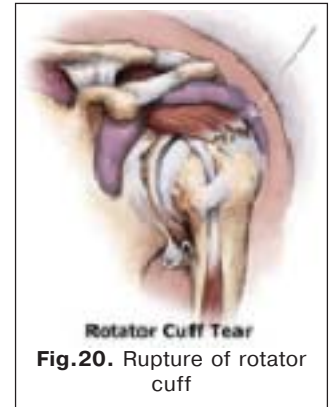
Reliably detect Magnetic resonance imaging (MRI) and ultrasound are comparable in efficacy. **Operative treatment indication.**

Other causes like bicipital tendinitis, etc. may give rise to rotator cuff problems but they are not that common.

Causes of supraspinatus syndrome

- Complete or partial rupture of rotator cuff
- Supraspinatus tendinitis
- Calcific deposits
- Subacromial bursitis
- Subdeltoid bursitis
- Bicipital tenosynovitis
- Fracture greater tuberosity

Among the various causes mentioned above supraspinatus tendinitis is the one that is commonly encountered and this gives rise to the *impingement syndrome*. Impingement occurs beneath the coracoacromial arch. The most vulnerable structures for impingement between the undersurface of the acromion and the head of the humerus are the greater tuberosity, the overlying supraspinatus tendon and the



long head of biceps. The major site of compression is slightly anterior to the angle of the acromion. Hence the proper term is *anterior impingement syndrome* or painful arc syndrome

Clinical Features

All patients with supraspinatus syndrome have similar clinical features like pain, swelling, limitation of shoulder movements, muscle atrophy (supraspinatus and infraspinatus), tenderness over the greater tuberosity, etc. The following grades are described in anterior impingement syndrome.

Management

Conservative treatment It consists of heat, massage, NSAIDs, local infiltration of hydrocortisone, subacromial steroid injections, exercises both active and passive, temporary immobilisation, etc. 80% will recover with these measures.

Surgical treatment

Indications Failure of conservative treatment for 3 months, if the patients are young and active, and if there is increasing loss of shoulder function, surgery is indicated.

Methods

Depending upon the aetiological factors the following surgical techniques are described: excision of adhesions and manipulation of shoulder, excision of calcium deposits, repair of incomplete tear, acromioplasty, acromiectomy for more disabling pain with normal range of movements, direct suture for complete rupture of rotator cuff, rotation and transposition of flap, free graft, etc.

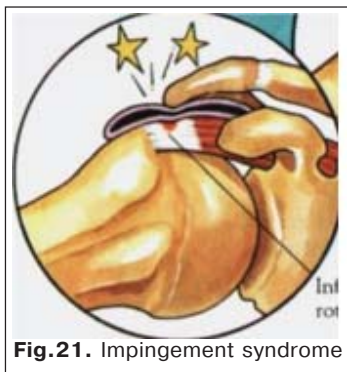


Fig.21. Impingement syndrome

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