Conceptual Orthopedics
The Learning Never Ends

Concepts of Clinical Examination in Orthopedics

Dedicated To

The Art of Clinical Examination
from The Masters of Yesterday to The Torchbearers of Tomorrow

Authored By The Faculty of Conceptual Orthopedics

Concepts of
Clinical Examination in Orthopedics

First Edition



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1 Chapter

Principles of General Orthopedic Examination

The first step of any clinical evaluation is to make the patient comfortable and take their confidence at the initial part of your interaction with them. For this it is always best to ask the basic details of the patient. Ask their name (*Addressing them by their name always gives the patient more confidence*), their occupation (*You understand what basically their functional requirement is*), where do they live (*You understand the seriousness of his disability if he has travelled miles to meet you*) and always their age.

Listen to their complaints first (pain, swelling, fever, appetite, weight loss, limp, restriction of movement, deformity). Then take the history of presenting illness and try to elaborate what their complaints were. If pain was the main complaint detail it out in terms of exact location, radiation if any, onset, progression, aggravating factors, relieving factors, diurnal variation, seasonal variation, associated with trauma/swelling/ clicks/sounds. Similarly detail other complaints as well.

Pain	Exact location, intensity, radiation if any, onset, progression, aggravating factors, relieving factors, diurnal variation, seasonal variation, if it is in any joint -associated with trauma/ swelling/ clicks/sounds. If pain is more localized to dermatomes then associated with numbness/ loss of sensations/skin changes in their own language
Swelling	Location, onset, progression, size (increasing or decreasing), fever, aggravating factors, relieving factors, diurnal variation, seasonal variation, associated with trauma/ pain/ clicks/ sounds, whether it is single or associated with other swellings. *Remember- swellings that usually reduce with progression could be either traumatic/ infective and unlikely to be neoplastic.*
Limp	Onset, progression, aggravating factors, relieving factors, associated with trauma/ shortening/ instability
Restriction of movement	Onset, progression, associated with stiffness, aggravating factors, relieving factors, associated with trauma/swelling/ clicks/sounds.
Deformity	Onset, progression, associated with trauma/swelling.

History of trauma

Usually, every patient tends to relate an orthopaedic problem to trauma. Our aim is to find out whether it is significant or not. For that ask the patient the exact mechanism of the injury which would help you to correlate better. Histories like motor vehicle accidents, sports trauma and fall from height can be considered significant.

If you feel that it is insignificant then ask if it is repetitive or not- multiple microtrauma can lead to various conditions.

Now while detailing these complaints one should prioritize them. An easy way is to understand what red and yellow flags of orthopaedics are.

Red flags (might require multi-specialty involvement)	Severe unremitting pain Pain unaffected by medication or position Severe night pain Severe pain with no history of injury Severe spasm Urinary symptoms Prolonged hyperthermia Psychologic overlay
Yellow flags (need detailed evaluation in the form of investigations)	Abnormal signs and symptoms Bilateral symptoms Neurological symptoms Multiple nerve root involvement Abnormal sensation patterns Progressive muscle weakness Multiple joint involvement Progressive walking abnormalities Autonomic changes

Now one has to ask for significant past history, personal history, family history and correlate it with the above symptoms.

Now describe the disability or functional loss the patient has what exactly the disease or condition is doing to the patient? This could be due to pain, stiffness or swelling.

Now one has to compile all the symptoms and try to explain what are the most probable conditions that could cause this and form out a differential diagnosis.

Examination

Before starting examination, it is always better to educate the patient what exactly you are going to perform. Explain them that you need to examine the body part that is affected and also would like to compare it with the opposite normal side and this would help you to come to a better diagnosis. Tell them to answer only to the questions asked from now on.

Make the patient comfortable and examine them in all possible comfortable positions.

Expose the patient with adequate covering of the private parts.

Always have a female attendant with a female patient and a child.

Make a habit to examine from proximal to distal, from head to toe, from a normal part to an abnormal part and always follow the steps of look, feel, move, measure, compare and then perform special tests.

Some tips to improve the outcome of your examinations are-

- While testing movements test the normal side first and ask the patient to repeat the same on the affected side (active) and compare. Then if there is restriction actively further perform it passively.
- Perform the examinations that cause pain at the end. For example, painful range of movement, or a special test that is likely to reproduce the pain that the patient has should be done at the end.
- While testing the adequacy of a particular ligament, perform the test multiple times and each time increase the force that you apply and stop when patient feels uncomfortable.

Examination of a musculoskeletal swelling

1. Inspection- location (anterior/posterior/medial/ lateral) and relate it with a nearby visible landmark, size, shape, edge, skin over it, any visible movement like pulsations and any engorged veins. Also mention if there is any scan, sinus or wound over the swelling. It can also indicate a previous intervention done.
2. Palpation- local rise of temperature, tenderness- superficial/deep, consistency, confirm size, shape and location, surface of the swelling- smooth/lobulated/irregular, margin of the swelling, pulsations (*relation to an artery*), reducibility, compressibility, fluctuation (*only in cystic compressible swellings*), mobility and translucency.
3. Mobility- check if the swelling is mobile in transverse and longitudinal plane
4. Plane of the swelling –
    - First check if the swelling is free from the skin- 'pinch test'. If the swelling is not arising from the skin then the skin will be pinchable over the swelling.
    - Next, we have to see if the swelling is in the subcutaneous plane (superficial or from the deep fascia). If the swelling is mobile in all directions then it can either be from the subcutaneous plane or surface of muscle.
    - However, swellings rising from the deep fascia or muscle has comparatively lesser movement. This movement is reduced once the muscle is made taut. This means that the swelling is either attached to the deep tissue or muscle.
    - These swellings become more prominent on muscle contraction.
    - But if the swelling is arising from within the muscle bulk, then it reduces in size when the muscle is made contracted.
    - However, if it is arising from the bone or fixed to the bone then one cannot appreciate any movement and on muscle contraction the swelling becomes less prominent depending on the size of the swelling and the muscle over it.
    - In case if one appreciates a swelling fixed to the bone and the bony swelling is becoming more prominent after muscle contraction then that means it might be a tear in the muscle.
    - Swellings arising from a tendon will glide along with movement of the tendon but when the tendon is made taut loses its mobility.
    - Swellings arising from nerves or vessels are relatively less mobile. Vascular swellings or swellings over a vessel can show bruit and transmitted pulsations.
    - Swelling arising from a joint might show a variation in size when the joint is taken through the range of motion. Most of the swellings arising from the vessels are compressible to some extent.
5. Bruit- Also auscultate for any bruit. It might be present if the swelling is associated with a blood vessel or a arterio-venous malformation.

2 Chapter

Examination of Shoulder Joint

Shoulder is the most mobile joint in human body. The humeral head on glenoid looks like golf ball on a tee. The shoulder girdle connects upper limb to axial skeleton

Shoulder girdle is made up of clavicle, scapula and the proximal humerus

It has four joints.

1. **Sternoclavicular joint (SCJ):** Saddle type synovial joint.
2. **Acromioclavicular joint (ACJ):** Plane type of synovial joint.
3. **Scapulothoracic joint:** Not a true joint, it is only an articulation (gliding or rotational movements over the thoracic cage)
4. **Glenohumeral:** Ball and socket type of synovial joint.

Glenohumeral joint is stabilized by- Static stabilizers and dynamic stabilizers

Static stabilizers: Glenohumeral ligaments:

Glenohumeral ligaments augment the capsule of the shoulder joint which extends all around the joint (superior, anterior, inferior, posterior) attached to the margins of the glenoid cavity and the articular margins of the humeral head. There are three in number.

1. Inferior glenohumeral ligament which is made up of anterior, posterior and superior bands,
2. Middle glenohumeral ligament and
3. Superior glenohumeral ligament.

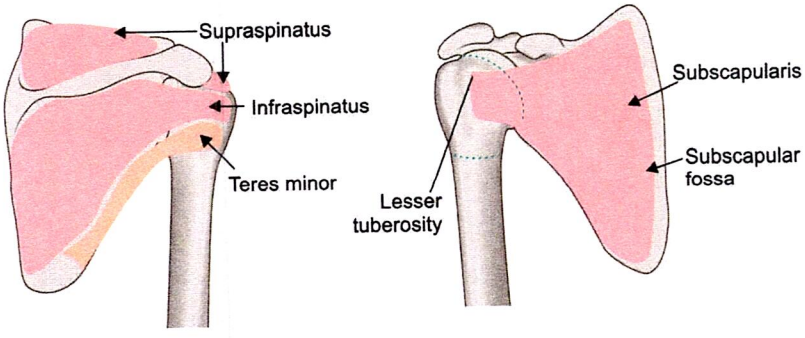
Other static stabilizers are coracohumeral ligament and glenoid labrum

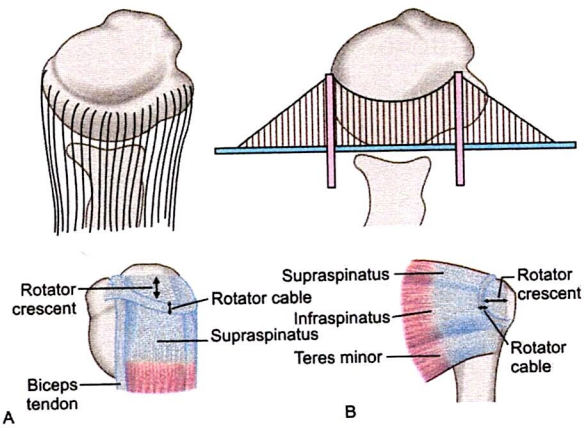
Dynamic stabilizer: Rotator cuff: It is made up of subscapularis, infraspinatus, supraspinatus, teres minor.

The other dynamic stabilizer is the long head of biceps

Movements of shoulder: 1. Abduction 2. Adduction, 3. Flexion 4. Extension 5. Internal rotation 6. External rotation.

Muscles around shoulder





1. **Deltoid:**

Origin - Lateral end of clavicle, acromion and scapular spine

Insertion - Deltoid tuberosity

Function - Anterior fibers provide flexion, middle fibers provide abduction and posterior fibers provide extension

2. **Supraspinatus:**

Origin- Posterior surface of scapula from supraspinatus fossa

Insertion- Greater tuberosity of humerus

Function- Initiation of abduction

3. **Infraspinatus:**

Origin- Posterior surface of scapula in infraspinous fossa

Insertion- Greater tubercle of humerus between supraspinatus and teres minor

Function- External rotation of arm

4. **Teres minor:**

Origin -Inferior angle of scapula

Insertion- Inferior aspect of greater tubercle of humerus.

Function- External rotation of arm

5. **Subscapularis:**

Origin - Anterior surface of scapula

Insertion - On lesser tubercle of humerus

Function Internal rotation of arm and adduction

6. **Trapezius:**

Origin- Medial one third of the superior nuchal line, external occipital protuberance, spinous processes of vertebra C7-T12, nuchal ligament

Insertion - Posterior border of the lateral one third of clavicle, acromion process and spine of scapula

Function- Elevation of scapula is done by upper fibers, middle fibers retraction of scapula, lower fibers pull scapula inferiorly

7. **Latissimus dorsi:**

Origin - Spinous processes of vertebrae T7-L5, thoracolumbar fascia, iliac crest, inferior 3 or 4 ribs and inferior angle of scapula

Insertion -Floor of intertubercular groove of the humerus

Function- It causes extension, adduction, internal rotation

8. **Levator scapulae:**

Origin- Posterior tubercles of transverse processes of C1 - C4 vertebrae

Insertion- Superior part of medial border of scapula

Function- It elevates the scapula

9. **Rhomboid major and minor:**

Origin-

Major - Spinous process of the T2 to T5 vertebrae

Minor -Nuchal ligaments and spinous process of C7-T1

Insertion –

Major - Medial border of the scapula, inferior to the insertion of rhomboid minor muscle

Minor - Medial border of scapula, superior to the insertion of rhomboid major muscle

Function - Retraction of scapula

10. Serratus anterior:

Origin- Fleshy slips from the outer surface of upper 8 or 9 ribs

Insertion- Costal aspect of medial margin of the scapula

Function- Fixes scapula to thoracic wall, scapular protraction and upward rotation

11. Pectoralis major:

Origin- Clavicular head: Anterior surface of the medial half of the clavicle

Sternocostal head: Anterior surface of the sternum, the superior six costal cartilages, and the apnoneurosis of the external oblique muscle.

Insertion: Lateral lip of the bicipital groove of the humerus (anteromedial proximal humerus)

Function

Clavicular head: it helps in flexion and adduction of arm

Sternal head: adduction and internal rotation

12. Biceps:

Origin- Long head from the supraglenoid tubercle

Short head of biceps originates from tip of coracoid process along with the origin of the coraco-brachialis and inserts on radial tuberosity and forearm fascia

Insertion: Radial tuberosity and forearm fascia

Functions- Helps in flexion of forearm and supination

13. Triceps:

Origin- Long head originates from infraglenoid tubercle, medial head originates from the posterior aspect of the humerus below the radial groove and lateral head originates from the posterior aspect of the humerus above the radial groove.

Insertion- Olecranon process of ulna

Function: Extensor of elbow

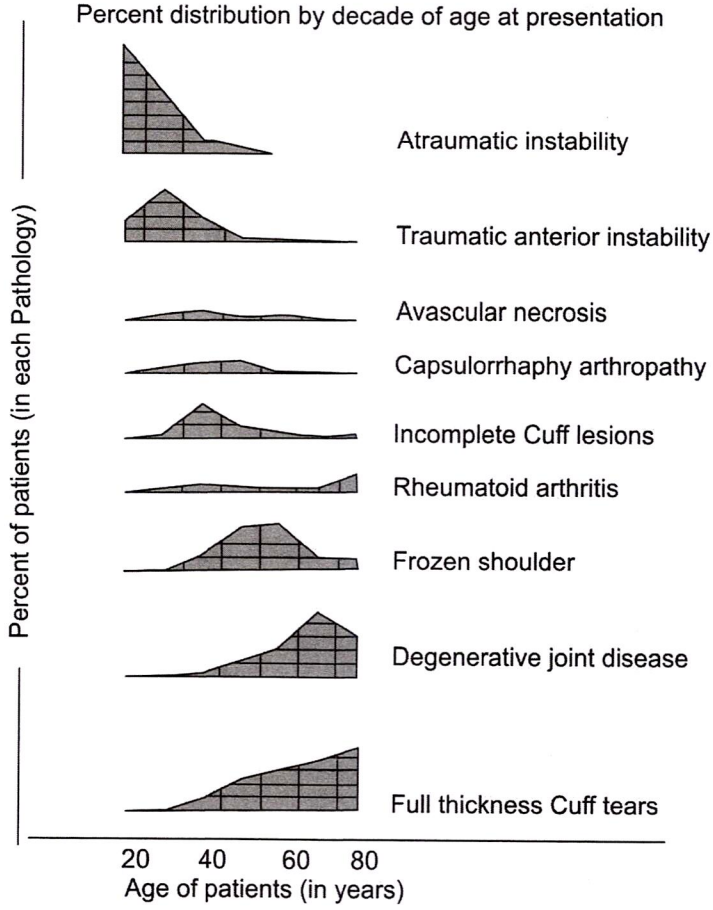
History taking in a shoulder case

A diagnosis of shoulder pathology can almost always be made at the end of the history. The physical examination and radiological investigations usually help to rule out any differential diagnosis and confirm the diagnosis suspected on basis of history.

Important points in shoulder history

1. Age – Diffferent shoulder pathologies usually present at different age groups. So just looking at the age of the patient, we can narrow down the different potential diagnosis to usually 2 or 3 possibilities

Non Infective Pathologies and Age distribution



Occupation – Some shoulder pathologies are more common in certain populations . For example, impingement is more common in people involved in overhead work; Superior Labrum from Anterior to Posterior (SLAP) tears are more common in throwing athletes. Also occupation may alter the line of treatment in certain groups of patients. For example, a contact sports athlete with shoulder instability will be better managed with a bony procedure like Latarjet rather than a soft tissue procedure

2. Pain
    a. Location – patient keeps his palm over the lateral aspect of deltoid in case of rotator cuff pathology, where as he places his fingertip over the AC joint area in case of AC joint pathology.
    b. Onset – most non traumatic shoulder pathologies present with a gradual onset of pain. Only exception is acute calcific tendinitis which present with an acute onset, non traumatic severe pain with the patient seeking a consultation within a few days of onset of pain
    c. Duration
    d. Type of pain
    e. Radiation – typically the shoulder pain radiates along the lateral border of the arm and does not radiate distal to the level of the elbow joint. Radiation distal to the elbow should raise suspicion of a cervical spine or brachial plexus problem and one should proceed with their examination.
    f. Aggravating and relieving factors
    g. Night pain – very common in shoulder pathologies like impingement syndrome, rotator cuff pathologies and adhesive capsulitis (lesser pain in comparison to rotator cuff pathologies). A severe night pain impairing sleep continuously for many days indicates an irritable shoulder and is an indication for peri/intra articular steroid injection for a number of surgeons.
3. Stiffness – Stiffness affecting activities of daily living is a common shoulder complaint especially in

adhesive capsulitis and shoulder arthritis

4. History in shoulder instability patient –
   a. History of index dislocation – to plan the treatment of a shoulder instability patient, it is important to classify whether the instability is traumatic or atraumatic. This is decided on the basis of the first dislocation (also known as the index dislocation). The traumatic episode leading to the index dislocation will most probably have a structural lesion and will need an operative treatment, while atraumatic index dislocation will fit in the atraumatic instability classification and may require non operative treatment as the first line of management.
   Also, the mechanism of injury during the index dislocation can guide us about the direction of instability.
   b. Number of dislocations – repeated dislocations increase the chances of injury to capsular and bony tissues leading to increased possibility of a bony procedure being required for stabilization.
   c. Reduction history
   d. Sleep dislocation – sleep dislocation is considered, by many surgeons, as an indicator of poor quality of capsular tissue.
   e. Association with convulsive disorder
   f. Congenital dysplasia or dislocation of shoulder- anterior, posterior or global.

The shoulder examination consists of

1. Assessment of generalized ligamentous laxity
2. Inspection
3. Palpation
4. Movements and scapular dyskinesis
5. Muscle testing
6. Special tests

Examination of shoulder joint should be done in sitting and also supine position.

Examination is done from front, lateral and also from the back.

1. **Assessment of generalized ligamentous laxity**- Joint mobility is usually more in females.

Beighton score: Also called Beighton and Horan Joint Mobility index; first described by Carter/ Wilkinson Beighton/ Horan modified it. It is also used for diagnosing benign joint hypermobile syndrome

Higher the score, more is the laxity.

Test to be done	Scoring		
	0	1	2
Little finger Metacarpo phalangeal joint hypermobility: In sitting position / elbow flexed to 90°, palm in pronation, extend little finger passively.	< 90° extension	> 90° extension U/L	> 90° extension B/L
Thumb: with elbow extended bring the thumb to volar aspect of forearm	Cannot touch	Can touch volar aspect U/L	Can touch volar aspect B/L
Elbows: Arms outstretched elbow extended > 10°	< 10°	>10° U/L extension	> 10° B/L extension
Knees: In standing position if knees hyperextended (or) Recurvatum> 10°	<10°	>10° U/L	>10° B/L
Spine: with knees in extension can keep palms of both hands on the floor		B/L palms on floor	
Beighton score > 6 shows a generalized laxity.			

Benign joint hypermobile syndrome

Brighton score:

Major Criteria-

1. Beighton score ≥ 4/9
2. Arthralgia ≥3 months in 4 or more joints

Minor Criteria-

1. Beighton score less than 4
2. Arthralgia (≥3 months) in 1-3 joints

Or

Back pain longer than 3 months

Or

Spondylosis, spondylolysis, spondylolisthesis

3. Dislocation or subluxation in more than one joint (or) more than one time in single joint
4. Marfan features
5. Abnormal skin, striae, thin skin, hyperextensibility
6. Eye: Drooping eye lids, myopia
7. Varicose veins/ hernia
8. Mitral valve prolapsed

Diagnosis:

1. Two major criteria
2. One major + two minor criteria
3. Four minor criteria
4. Two minor + first degree relative affected



Beighton's tests

Shoulder examination:

Inspection:

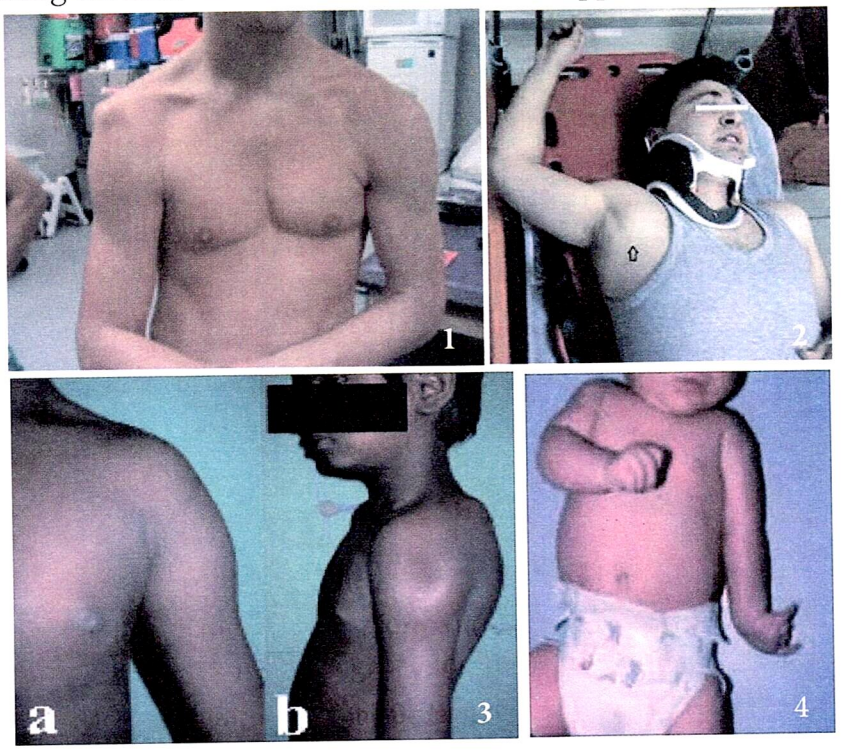
Strip the patient till waist; make the patient comfortable.

Examine the patient in sitting position

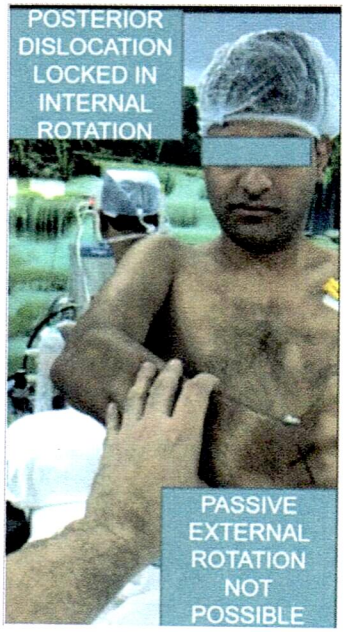
Attitude of the upper limb

1	Anterior dislocation	Shoulder abducted/ externally rotated supported by opposite hand
2	Posterior dislocation	Adducted and internally rotated
3	Superior dislocation luxation erecta	Hand held by the side of head
4	Abduction contracture deltoid	Arm hangs in fixed abduction
5	Abscess	Mild flexion and external rotation
6	Erb's palsy	Arm hangs by side/ internally rotated, elbow extension and forearm pronated, wrist flexed palm facing posteriorly

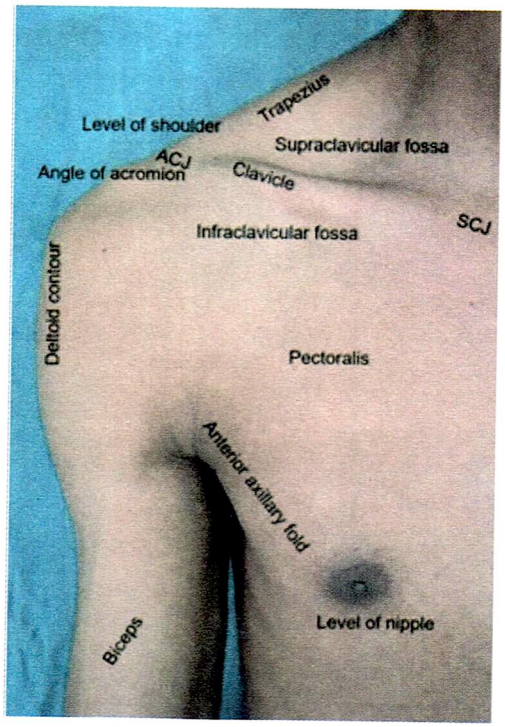
Attitude should be observed in sitting/standing position. Attitude should be described as the position in which the patient is holding the limb and mention if the arm is supported by the other limb or not.



Images show 1. Anterior dislocation of shoulder 2. Luxatio erecta 3. Deltoid contracture (a and b) and 4. Erb's palsy



Inspection: Inspection is done from front, side and behind.



1. Front:

a. Level of both shoulder

Normally level of both shoulders are equal. In people who perform heavy labor or work/ athletes like Javelin throwers, tennis players, the level of the shoulder on dominant side can be slightly higher.

b. Level of both nipples: In patient with partial absence of pectoralis major the nipple can be at a lower level. However the areola of the nipple can be under developed and also has to be noted.

c. The line from the acromion to sterno-clavicular joint should be inspected on both side which include the AC joint, clavicle and sternoclavicular joint. Generally, this is a smooth line sloping downwards, forwards and medially from AC joint to SC joint. The SC joint can be identified on either side of the suprasternal notch.

d. Look for any fullness in supraclavicular and infraclavicular fossa.

e. Look for any scars/ sinuses/ erythema/ engorged veins/ lymph nodes.

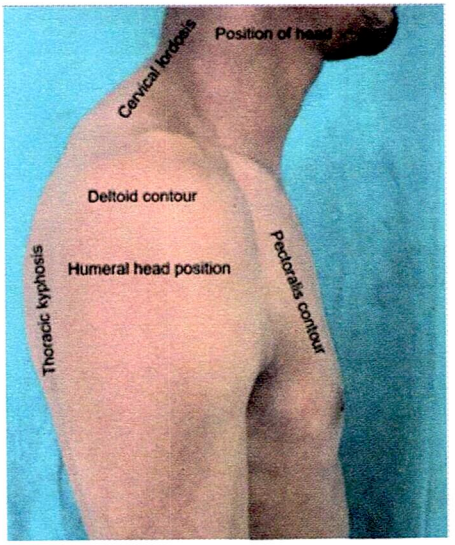
f. Look for any muscle wasting

2. Lateral Side:

a. Look at cervical spine curvature

b. Look for position of head in relation to shoulder- a forward head posture is more frequently seen in patients with impingement syndrome and degenerative rotator cuff tears.

c. Look for contour of deltoid. Flattening or loss of deltoid contour is seen in dislocation/ deltoid paralysis due to axillary nerve injury. Sometimes humeral head can be seen as a mass under the posterior or anterior part of the deltoid/ axillary fold depending upon the type of dislocation.



3. From back in standing or sitting position:

Most prominent structure visible on posterior aspect is scapula.

Most prominent part is the medial border of scapula

- Scapular spine is at the level of T3 vertebra - Inferior scapular angle is at the level of T7 vertebra

Small and high riding scapula is seen in Sprengel shoulder. *(Remember the scapula has not descended down)*

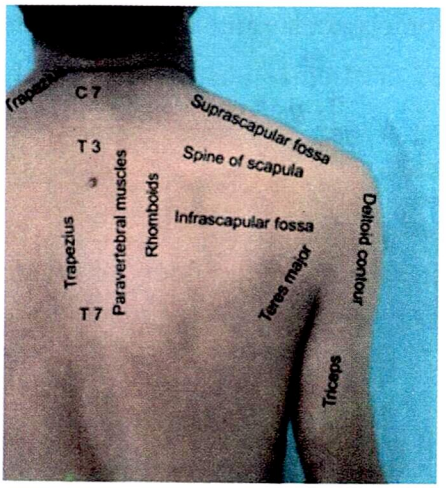
Look for swelling or wasting in supraspinatus/ infraspinatus fossa.

Look for soft tissue abnormalities.

The medial borders of both scapula should be equidistant from center of spine. The lateral shift of scapula is seen in athletes with overhead throwing like Javelin throw.

Look if scapula is retracted or protracted.

Remember: Wasting of the supraspinatus; infraspinatus can indicate a pathology in the muscle. However wasting of subscapularis is not visible as it is a deep seated muscle.



Look from top look for :

- Contour of deltoid
- Any acromioclavicular abnormality

In all aspects look for

- Bruises
- Swelling
- Scars
- Sinuses
- Engorged veins
- Erythema

Palpation:

Local rise of temperature:

Feel and compare local rise of temperature with dorsum of hand. First examine normal and then the affected side.

Palpate all bony prominences

Start from manubrium sterni. The suprasternal notch can be easily felt and just next to it laterally the medial end of the clavicle is palpated and one can advance palpating the entire subcutaneous border of the clavicle. A dip is felt at the lateral border of the clavicle indicating the acromioclavicular joint.

From lateral border of clavicle drop inferiorly about one inch and palpate the coracoid process.

At this point give some traction to the limb and this will help in better palpation of the anterior edge of acromion. Palpate along the acromion towards posterior acromion. While further palpating one can continue along the scapular spine to reach the medial border of spine. From here reach the inferior and superior point of scapula.

Mark all the bony prominences:

1. Medial end of clavicle
2. Acromioclavicular joint
3. Coracoid process
4. Acromion process (anterior, posterior and the angle)
5. Spine of scapula
6. Inferior angle of scapula