Chapter

# 3

# Shoulder Joint

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## INTRODUCTION

The use of ultrasound (USG) for diagnosing and treating shoulder pain by pain physicians is comparatively a recent practice. Shoulder ultrasound examination is considered operator-dependent, but almost as accurate as magnetic resonance imaging in the detection of different soft tissue pathologies of shoulder. Scanning of the shoulder can be challenging and also time-consuming if a protocol is not followed. It is essential that the individual performing the USG examination has an understanding of pertinent anatomy, such as bone surface anatomy and tendon orientation. It is also important to be familiar with imaging pitfalls related to USG of specific structures, such as anisotropy of biceps tendon or subscapularis. Individual variations in anatomy should also be taken into account.

Although magnetic resonance imaging (MRI) is typically the modality of choice for evaluating the soft-tissue structures of the shoulder, USG is becoming an important complementary imaging tool. The advantages of USG over MRI include low cost, easy accessibility. High-resolution real-time imaging enables us both dynamic assessment and intervention with direct needle visualization. USG and MRI imaging have been shown to have comparable diagnostic accuracy in the evaluation of rotator cuff pathologies, subacromial-subdeltoid (SASD) bursa, and long head of the biceps tendon (LHBT) disease, which include the most common causes of shoulder pain.[1–6]

This chapter presents a simplified protocol-based approach for scanning of the shoulder.

## SONOANATOMY ON HEALTHY VOLUNTEER

The shoulder USG examination is performed using high-frequency (9–15-MHz) linear broad-band array transducers. Usually, the patient adopts sitting position (preferably on a backless rotating chair) facing the monitor, with the examiner stands behind the patient (Fig. 3.1).

If an additional monitor (slave monitor) is used (especially during intervention), then USG machine can be placed by the side of the examiner and slave monitor can be placed in front of the patient for easy viewing (Fig. 3.2).

Use of 2 monitors makes the process easily manageable by a single examiner. Slave monitor should be placed in front of the examiner for easy viewing during intervention, while the USG machine is placed at a comfortable distance for adjusting the knobs of USG machine, if required (Fig. 3.3).

**Fig. 3.1:** Patient is sitting and facing the USG machine, while the examiner is standing behind the patient.

**Fig. 3.2:** Patient is sitting and facing the slave monitor, while the examiner is standing behind the patient and the USG machine is kept on one side of the examiner.

**Fig. 3.3:** During USG guided shoulder intervention, monitor is kept in front of the interventionist for easy viewing, while the USG machine is kept machine at a comfortable distance for machine knob adjustment.

Each individual anatomic structure is evaluated in both long and short axis, along with specific dynamic maneuver for that structure as needed.

Real-time diagnostic shoulder USG should be performed in a logical and systematic fashion. Method should be easily understood and remembered, so that the findings are reproduced easily.

At our institution, we perform a standardized protocol-based shoulder examination. Common causes of pain syndromes are evaluated first. The examination starts with the rotator cuff muscles and tendons, which is then followed by the uncommon pain generators of shoulder. A chart is presented here (Flowchart 3.1). Although the order in which the examination is performed is subject to institutional preference, main aim is to facilitate the optimal evaluation of individual anatomic structures.

The positions adopted by the patient to facilitate the ultrasound evaluation of shoulder are shown in Figure 3.4.

**Flowchart 3.1:** A protocol-based approach at our institution (Daradia Pain Hospital, Kolkata, India)



**Fig. 3.4:** (A) Shoulder in neutral position with elbow flexed, (B) Shoulder in internally rotated position with elbow flexed, (C) Shoulder in externally rotated position with elbow flexed, (D) Patient holding the opposite shoulder, (E) Crass position (patient's arm hyperextended and internally rotated, with the elbow flexed and the dorsal aspect of the hand rests along the low midline of the back), (F) Modified crass position (elbow flexed and the volar aspect of the hand is placed along the ipsilateral iliac wing in a "hand-in-back-pocket" configuration)

## MUSCLES AND TENDONS

The shoulder demonstrates a unique functional balance between mobility and stability. Dynamic stability is provided by the periarticular musculature, whereas passive stability comes from the passive forces such as articular surface configuration, capsule, or ligaments. Four muscles which make up the rotator cuff, attach onto the proximal humerus as tendons. The subscapularis originates in the subscapular fossa and inserts onto the lesser tuberosity of the proximal humerus (Fig. 3.5B). The supraspinatus is located in the suprascapular fossa of the scapula and inserts onto the greater tuberosity of the proximal humerus (Fig. 3.5C). The infraspinatus from infrascapular fossa inserts onto the posterior aspect of the greater tuberosity, while the teres minor is located just inferior to the infraspinatus and also

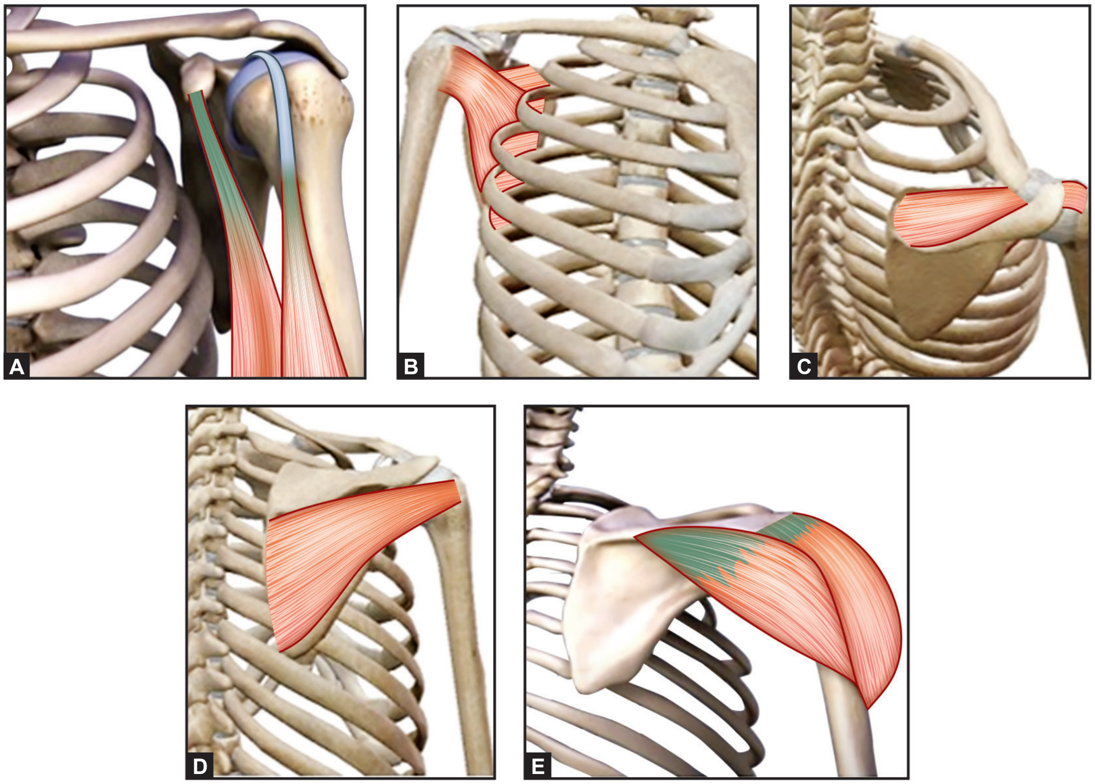


**Fig. 3.5:** (A) Biceps, (B) Subscapularis, (C) Supraspinatus, (D) Infraspinatus, (E) Deltoid

inserts onto the greater tuberosity (Fig. 3.5D). The associated muscles which come in the way during rotator cuff evaluation are (a) long head of biceps tendon (LHBT), (b) deltoid (Fig. 3.5E) (c) trapezius (d) short head of biceps (e) coracobrachialis (f) pectoralis major.

LHBT is a noncontractile traction tendon that assists in anterior shoulder stability. The LHBT is anchored to and originates from the superior glenoid labrum and supraglenoid tubercle. The intracapsular LHBT courses through the rotator interval and makes a 30°–45° turn while entering the bicipital groove. Transverse humeral ligament covers the LHBT in the bicipital groove.

Shoulder USG starts with the evaluation of LHBT in both short and long axis (Fig. 3.6). Evaluation should extend proximally from the superior aspect of bicipital groove to the pectoralis major tendon attachment on humerus distally. The LHBT should have a normal fibrillar pattern, which represents the parallel collagen fibers of the tendon. Real-time USG examination of all the tendons should be performed with gentle toggling (i.e. rocking and angling) of the transducer to eliminate the anisotropy artifact, which may mimic tendinopathy or a tear. Dynamic USG examination of the LHBT is performed to evaluate for possible tendon subluxation or dislocation. The patient's arm is gently manipulated in internal and external rotation, while the arm is held in adduction, with the elbow flexed and palm supinated position. The ultrasound images are given below.

A long axis view of lesser tuberosity and greater tuberosity is given here for better orientation of the bicipital groove (Fig. 3.7).

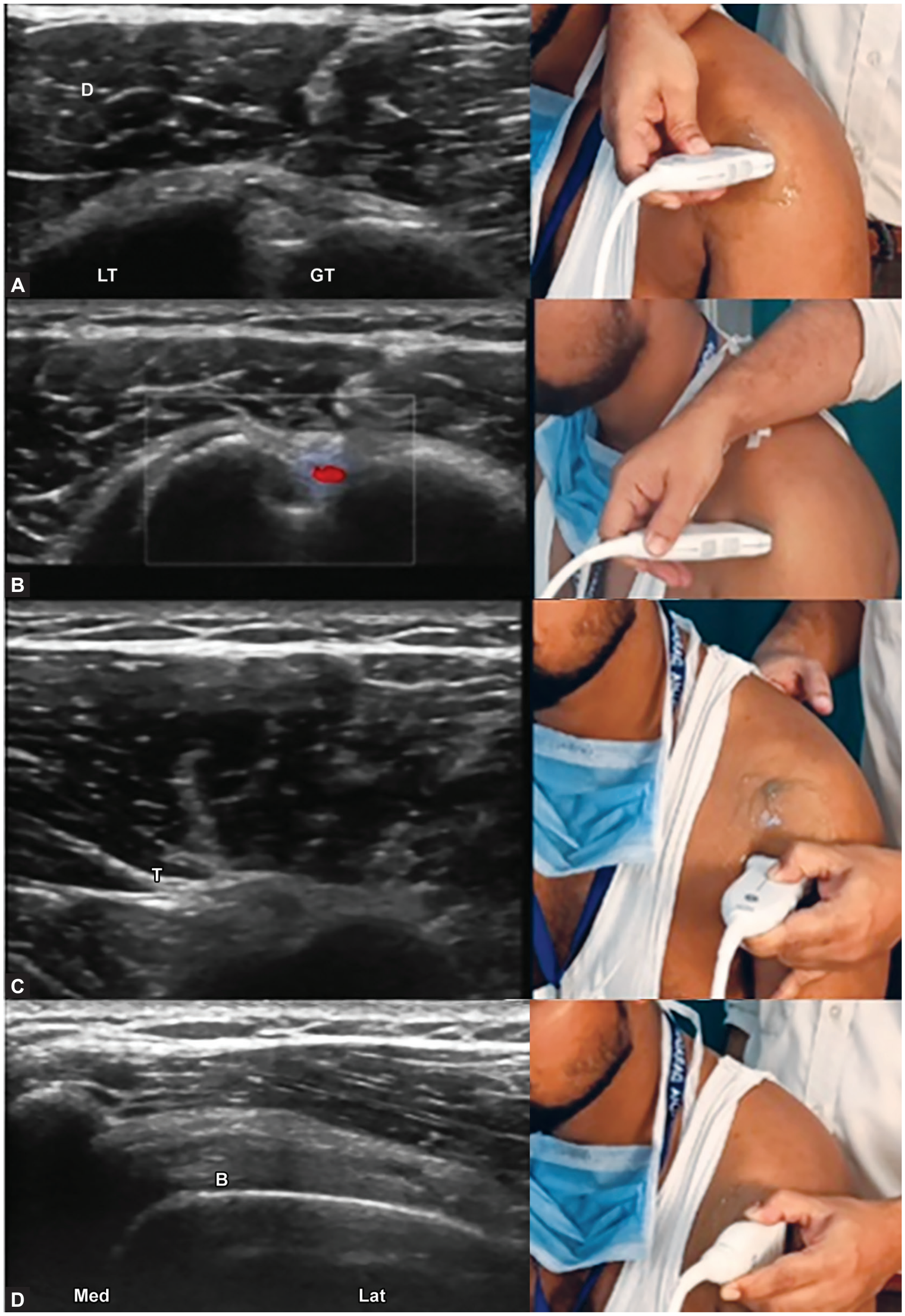


**Fig. 3.6:** The USG transducer is placed in the short-axis orientation over the bicipital tendon over (A) the proximal bicipital groove, (B) the proximal bicipital groove where color Doppler identifies ascending branch of circumflex humoral artery (C) distal area where pectoralis major tendon covers the biceps tendon and joins the humerus (D) in a long axis orientation of LHBT. [LT = Lesser tuberosity, GT = Greater tuberosity, D = Deltoid, B = Biceps tendon, T = Trapezius tendon]

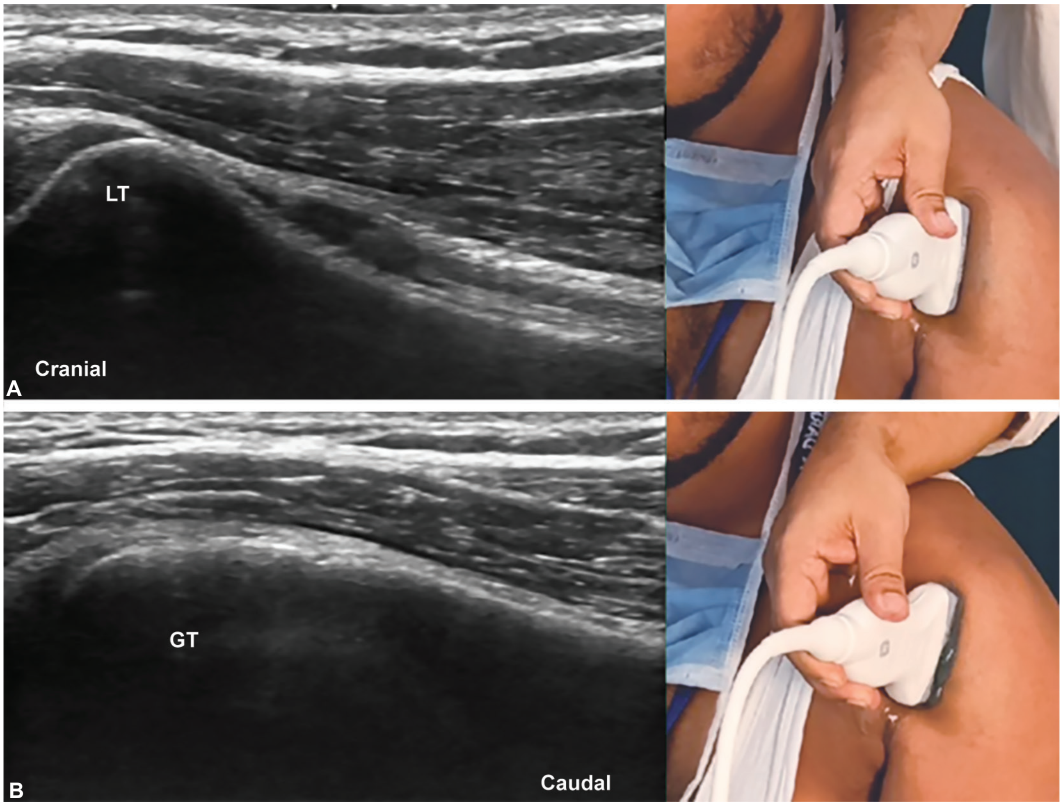


**Fig. 3.7:** From Figure 3.6 probe position, transducer is moved medially parallelly over the lesser tuberosity (A) and then laterally over the greater tuberosity (B). [LT = Lesser tuberosity, GT = Greater tuberosity]

By taking a closer look at the greater tuberosity, familiarity with facet anatomy and bone landmarks can assist in correctly identifying the individual tendons of the rotator cuff (Fig. 3.8). The greater tuberosity consists of three facets moving from anterior to posterior: a superior facet, a middle facet, and an inferior facet.

The subscapularis tendon (SubT) is best evaluated using the same arm and hand positions that were used for evaluation of the LHBT. The transducer is held in the short axis orientation for LHBT at first. The SubT insertion over lesser tuberosity is identified. The patient's arm is maneuvered into external rotation, which causes the lesser tuberosity to rotate laterally. This ultimately elongates the SubT and brings the myotendinous junction into view. Long and short-axis images of the tendon are obtained. Probe is moved up and down (when in long axis orientation of subscapularis tendon) and medially and laterally (when in short axis orientation for subscapularis tendon), to evaluate the full length of the tendon up to the myotendinous junction. The normal tendon is hyperechoic and has uniform fibrillar appearance in the long-axis plane (Fig. 3.9A). The hypoechoic medial most portion is usually due to anisotropy. The short-axis image will largely show hypoechoic muscle with interspersed linear hyperechoic tendon fibers, which is a normal finding (Fig. 3.9B).

Patient positioning in 'crass' or 'modified crass' position is required for examination of the supraspinatus tendon (SST). In neutral position of the arm, a majority portion of the

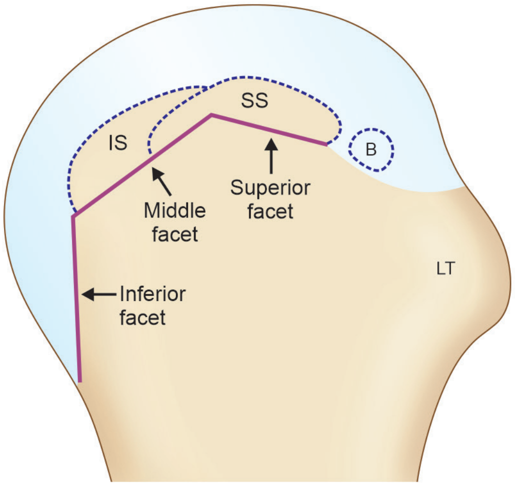


**Fig. 3.8:** Greater tuberosity facets. Illustration of sagittal section through head of humerus shows location of supraspinatus (SS) and infraspinatus (IS) tendon attachments relative to the greater tuberosity facets. B = Long head of biceps brachii tendon, LT = Lesser tuberosity.

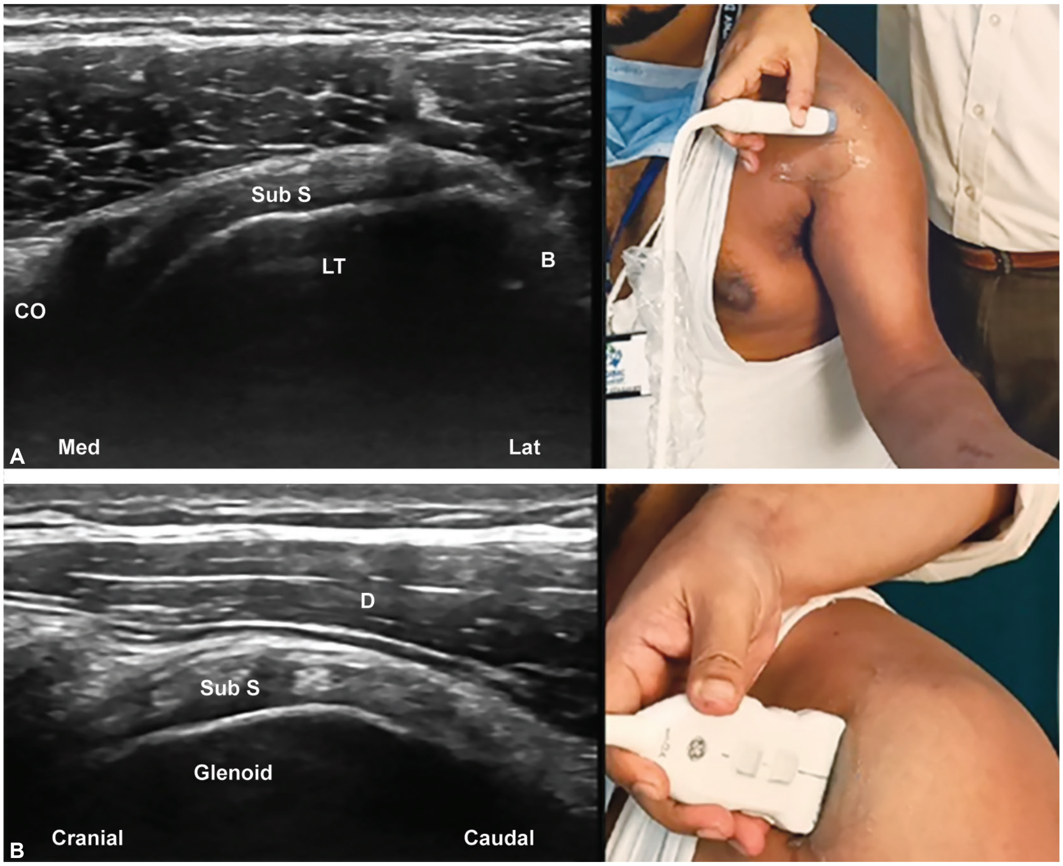


**Fig. 3.9:** Subscapularis tendon. (A) Long-axis view; Externally rotated shoulder position is adopted while examining the tendon in long axis view, (B) Short -axis view [LT= Lesser tuberosity, D = Deltoid, B = Biceps tendon, Sub S = Subscapularis, CO = Coracoid]

SST remains hidden under the acromion and so remains inaccessible due to bony shadow. Patients of shoulder pain and stiffness often find it difficult to adopt Crass position. In those cases, a modified Crass position is preferred. These positions bring the SST out from underneath the acromion, and allow optimal imaging of the SST. The SST is examined in long (Fig. 3.10A) and short axis (Fig. 3.10B). The normal tendon is hyperechoic, with a

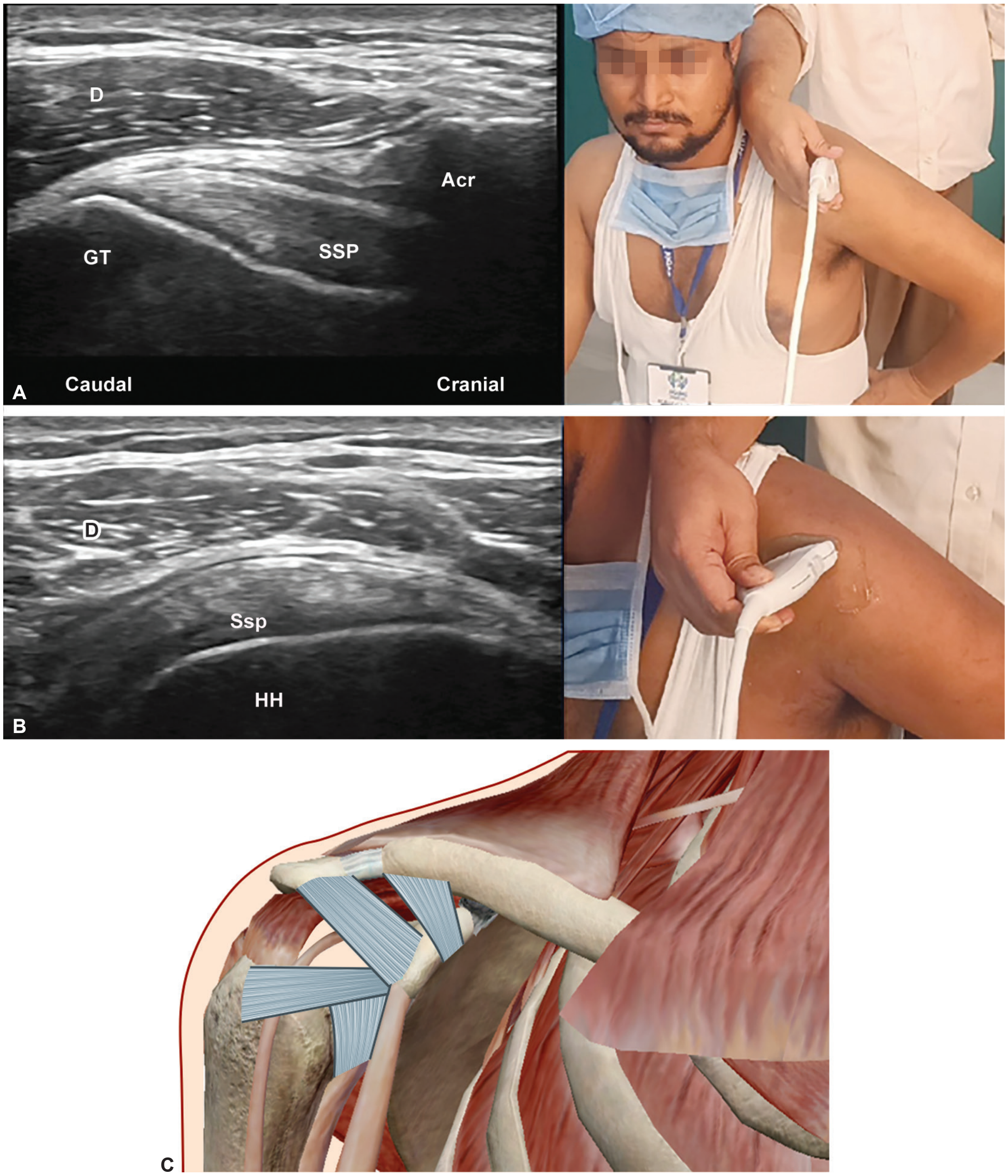


**Fig. 3.10:** Supraspinatus tendon. (A) Long-axis view; Crass position is adopted while examining the tendon in long-axis view, (B) Short-axis view, (C) Biceps tendon forms the anterior border of SST. [GT = Greater tuberosity, Acr = Acromion, Ssp = Supraspinatus, D = Deltoid, HH = Humeral head]

convex surface and uniform fibrillar appearance. Tendon insertion at the greater trochanter is often described as having a bird's beak appearance.

Anisotropy should be eliminated by gentle toggling of the transducer. Anisotropy is expected as it travels circumferentially around the humeral head. The LHBT at the rotator interval is an anatomic landmark that is helpful for identifying the anterior edge of the SST, which can be seen just posterior to the LHBT (Fig. 3.10C). So, to visualize the complete tendon width, transducer placed in the long axis of SST should be moved from anterior to anterolaterally.

Supraspinatus muscle bulk can be examined in the supraspinatus fossa both in long-axis (Fig. 3.11A) and short-axis view (Fig. 3.11B) for any abnormality. Trapezius muscle covers the supraspinatus muscle in this area.

For USG evaluation of the infraspinatus tendon (IST), patient's arm remains in adducted position with elbow flexed and internally rotated. The USG transducer is then placed just below the scapular spine in a transverse orientation. Infraspinatus muscle belly is readily identified on the basis of its triangular shape. Transducer should be slowly moved laterally from this long-axis view of the infraspinatus muscle belly to its insertion onto the greater tuberosity (Fig. 3.12A). With the transducer placed in the short-axis orientation on the infraspinatus muscle, the teres minor muscle can also be identified by moving the transducer inferiorly while maintaining the same transducer orientation (Fig. 3.12B).

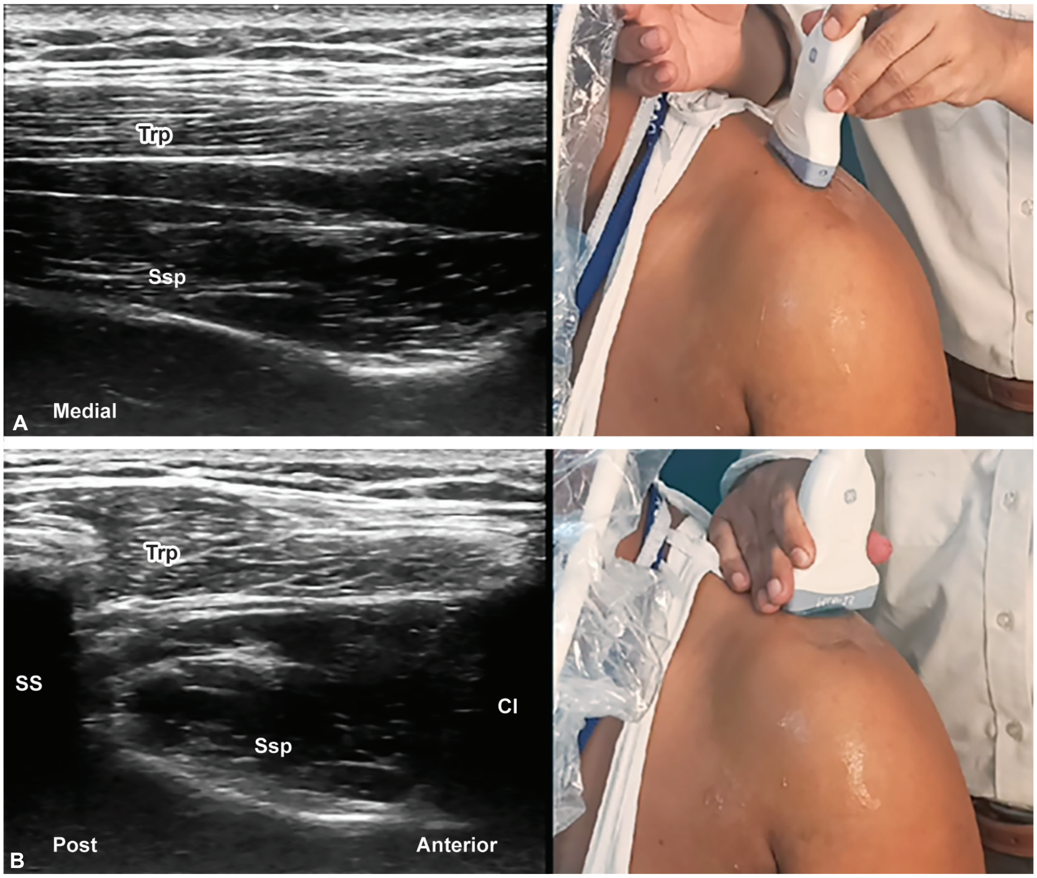


**Fig. 3.11:** Supraspinatus muscle belly at supraspinatus fossa in long-axis (A) and short-axis view (B) [Ssp = supraspinatus, Trp = Trapezius, Cl = Clavicle, SS = Scapular spine]

Normal muscles have a pennate pattern, are hypoechoic, and have linear hyperechoic septa. Teres minor muscle belly can also be followed to its tendinous insertion on the greater tuberosity (Fig. 3.12C).

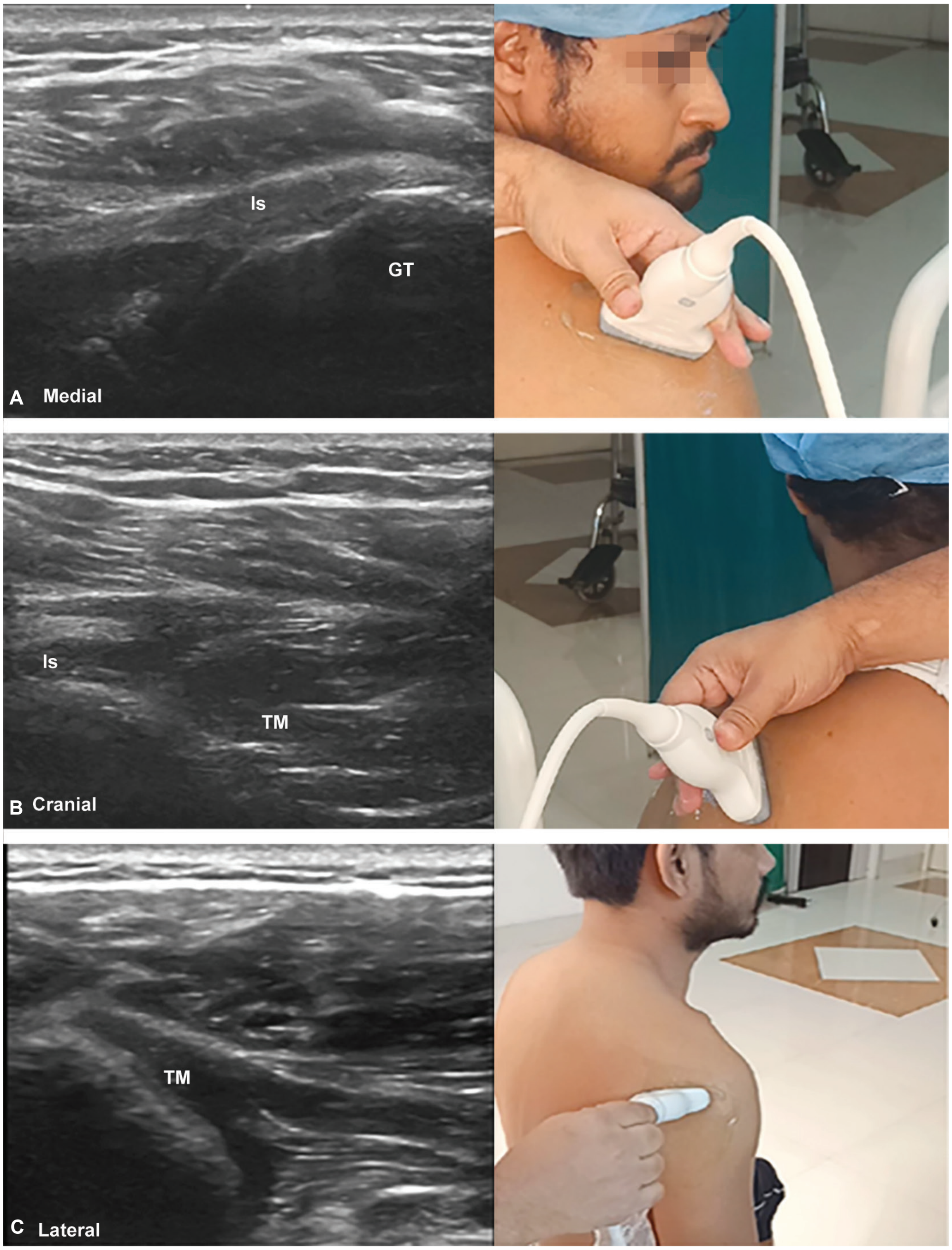


**Fig. 3.12:** (A) Long axis view of infraspinatus tendon (B) Short-axis view of both infraspinatus and teres minor muscle belly (C) Long-axis view of teres minor tendinous insertion [Tm = Teres minor, Is = Infraspinatus, GT = Greater tuberosity]

## LIGAMENTS

There are 3 main ligaments in the shoulder joint. They are (a) glenohumoral ligament which has superior, middle and inferior components (b) coracohumoral ligaments and (c) coracoacromial ligaments. Inferior glenohumoral Ligament is further subdivided into 3 different portions: anterior band, posterior band, and the axillary pouch (Fig. 3.13).[7] Other ligaments are coracoclavicular, acromioclavicular and transverse humoral ligaments.

**Coracohumoral ligament (CHL):** Ultrasound scanning is done by using the similar technique of LHBT short-axis scan. Patient remains seated with shoulder in slight extension and external rotation. Scanning starts from caudal (at the level of bicipital groove) to cephalad (when the coracoid origin of ligament is visible). Images are shown below at three levels (Fig. 3.14).[8] At Figure 3.14C probe position, CHL width is measured in cases of frozen shoulder.[9]

Coracoacromial ligament (CAL) connects the acromion and coracoid process of the scapula. It forms an osseoligamentous static restraint to superior humeral head displacement. Ultrasound transducer is kept on a line joining coracoid and acromion for easy visualization of CAL (Fig. 3.15A).[10] The short-axis view of the coracoacromial ligament shows a plate-like structure covering the supraspinatus tendon and the subacromial bursa (Fig. 3.15B).[11]

All parts of glenohumeral ligament (GHL) are not easily visible by ultrasound. Only the inferior GHL is partly seen. It is looked for thickening in cases of adhesive capsulitis (Fig. 3.16).[12]

The biceps tendon stabilizing role of transverse humoral ligament (THL) or Brodie ligament is controversial. It extends between the lesser and greater tubercles of the humerus.[13] Cadaveric study reveals that two tissue layers can be identified in the area described as the THL. In the deep layer, fibers of the subscapularis tendon were found to span the bicipital groove with contributions from the coracohumeral ligament and the supraspinatus tendon. Superficial to this layer was a fibrous fascial covering consisting of distinct bands of tissue. Neurohistology staining revealed the presence of free nerve endings, giving rise to the possibility of becoming a pain generator (Fig. 3.17).[14]

The coracoclavicular (CC) ligament, which is the major vertical stabilizing factor of the acromioclavicular joint, can be divided into two parts: the more medial conoid ligament

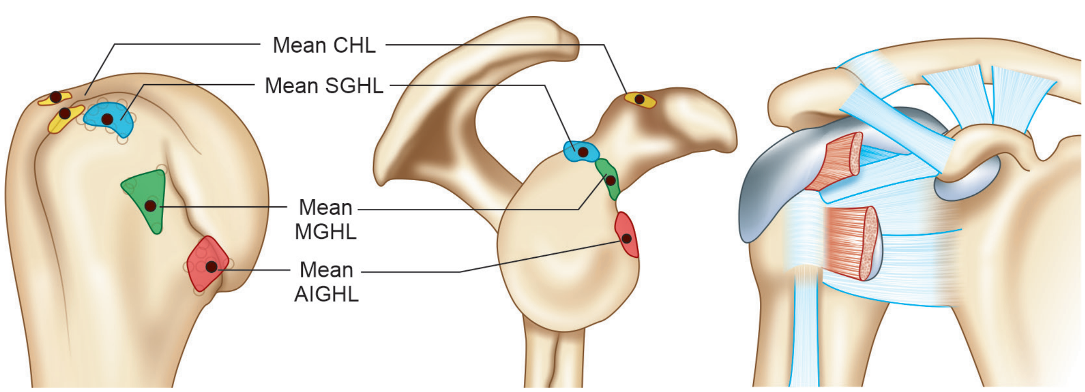


**Fig. 3.13:** Ligaments of the shoulder

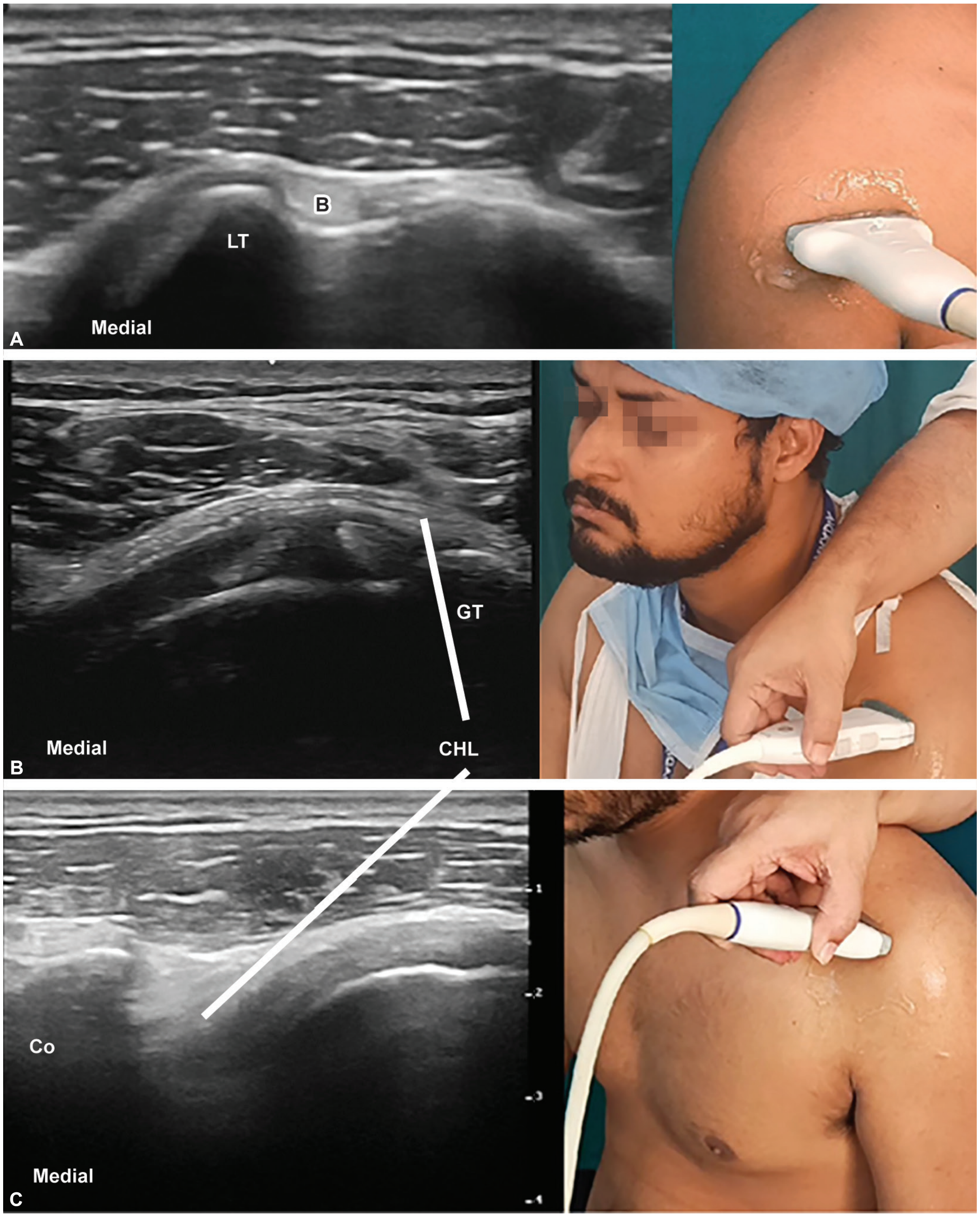


**Fig. 3.14:** Probe position at the level of the (A) bicipital groove, (B) rotator interval, (C) long axis of the CHL at coracoid process origin, [GT = Greater tuberosity, Lt = Lesser tuberosity, B = Biceps tendon, Co = Coracoid , CHL = Coracohumeral Ligament]

and the more lateral trapezoid ligament.[15] Coracoclavicular ligaments also can be visualized by placing the USG transducer under the clavicle (keeping the probe obliquely to visualize both bony shadow) (Fig. 3.18).[16]

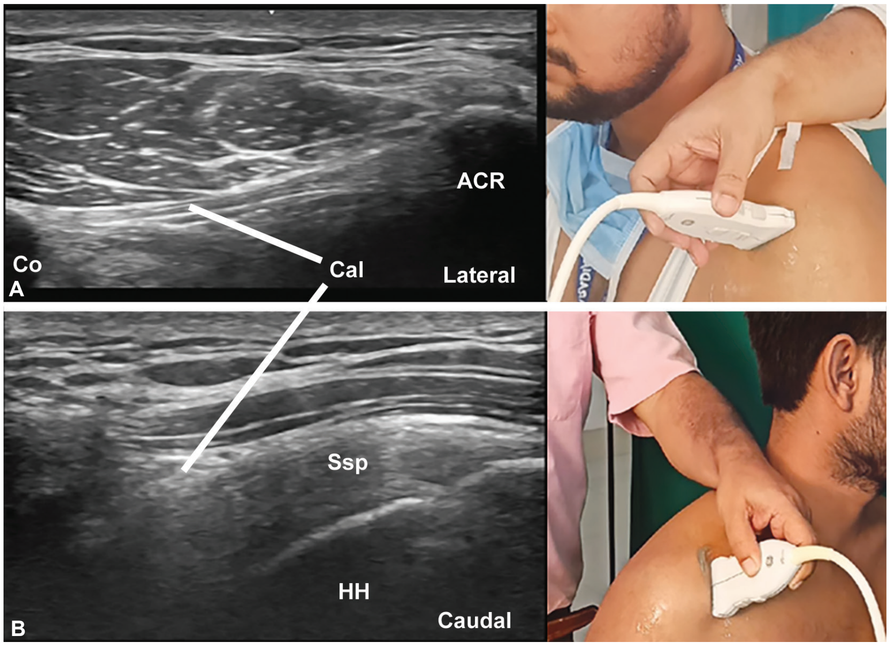


**Fig. 3.15:** (A) Long-axis and (B) short-axis view of coracoacromial ligament [Co = Coracoid, Acr = Acromion, HH = Humeral head, CAL = Coracoacromial ligament, Ssp = Supraspinatus]

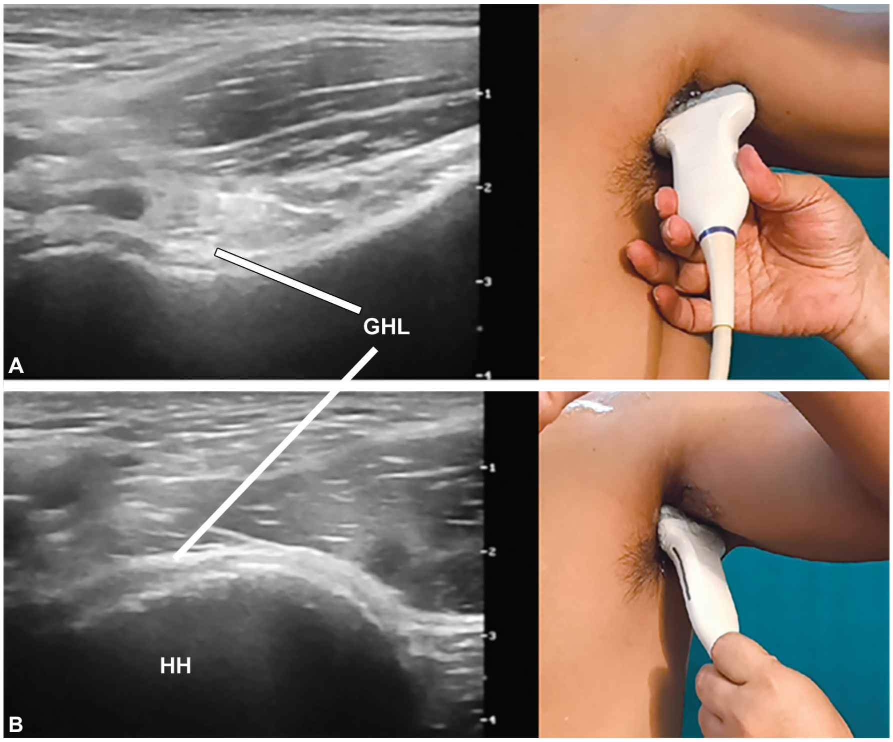


**Fig. 3.16:** Transducer positioning and normal appearance of GHL on (A) axial view and (B) coronal views. [HH = Humeral head, GHL = Glenohumeral ligament]

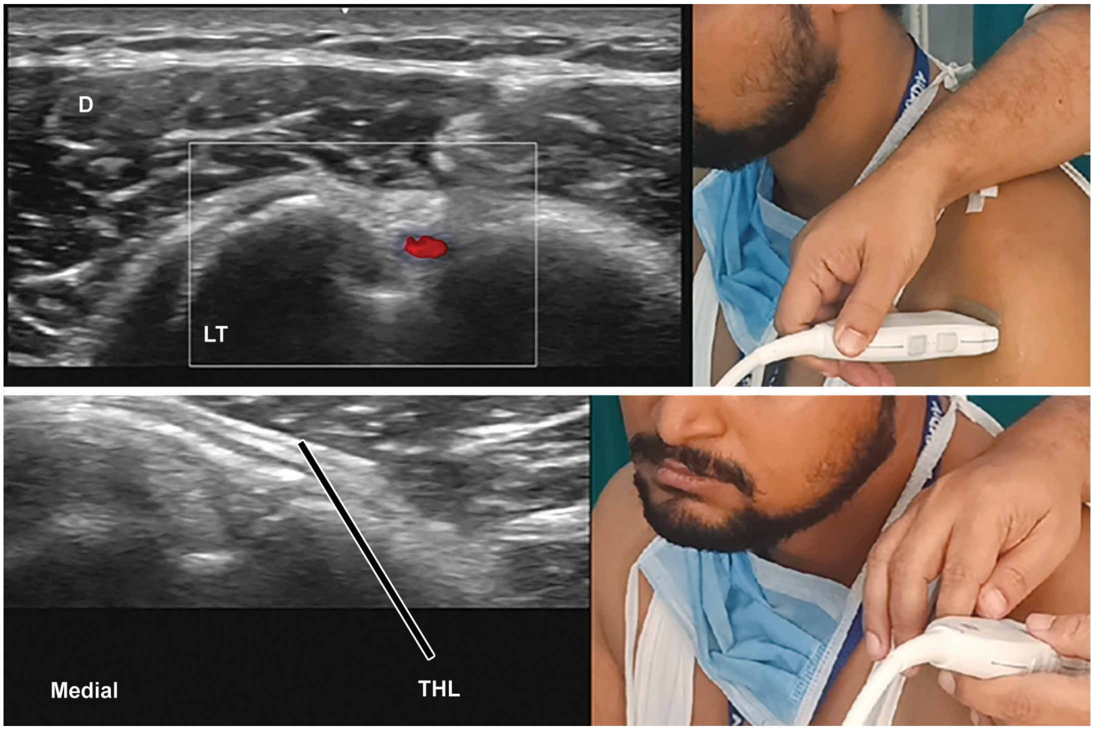


**Fig. 3.17:** The transverse humeral ligament lies superficial to the tendon. The subscapularis tendon can be seen medially. Using Doppler imaging, the ascending branch of the circumflex humeral artery may be visualized laterally. [THL = Transverse humeral ligament, LT = Lesser tuberocity, D = Deltoid

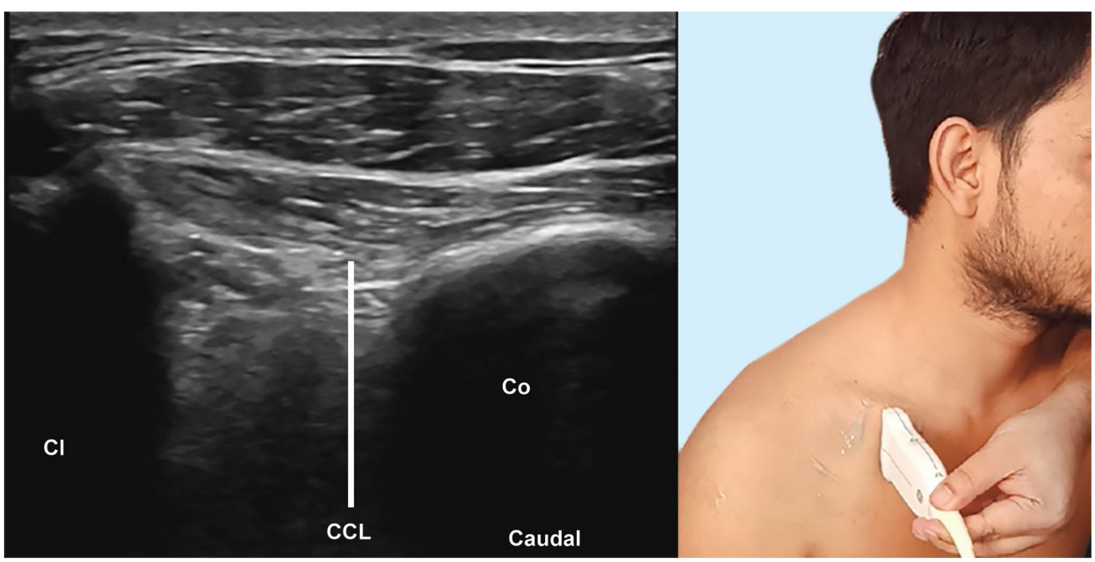


**Fig. 3.18:** Ultrasound appearance of the coracoclavicular ligaments. Long-axis view of the trapezoid ligament and conoid ligament. Acromion vascular pedicle is usually seen [Cl = Clavicle, Acr = Acromion, CCL = Coracoclavicular ligament]

## JOINTS

In the shoulder complex includes 3 bones; clavicle, scapula and humerus. It is a combination of four joints; the glenohumeral (GH) joint, the acromioclavicular (AC) joint, the sternoclavicular (SC) joint, and a "floating joint", known as the scapulothoracic (ST) joint. In glenohumeral (GH) joint, both humerus head and the glenoid are covered by a layer of hyaline articular cartilage. Shallow glenoid cavity is deepened by the fibrocartilaginous labrum, which forms a rim around the perimeter of the glenoid. The glenohumeral joint capsule, which is a passive stabilizer, is thickened at the front of the capsule. The joint capsule and glenohumeral ligaments are intimately adherents anatomically and mainly function as stabilizers at the extremes of range of motion.

### Glenohumoral Joint

For GH joint intra-articular injection (as a pain relief intervention), GH joint can be accessed by USG both anteriorly and posteriorly. USG transducer is placed transversely under the scapular spine and then moved laterally (almost same probe position as needed to visualize the long axis of infraspinatus tendon).

Posteriorly, acetabulum-labrum-capsule-humoral head complex becomes visible in a deeper plane than infraspinatus (Fig. 3.19). Posterior recess of the joint is checked for effusion during scanning. In thin subjects the posterior labrum can be clearly seen. A paralabral cyst originating in this area should be looked for.

### Impingement Syndromes

All impingement syndromes at the shoulder joint are caused by the movement of the humeral head in the glenoid cavity.

Posterior GH impingement (Fig. 3.20) is tested by dynamic examination during external and internal rotation of the arm while probe remains placed over the posterior aspect of the glenohumeral joint. A visibly smooth movement of humoral head under the labrum without any pinching type of pain production rules out GH impingement.

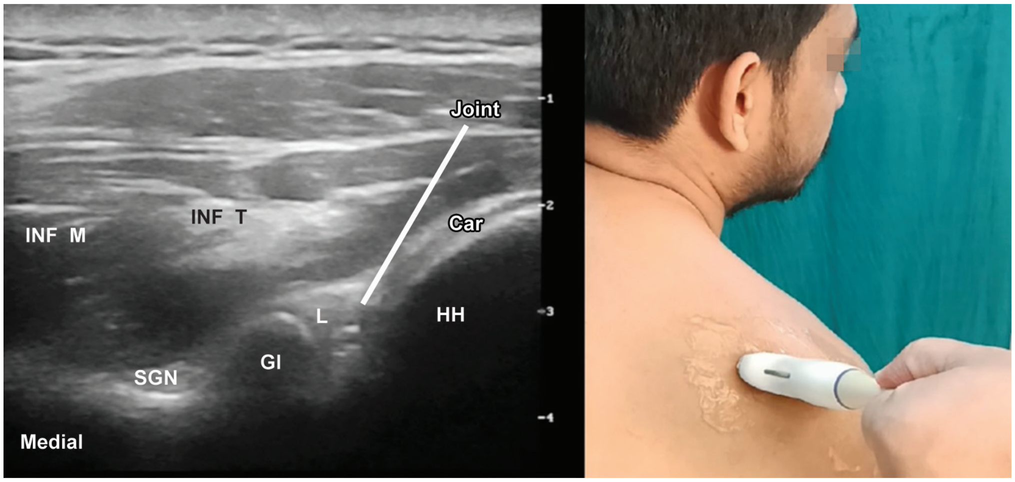


**Fig. 3.19:** Glenohumeral joint—posterior short-axis view. [INF M = Infraspinatus muscle, INF T = Infraspinatus tendon, SGN = Spinoglenoid notch, car = Cartilage, HH = Humoral head, Gl = Glenoid, L = Labrum]

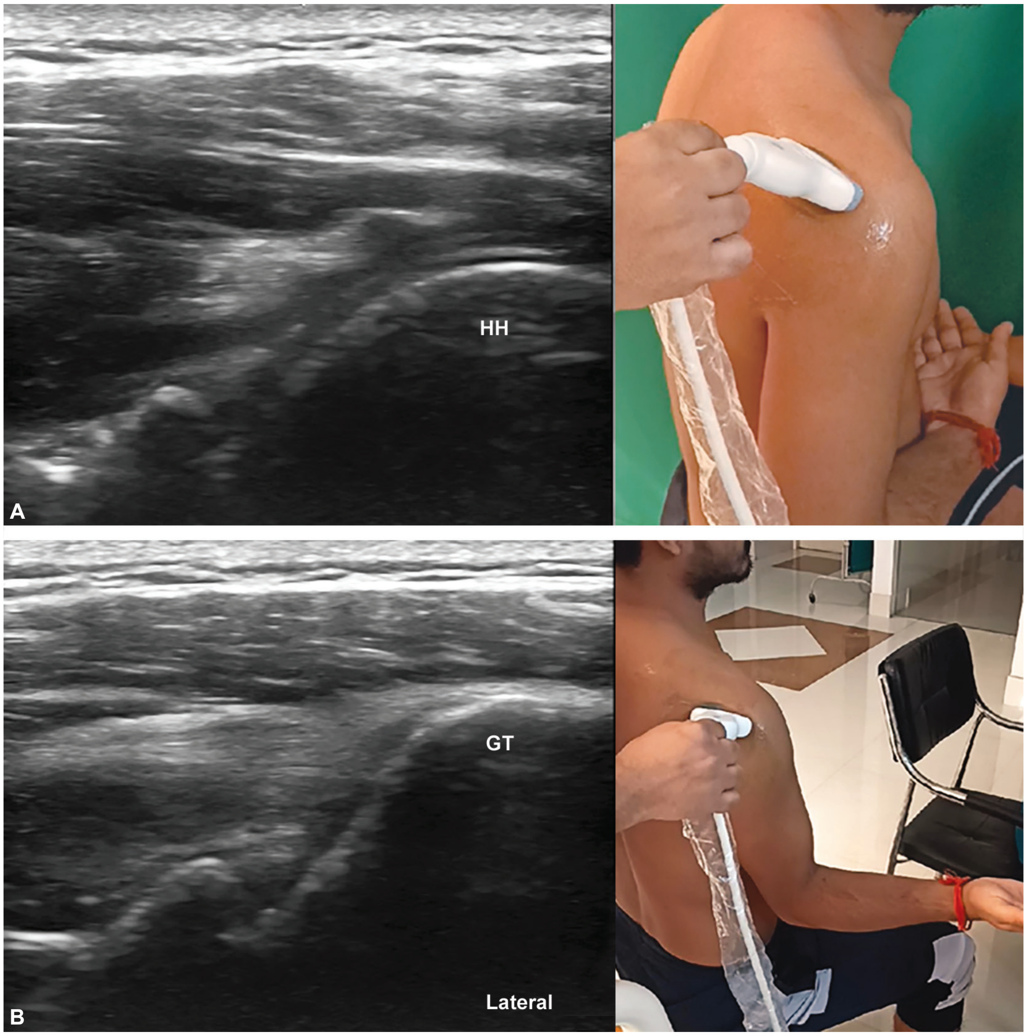


**Fig. 3.20:** Ultrasound transducer shows short-axis view of GH joint (A) arm adducted and internally rotated position and (B) arm adducted and externally rotated position [HH = Humeral head, GT = Greater tuberosity]

**Subcoracoid impingement** (Fig. 3.21), which is related to GH joint movement, causes anterior shoulder pain and subscapularis tendon tears can also be evaluated by USG. USG shows a narrowing of the coracoid-humeral distance in symptomatic patients, but inter-observer reliability and validity of this technique has not been prove.[17] Pathogenesis is still not clear. Some authors referred this to a primary narrow coracohumeral distance, while others state that the stenosis is secondary to an anterosuperior translation of the humeral head toward the coracoid due to degenerative changes of the rotator cuff tendons.[18]

**Subacromial impingement** (Fig. 3.22): Dynamic evaluation for possible subacromial impingement involving the supraspinatus tendon (SST) and subacromial subdeltoid bursa (SASD) bursa is important when examining the painful shoulder. Positive findings for soft-tissue subacromial impingement at dynamic USG evaluation include impaired gliding of SST under acromion, bursal fluid pooling and thickening.

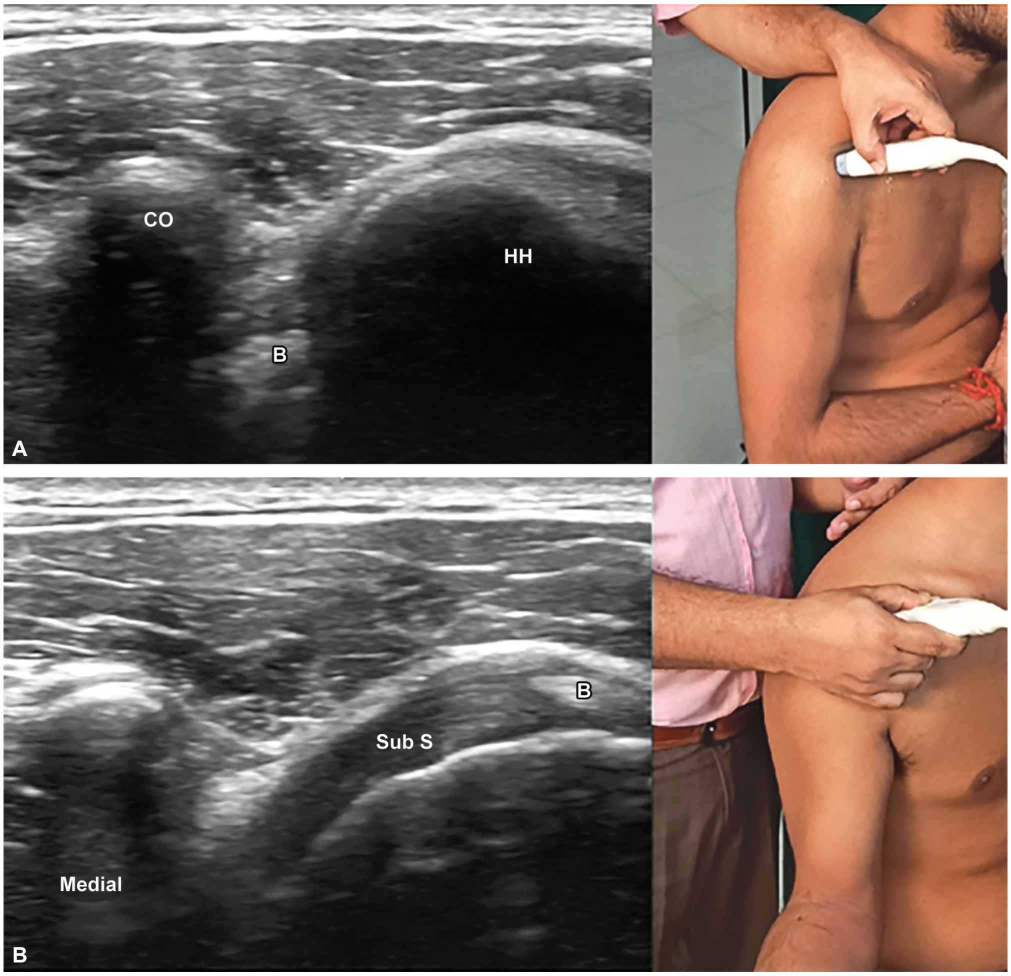


**Fig. 3.21:** Ultrasound transducer is placed on long axis over the subscapularis muscle. Coracohumeral distance in (A) arm adducted and internal rotated position (B) arm abducted and externally rotated position [B = Biceps, Sub S = Subscapularis tendon, Co = Coracoid, HH = Humoral head]

The acromioclavicular (AC) joint is imaged with the patient seated in the upright position and the arm in resting adduction. The transducer is placed transversely on top of the shoulder. Probe may also be moved along the long axis of the clavicle and then moved laterally to visualize the joint space (Fig. 3.23). USG scanning shows only the superficial aspect of the joint, and it has an overlying hypoechoic to hyperechoic joint capsule flanked by the hyperechoic bony acoustic shadow of the distal clavicle and acromion. The fibrocartilaginous disc may be seen as a hyperechoic structure in the center of the joint. The primary role of AC joint USG is to evaluate for capsular hypertrophy and distension.

Although the normal width of the AC joint varies according to the imaging modality, by USG, the normal width is approximately 3–4 mm and decreases with age. A 2–3-mm difference between the AC joint width on one side and that on the other side is considered abnormal in the appropriate clinical setting and when accompanied by correlative patient symptoms.[19–21] AC joint instability is checked by, dynamic imaging of the joint. Patient's keeps the arm initially in a neutral adducted position and then the elbow is bent and

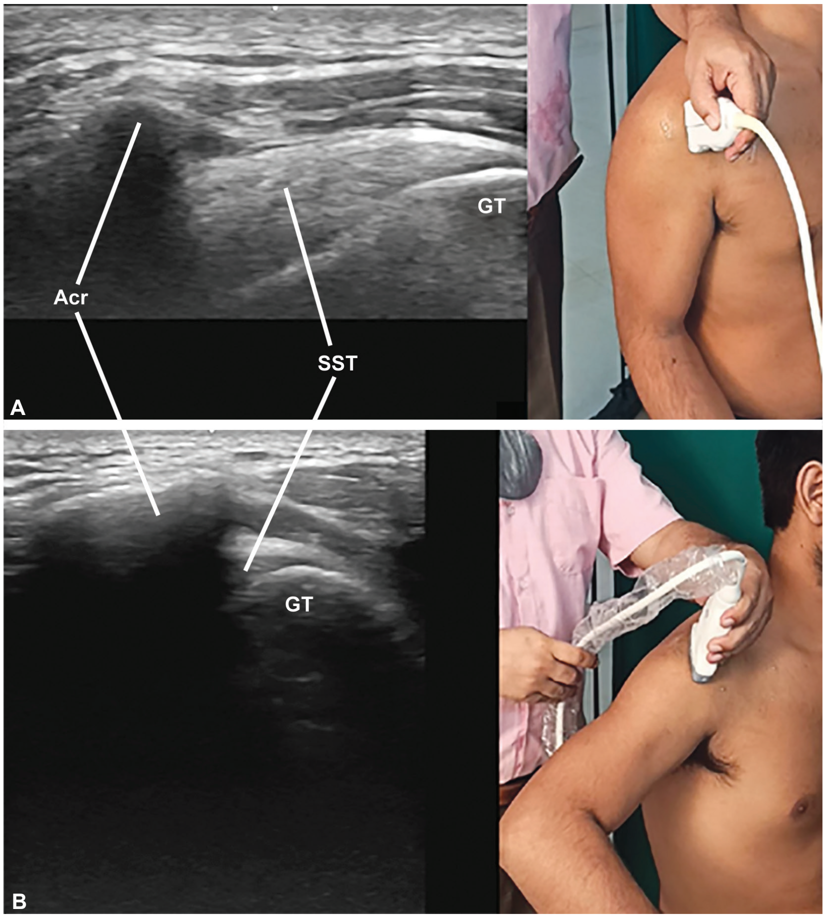


**Fig. 3.22:** Ultrasound transducer is placed along the long axis over the SST. Gliding of SST under acromion is noted from (A) neural position to (B) arm abducted position. [Acr = Acromion, SST = Supraspinatus, GT = Greater trochanter]

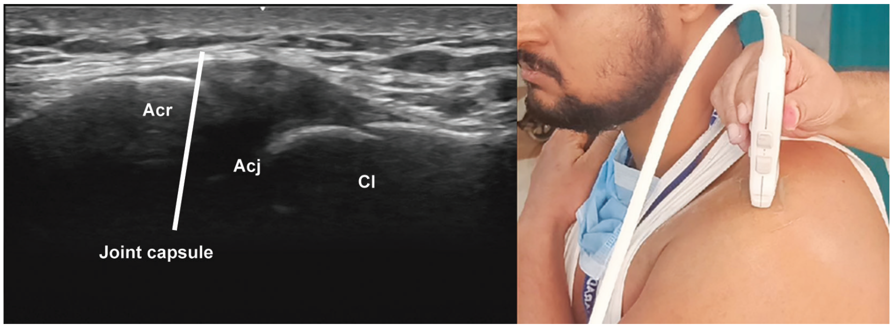


**Fig. 3.23:** Acromioclavicular joint ultrasound—long-axis view [Acr = Acromion, Cl = Clavicle ACJ = AC joint]

crossed over the chest to touch the opposite shoulder. The bony surface level of both acromion and clavicle detected by USG should remain at the same level under dynamic conditions to rule out instability. Stress imaging with the patient holding weights has also been described to detect instability.[22]

## Rotator Cuff Interval

Although the rotator interval cannot be evaluated completely with USG. It is a tetrahedron-shaped space, which is a natural opening on the anterior wall of the rotator cuff (RC). The RC is located between the anterior margin of the SST and the superior edge of the subscapularis. Anteriorly, the rotator interval is bounded by the joint capsule, posteriorly by the articular surface of the humeral head. The coracohumeral and superior glenohumeral ligaments merge with the joint capsule to form the biceps pulley, providing external and internal reinforcement of the rotator interval capsule, respectively (Fig. 3.24).[23] Rotator cuff interval is important for GH joint injection through anterior approach.

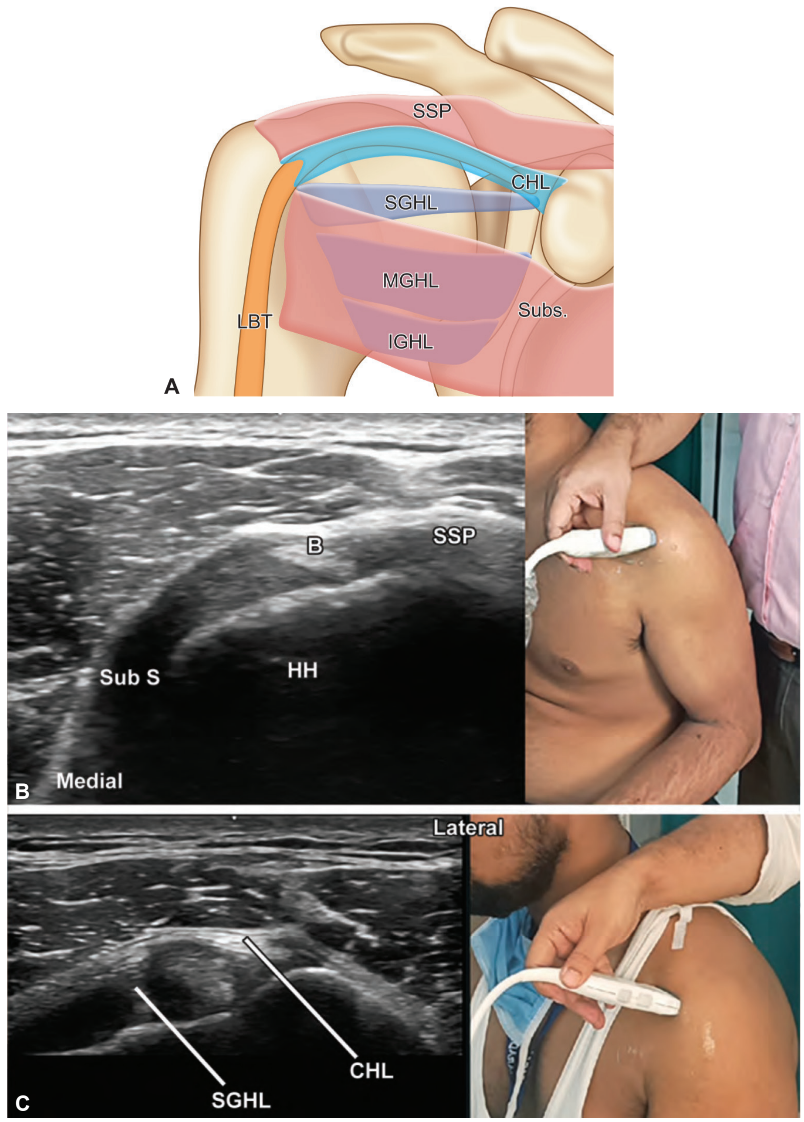


**Fig. 3.24:** Rotator cuff interval. (A) Schematic diagram, (B) USG image, (C) Zoomed USG image [CHL = Coracohumeral ligament, SGHL = Superior glenohumeral ligament, Sub S = Subscapularis, SSP = Supraspinatus, B = Biceps tendon, HH = Humeral head]

## BURSA

A bursa is a synovial fluid-filled sac, which acts as a cushion between tendons and bony surface (Fig. 3.25). The bursas of shoulder region are

1. Subacromial–subdeltoid (SASD) bursa
2. Subscapular bursa or superior subscapularis recess
3. Subcoracoid bursa
4. Subcutaneous acromial bursa.

SASD bursitis commonly accompanies rotator cuff (RC) tendinopathy. Chronic irritation from rubbing of the SST against the undersurface of the anterior one-third of the acromion, the coracoacromial ligament, and the acromioclavicular joint leads to tendinopathy/tears of the rotator cuff as well as SASD bursitis. Ultrasound is routinely used to demonstrate the supportive findings of RC tendinopathy. In a normal shoulder SASD bursa is seen as a thin hypoechoic line in between supraspinatus and deltoid (Fig. 3.26). The SASD bursitis is demonstrated by the presence of increased fluid in the bursa and/or thickening of the wall of the bursa.

Other bursae of the shoulder are not visible by USG scanning in a volunteer or normal healthy shoulder.

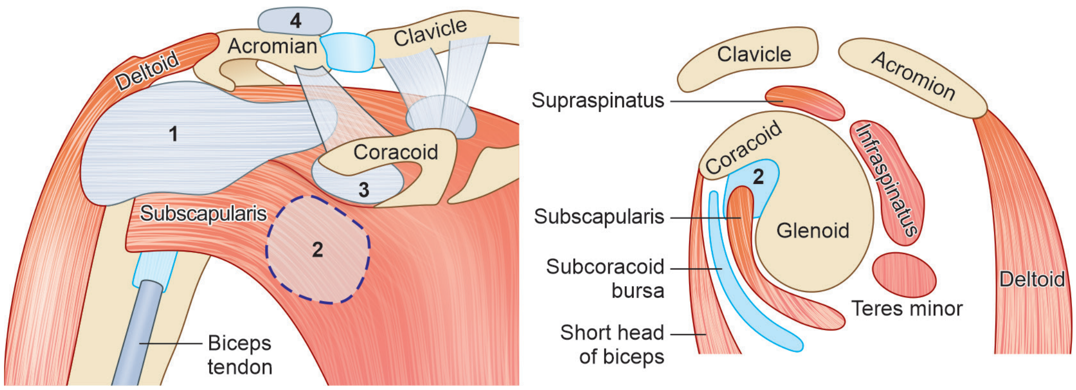


**Fig. 3.25:** Schematic diagram of all the bursae of shoulder [left: coronal view, right: sagittal view]

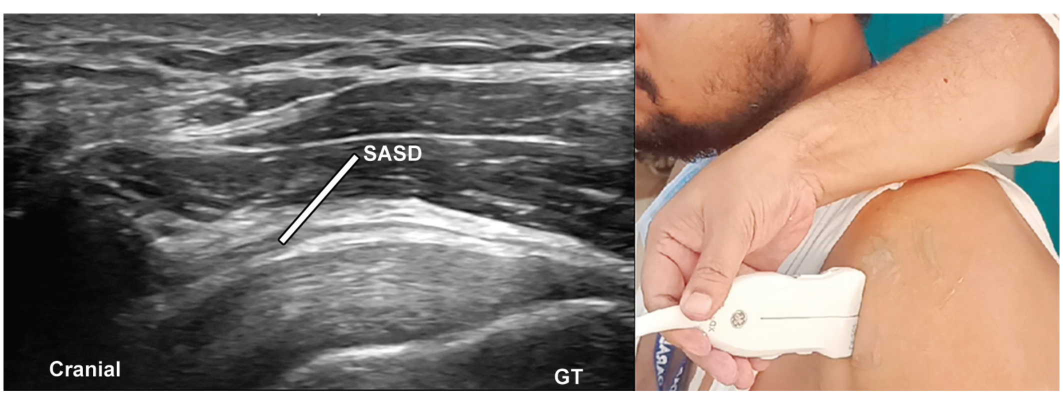


**Fig. 3.26:** SASD bursa in a healthy shoulder [SASD = Subacromial subdeltoid bursa, GT = Greater tuberosity]

## NERVES

The suprascapular nerve courses posterolaterally toward the suprascapular notch to the supraspinous groove, where it lies beneath the tendon of supraspinatus. It then winds around the greater scapular notch to terminate within infraspinatus. It has motor supply to supraspinatus and infraspinatus muscle of the rotator cuff, with some branches to teres minor. It provides sensation to bulk of the posterior, medial and superior joint capsule, and also innervates glenoid, acromion, posterior surface of scapula. The ultrasound transducer in a transverse orientation was placed over the suprascapular fossa. While imaging the supraspinatus muscle and the bony fossa underneath, the ultrasound transducer was moved laterally (maintaining a transverse transducer orientation) to locate the suprascapular notch. The suprascapular nerve was seen as a round hyperechoic structure beneath the transverse scapular ligament in the scapular notch (Fig. 3.27).[24]

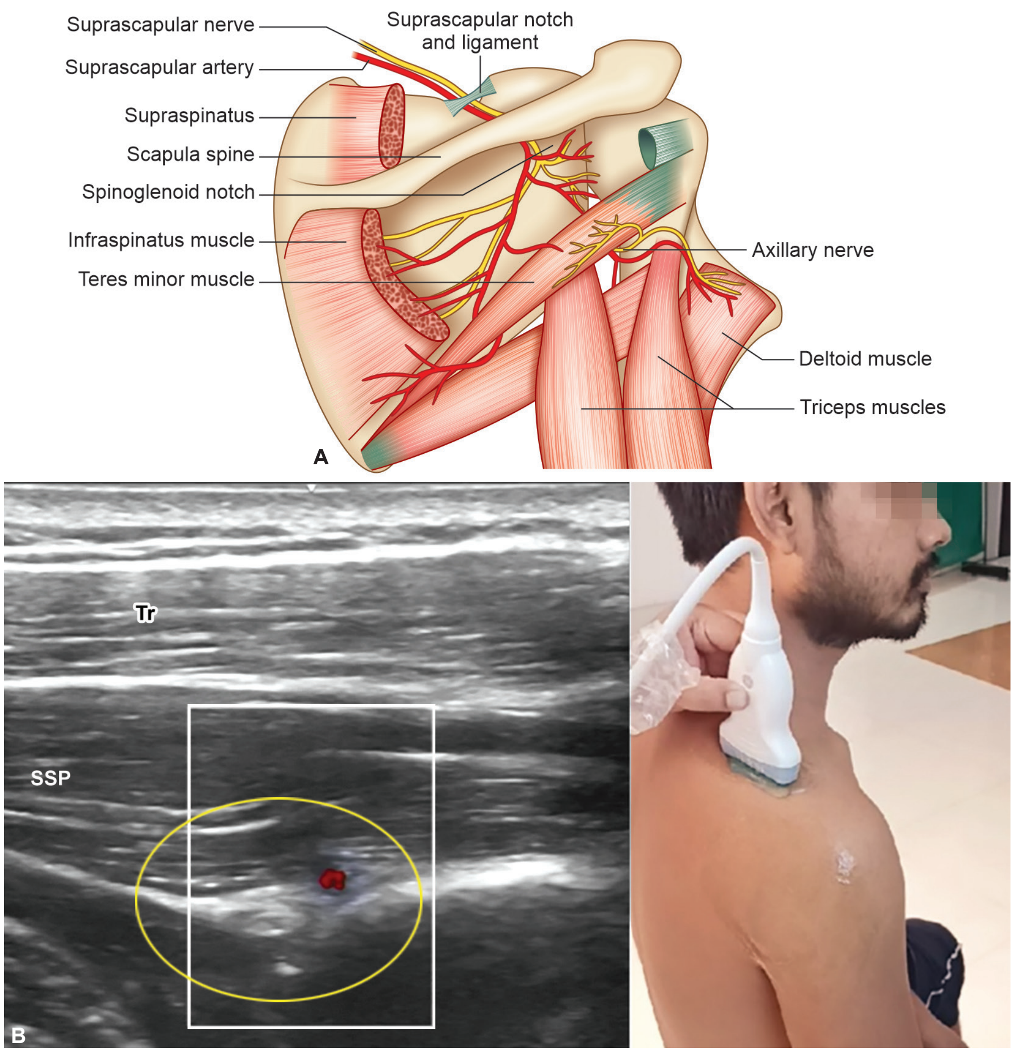


**Fig. 3.27:** (A) Suprascapular nerve course. (B) Encircled area of USG picture of suprascapular fossa contains suprascapular nerve and artery (doppler image) [Tr = Trapezius, SSP = Supraspinatus]

Suprascapular nerve articular branches can be accessed at the spinoglenoid notch (Fig. 3.28).

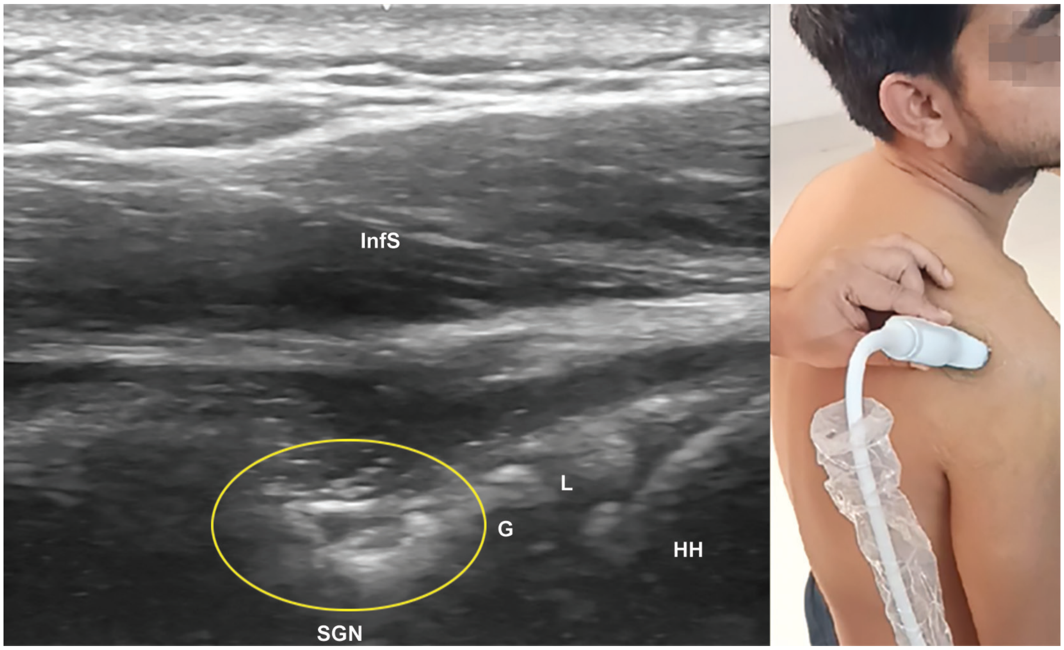


**Fig. 3.28:** Spinoglenoid notch. USG transducer is placed in the transverse orientation under the scapular spine. [InfS = Infraspinatus, G = Glenoid, L = Labrum, HH = Humeral head, SGN = Spinoglenoid notch, Encircled area represents neurovascular bundle]

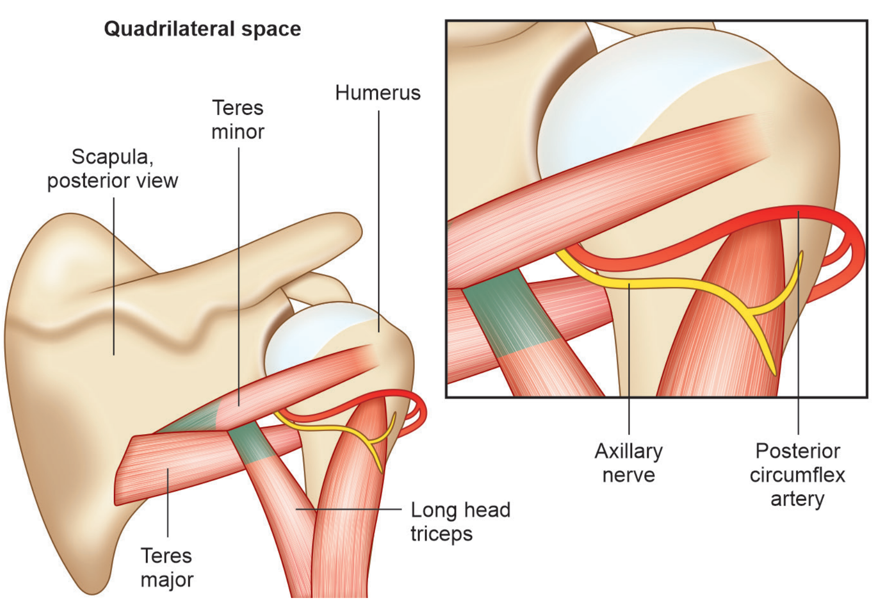


**Fig. 3.29A:** Schematic diagram of quadrilateral space

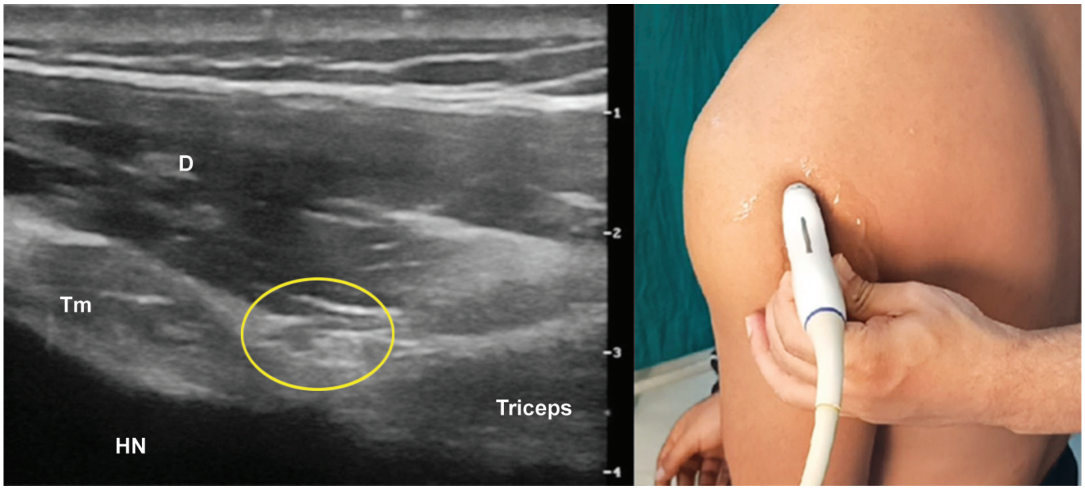


**Fig. 3.29B:** USG picture of quadrilateral space [Tm = Teres minor, d = Deltoid, HN = Humerus neck area, encircled area shows axillary nerve along with posterior humeral circumflex artery]

The axillary nerve is formed as a terminal branch of the posterior cord of brachial plexus. It runs beneath the shoulder joint only 2–3 mm below the inferior capsule. This space is created by the lateral head of the triceps, teres minor, teres major, and medial border of the humerus. In association with the posterior humeral circumflex artery, the axillary nerve passes through the quadrilateral space (Fig. 3.29).

## CONCLUSION

USG is an important and complementary imaging tool for the evaluation of a painful shoulder. The advantages of performing US includes patient satisfaction, low cost, accessibility, real-time dynamic assessment and needle guidance for pain interventions. In shoulder pain, USG is imperative for the delivery of high-quality patient care.

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