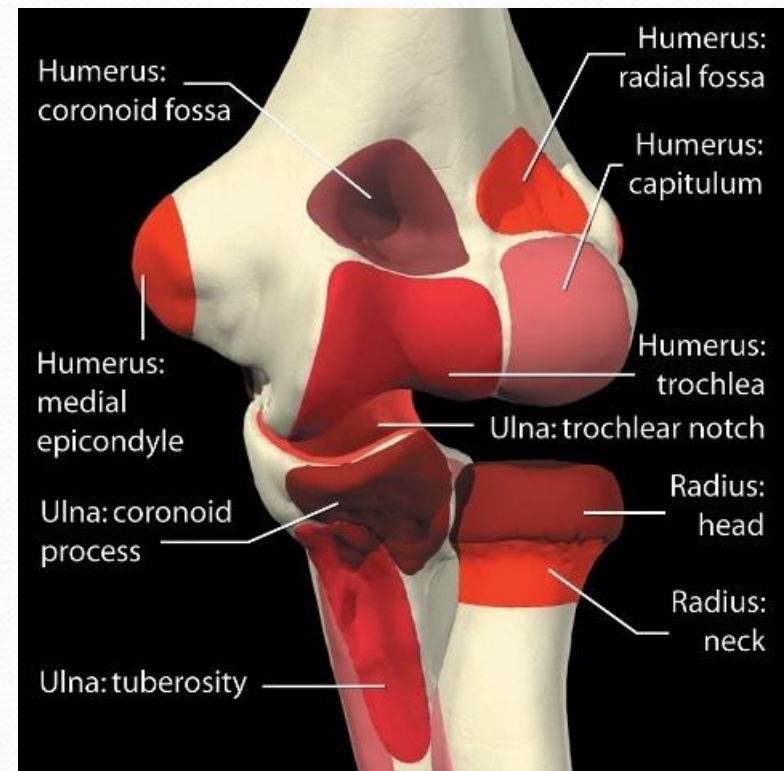


Ultrasound of the elbow

Dr. Tzvetanka Petranova
Clinic of Rheumatology,
Medical University, Sofia

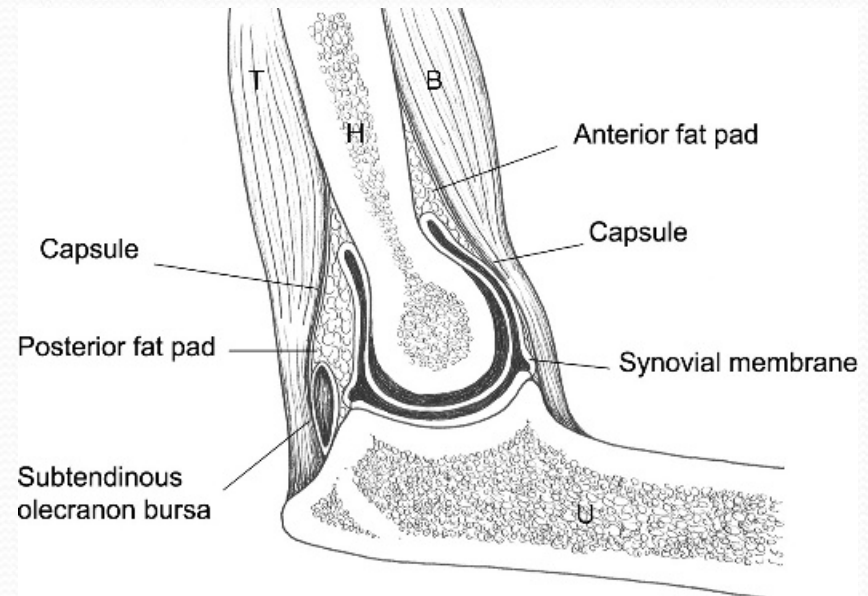
Elbow Joint

The elbow is a complex hinge-pivot joint, composed of three articulations: the ulnohumeral joint, between the ulnar trochlear notch and the trochlea of the humerus; the radiocapitellar joint, between the radial head and the capitellum of the humerus; and the proximal radioulnar joint.



Elbow Joint

They have a common joint cavity and are stabilized by a number of soft-tissue structures, including the lateral and medial collateral ligaments. Four discrete movements are facilitated at the elbow joint: flexion, extension, supination, and pronation.



Imaging Indications

- Soft tissue pathology – epicondylitis, regional tendon abnormalities - tendinopathy, calcifications, tears, and enthesiopathy; bursitis, ulnar nerve impingement and instability.
- Articular abnormalities - joint effusions, assessment of complications from arthritis, presence of intraarticular bodies, enthesophytes and synovitis.
- Incidental bone surface abnormalities can be also appreciated.
- Assistance with interventional procedures is a strong indication for elbow US. This includes US - guided joint aspiration and injections and synovial and soft tissue biopsies.

Technical review

- High-resolution, multifrequency linear- array transducers with a frequency band ranging from 5 to 15 MHz
- Large standard and smaller footprint probes
- Color and power Doppler are useful for demonstrating hyperemia and the relation of regional structures and pathology to normal arteries and veins

Standard scans/EULAR/

- 1. Anterior humeroradial longitudinal scan
- 2. Anterior humeroulnar longitudinal scan
- 3. Anterior transverse scan
- 4. Posterior longitudinal scan
- 5. Posterior transverse scan
- 6. Lateral longitudinal scan in 90° flexion

In general, the elbow ultrasound examination lends itself to an organized anatomical approach: anterior, lateral, medial and posterior.

Anterior elbow

The main anterior structures amenable to US examination are:

- the brachialis muscle
- the distal biceps muscle and tendon
- the brachial artery
- the median and radial nerve
- the anterior synovial recess with the anterior fat pad
- the radio-capitellar joint
- the trochlea-ulna joint

Anterior elbow

- The patient is seated facing the examiner with the elbow in an extension position over the table. Full elbow extension can be obtained by placing a pillow under the joint.

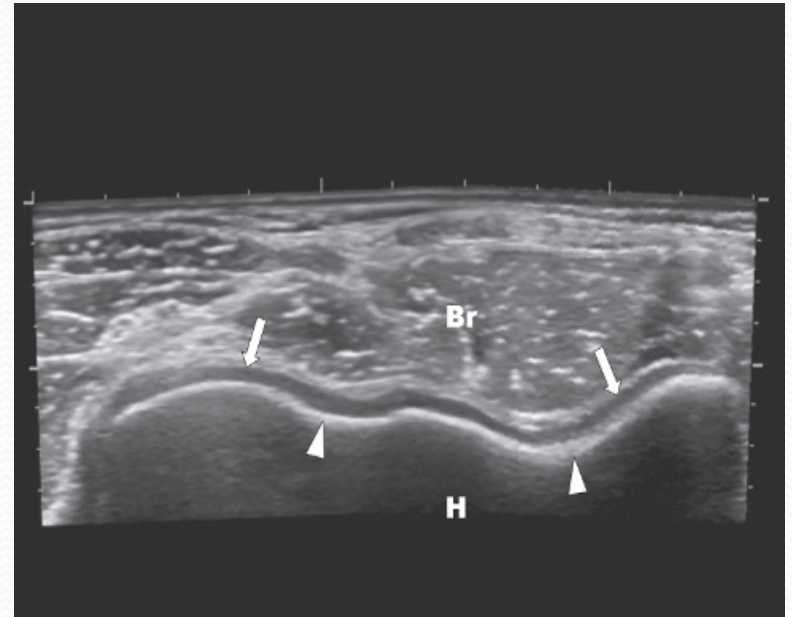
The examination begins in the transverse plane, placing the transducer parallel to the elbow crease.



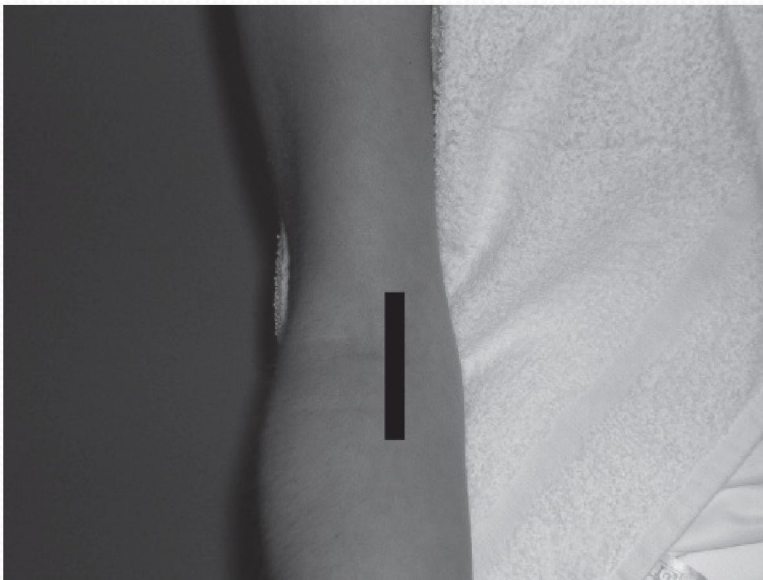
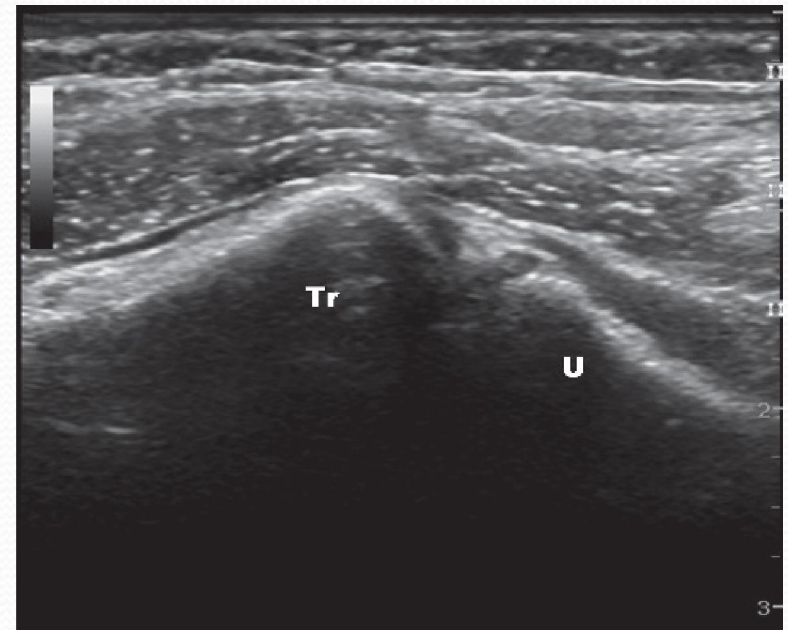
Anterior elbow

In this position, the distal humeral cartilage, cortical surface, and subchondral bone are evaluated. The normal cartilage appears as a hypoechoic layer of uniform thickness, parallel to the hyperechoic underlying subcortical bone.

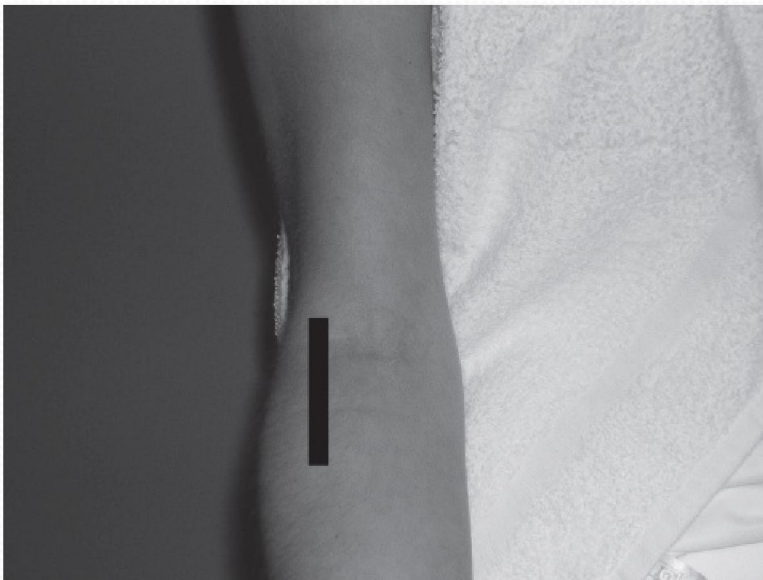
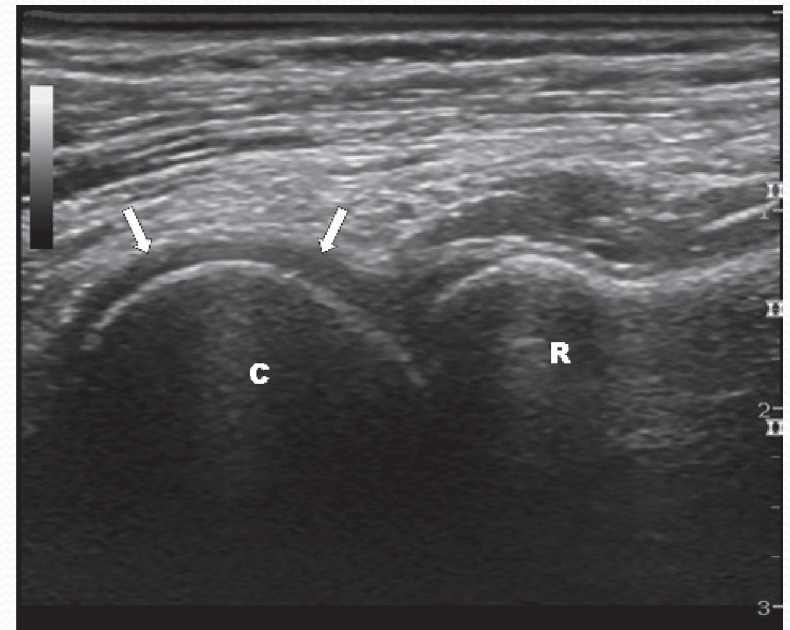
At the distal aspect of the humerus the transducer is rotated to the longitudinal plane and moved from the medial to lateral aspect of the joint, evaluating the medial trochlear ulnar joint space and the lateral radiocapitellar joint space.



Anterior humeroulnar longitudinal scan



Anterior humeroradial longitudinal scan



Anterior humeroradial longitudinal scan



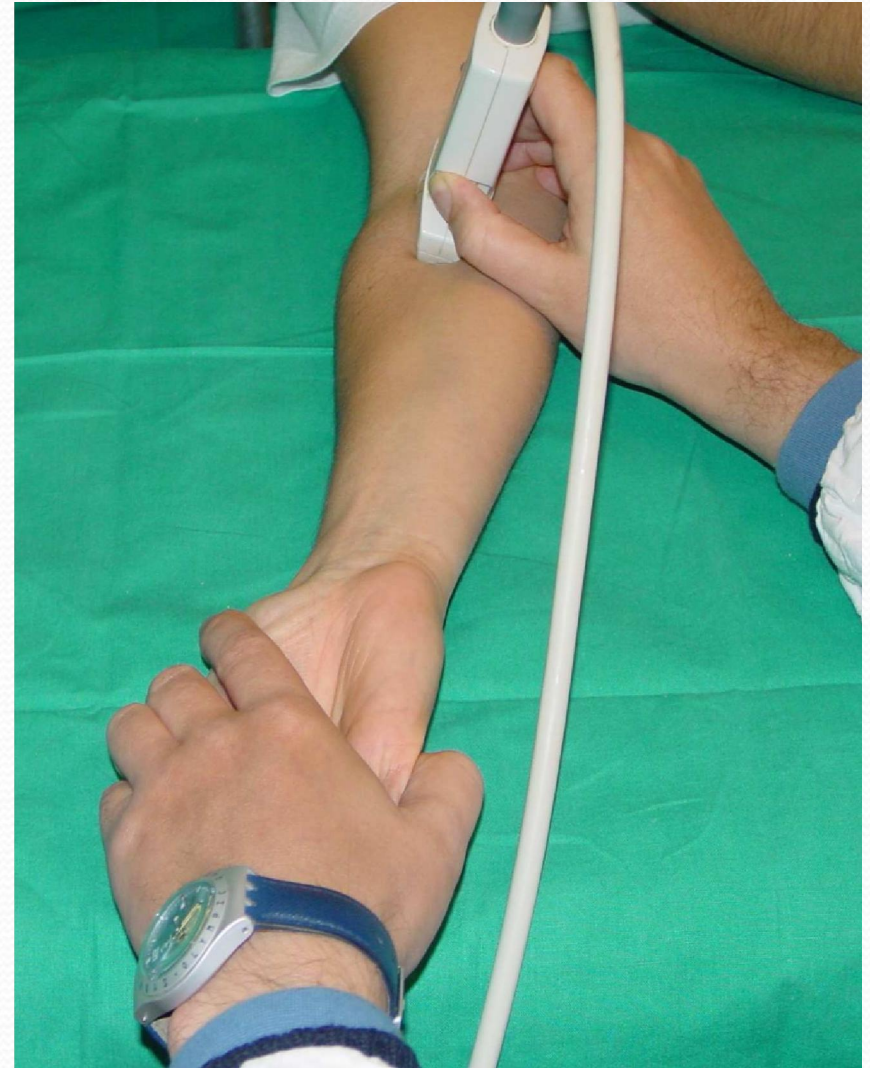
Anterior humeroradial longitudinal scan



Exudative synovitis in patient with psoriatic arthritis.
Moderate joint cavity widening due to an abnormal amount of synovial fluid in the radial fossa.

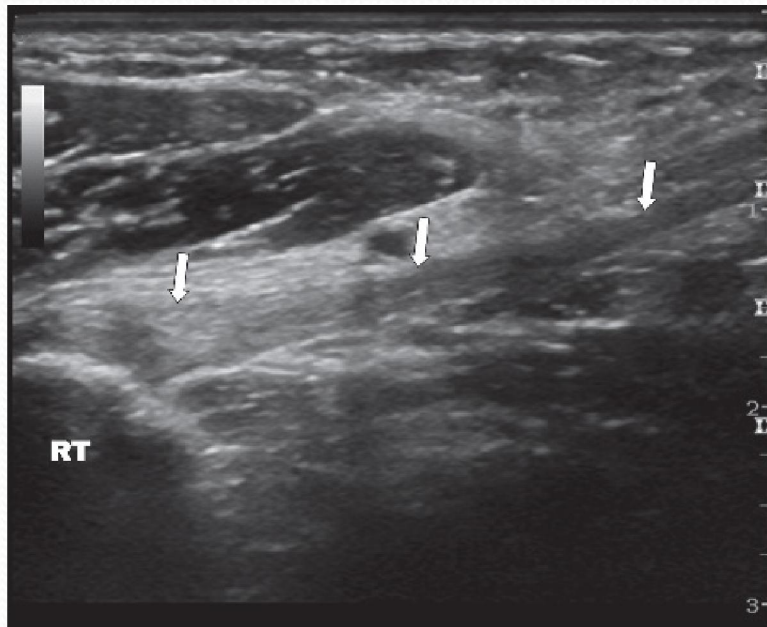
Distal biceps tendon: technique

The patient's forearm is in max supination to bring the tendon insertion on the radial tuberosity into view. Because of an oblique course from surface to depth, portions of this tendon may appear hypoechoic if the probe is not maintained parallel to it. The distal half of the probe must be gently pushed against the patient's skin to ensure parallelism between the US beam and the distal biceps tendon.

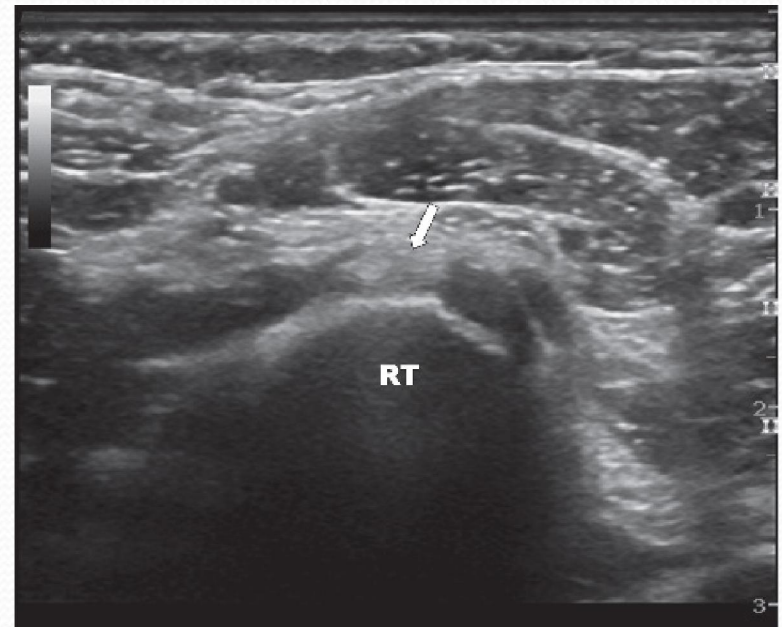


Distal biceps tendon

Longitudinal image

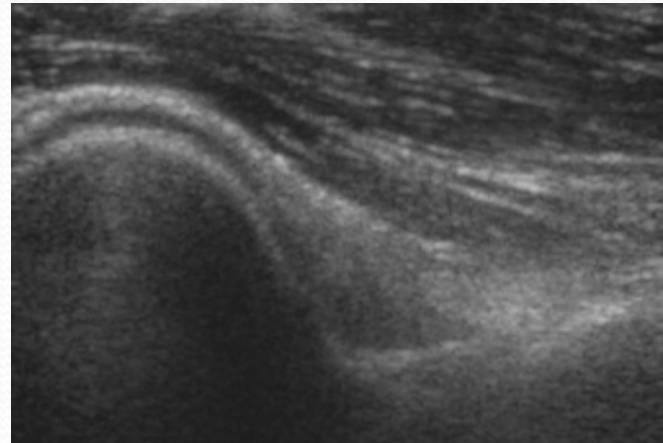


Transverse image



Anterior joint recess

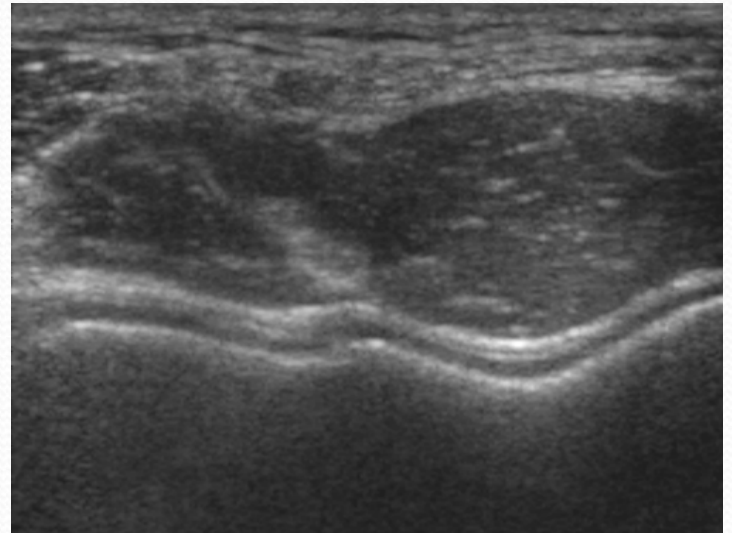
- On longitudinal scans, the coronoid fossa appears as a concavity of the anterior surface of the humerus filled with the anterior fat pad. In normal states, a small amount of fluid may be seen between the fat pad and the humerus.



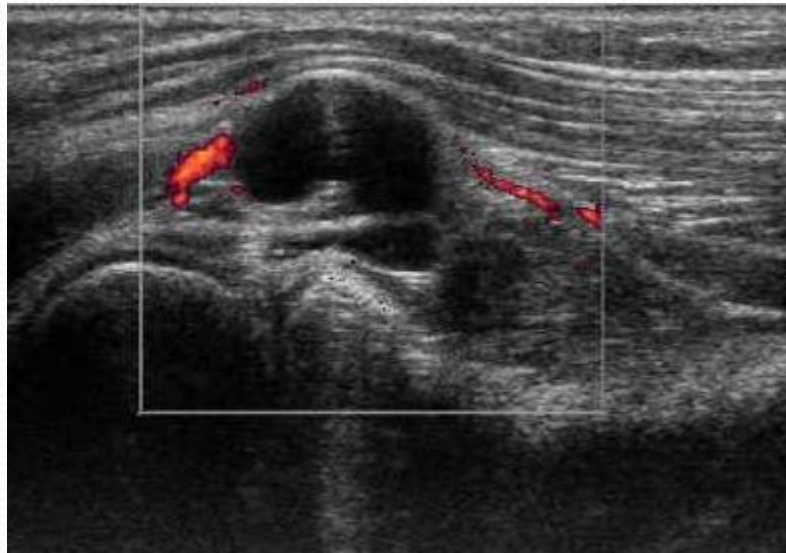
Anterior joint recess

Transverse scan

On transverse scans, the anterior distal humeral epiphysis appears as a wavy hyperechoic line covered by a thin layer of hypoechoic articular cartilage; the lateral third – the humeral capitulum/round/, the medial two thirds- humeral trochlea.

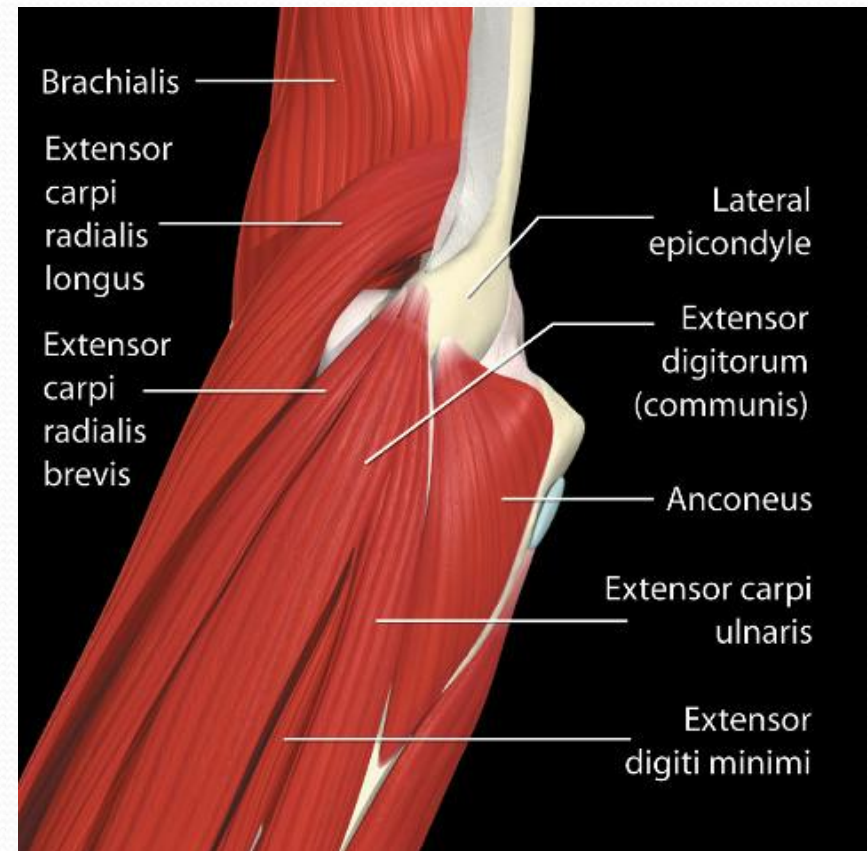


Antecubital Elbow Ganglion



Lateral elbow

- The lateral muscle compartment includes the extensors of the wrist and hand and the supinator and brachioradialis muscles.
- The common extensor tendon consist of tendon fibers from
 - extensor carpi radialis brevis
 - extensor digitorum
 - extensor digiti minimi
 - extensor carpi ulnaris



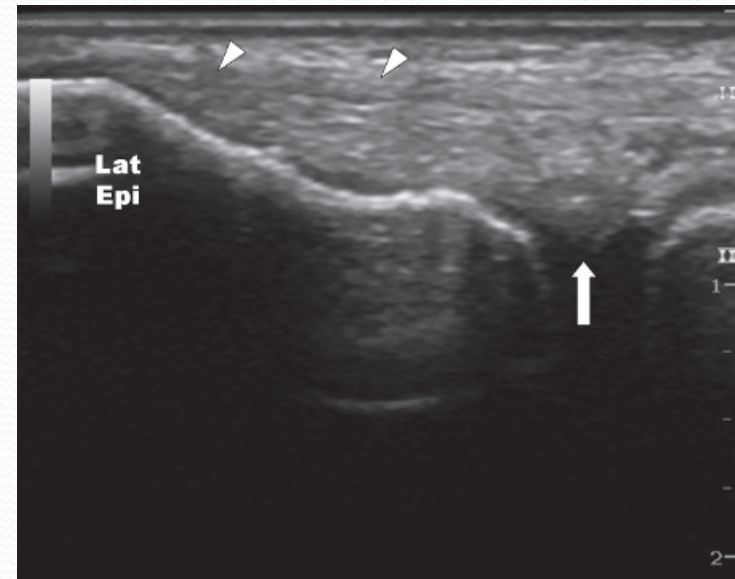
Lateral elbow: common extensor tendon

The lateral aspect of the elbow is examined with both elbows in extension, thumbs up, palms of hands together or with the elbow in flexion. The common extensor tendon origin is best visualized in longitudinal planes with the cranial edge of the probe placed on the lateral epicondyle.



Lateral elbow: common extensor tendon

In long-axis view the common extensor tendon is demonstrated as a beak-shaped hyperechoic structure with uniform fibrillar pattern, located deep to the brachioradialis muscle and superficial to the radio-capitellar joint.



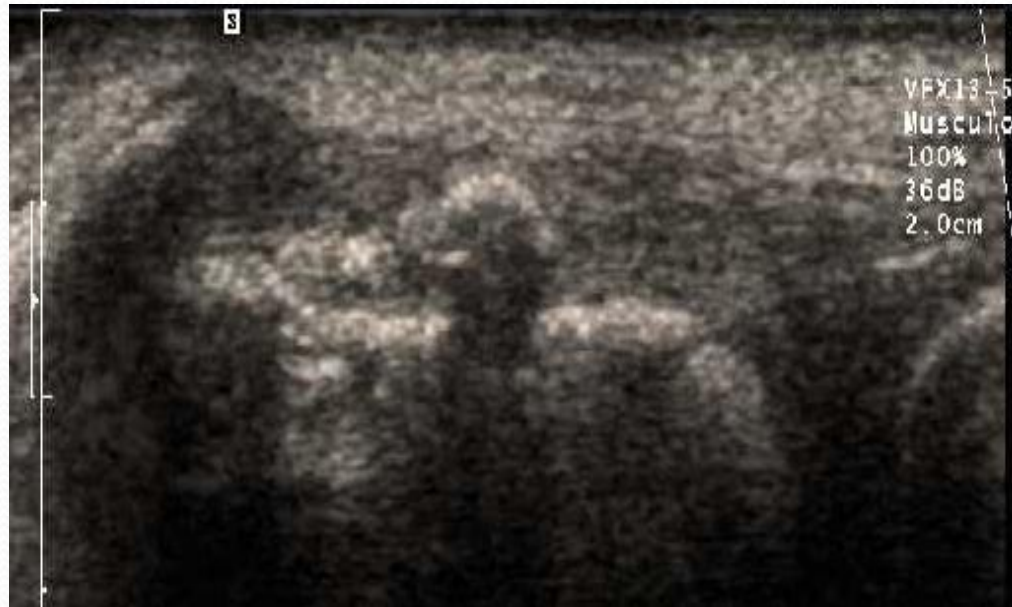
Lateral elbow: common extensor tendon

- Short-axis planes should be also obtained over the tendon insertion, depicting the oval cross-sectional shape of the normal common extensor origin. In normal conditions, the lateral ulnar collateral ligament cannot be separated from the overlying extensor tendon due to a similar fibrillar echotexture.

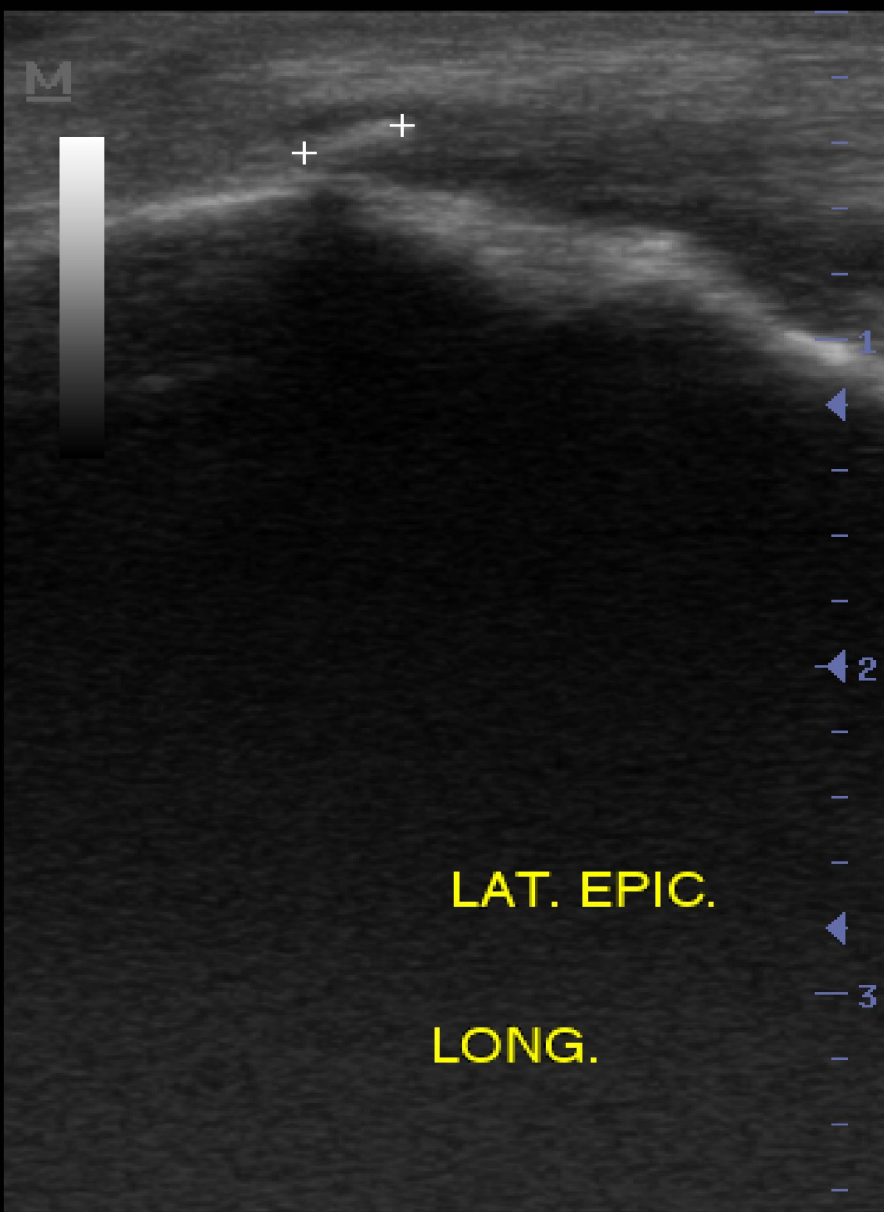
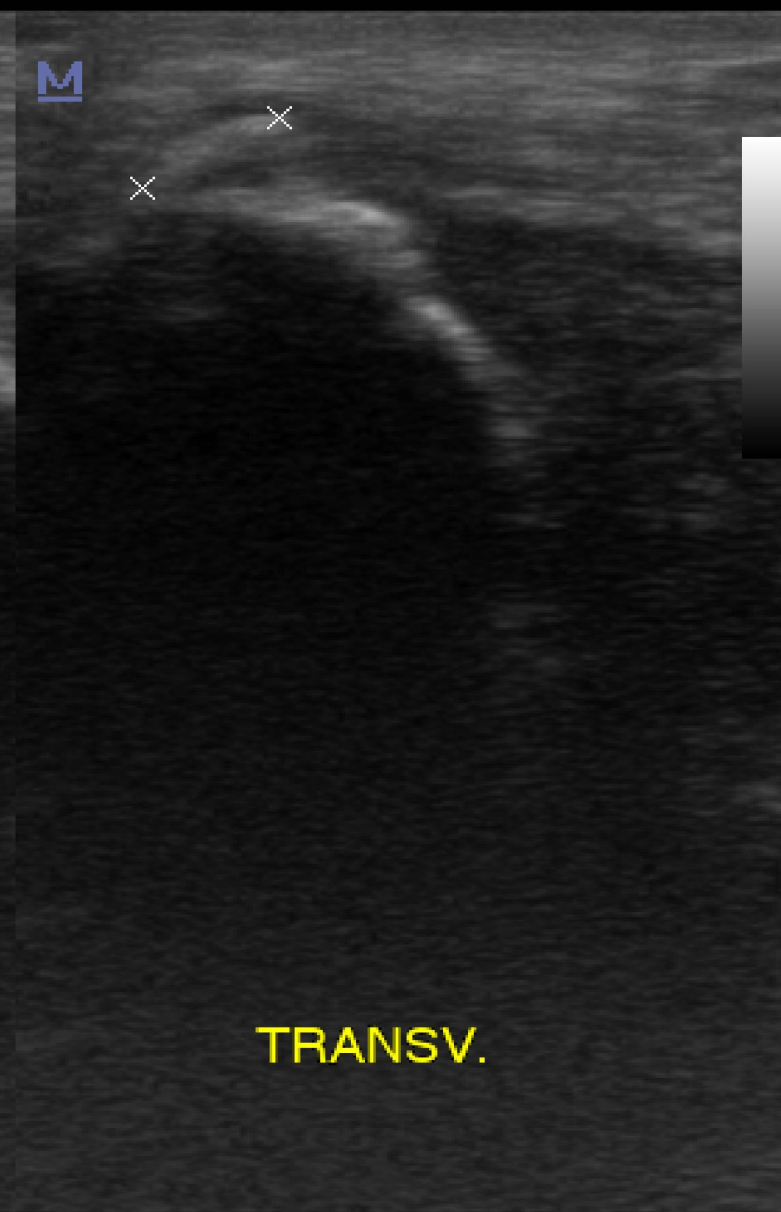
Lateral Epicondylitis “Tennis Elbow”



Calcific Tendinosis of Common Extensor Tendon



// D3.7 // G82
 // IP5 // DR70
 // D3.7 // G82
 // IP5 // DR70



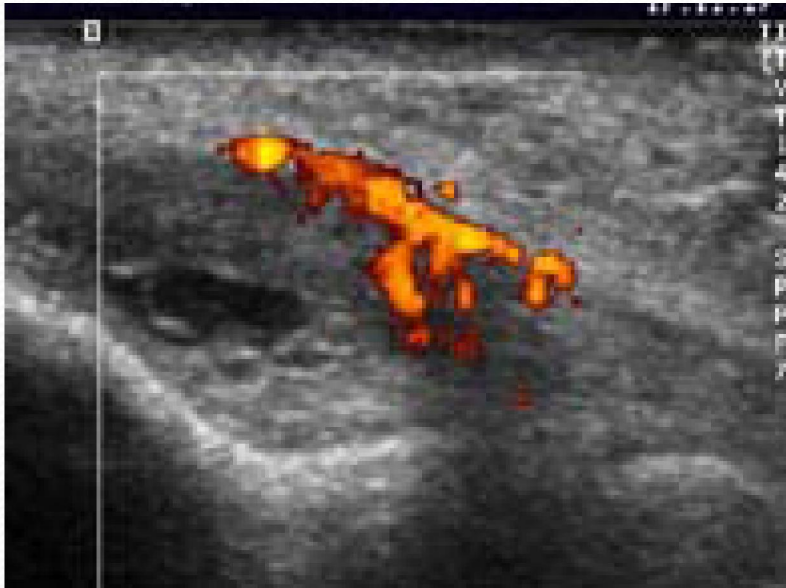
Dist 0.28cm

Dist 0.43cm

1/1

1/1

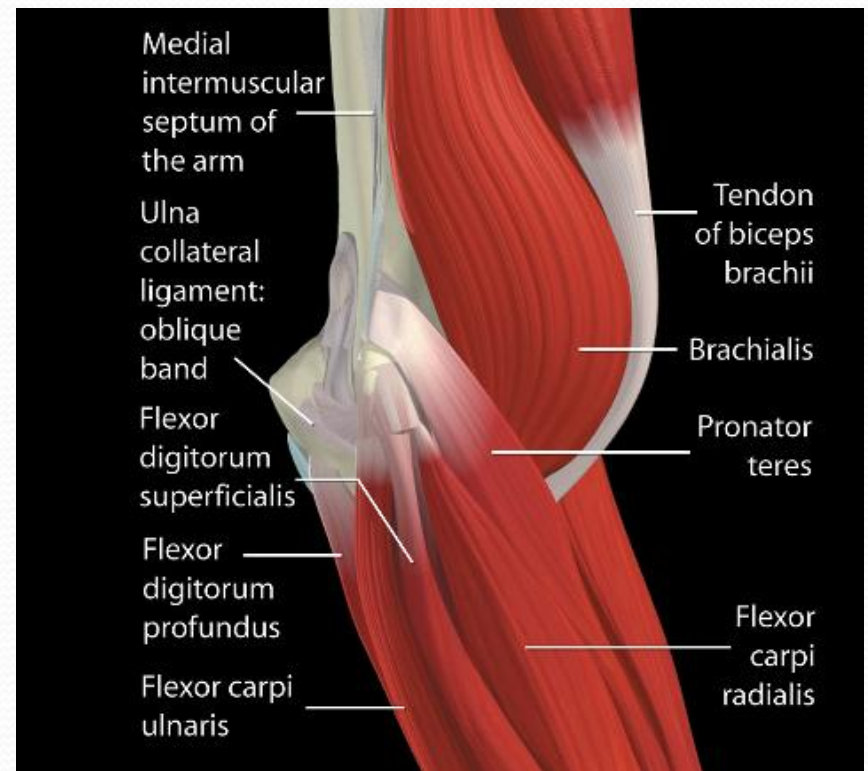
Tendinosis of Common Extensor Tendon



Medial elbow

The medial muscle compartment includes the pronator teres and the superficial flexor muscles of the wrist and hand that arise from the medial epicondyle as the “common flexor tendon” - flexor carpi radialis, flexor carpi ulnaris, palmaris longus, flexor digitorum superficialis .

The ulnar collateral ligament is composed of three components; the anterior band is the most important functionally and the most readily visible with US.

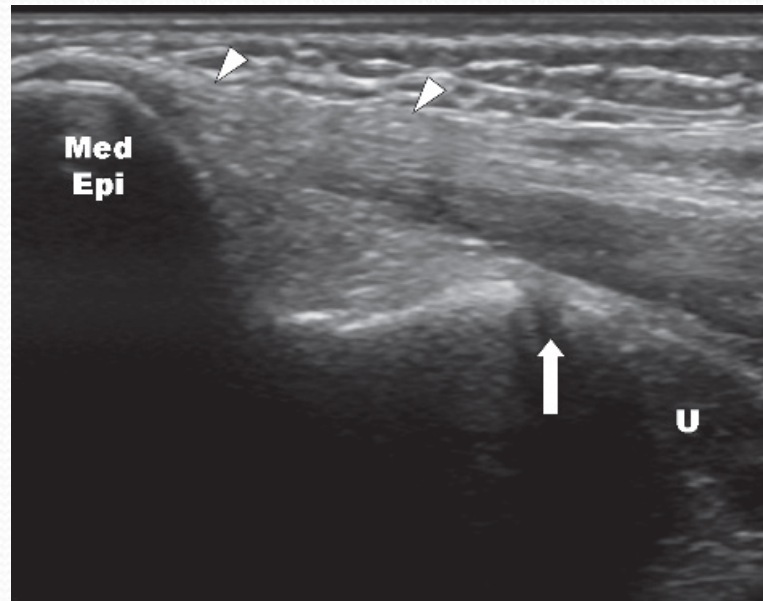


Medial elbow: common flexor tendon

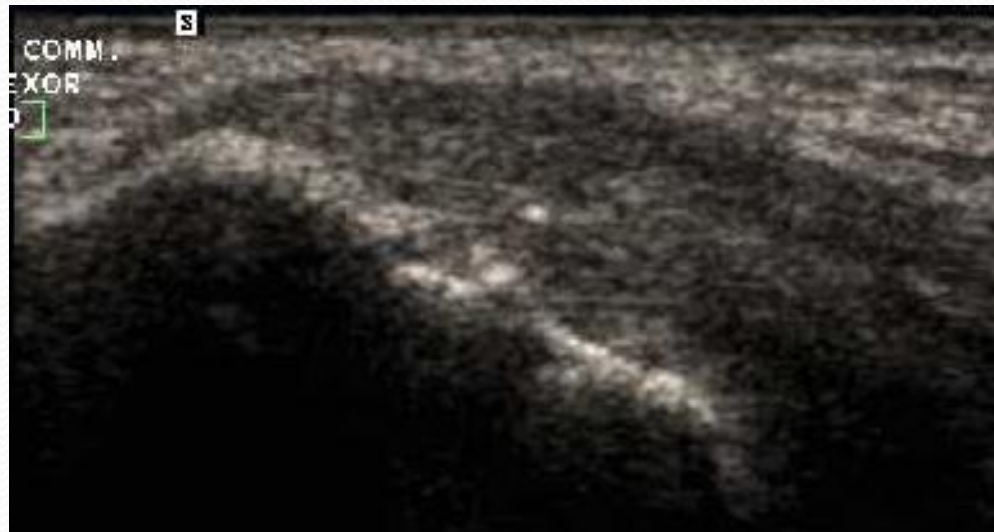
For the examination of the medial elbow, the patient is asked to lean toward the ipsilateral side with the forearm in forceful external rotation while keeping the elbow extended or slightly flexed, resting on a table. Coronal planes with the cranial edge of the probe placed over the medial epicondyle/epitrochlea/ reveal the common flexor tendon in its long-axis. The tendon is shorter and larger than the common extensor tendon.



Medial elbow-common flexor tendon- longitudinal scan



Tendinosis of Common Flexor Tendon



Posterior elbow

The main posterior structures amenable to US examination are:

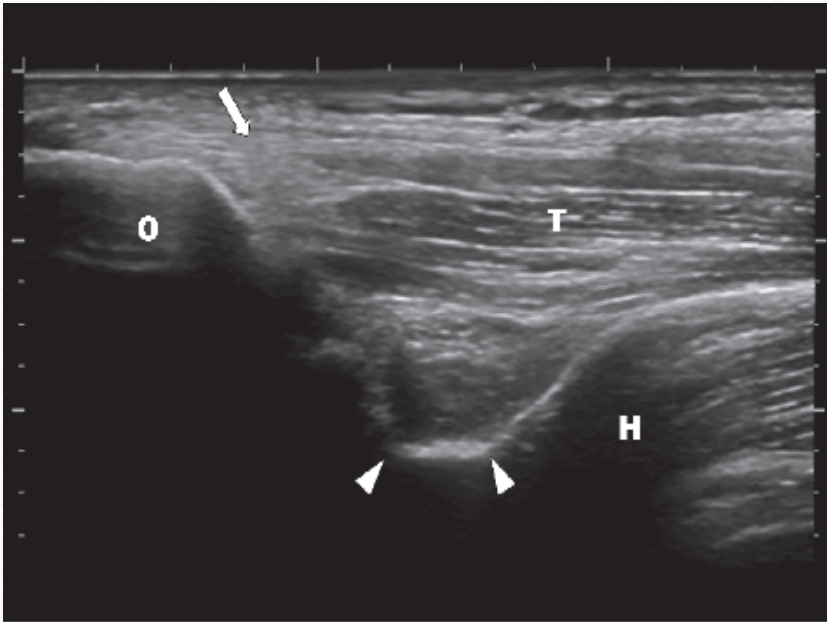
- the posterior joint space
- olecranon fossa
- triceps tendon
- olecranon process
- subcutaneous olecranon bursa
- subtendinous olecranon bursa
- cubital tunnel and ulnar nerve

Posterior elbow: triceps tendon

- The posterior elbow may be examined by keeping the joint flexed 90° with the palm resting on the table. Cranial to the olecranon, the triceps muscle and tendon are evaluated by means of long-axis and short-axis scans. The most distal portion of the triceps tendon needs to be carefully examined to rule out enthesitis.

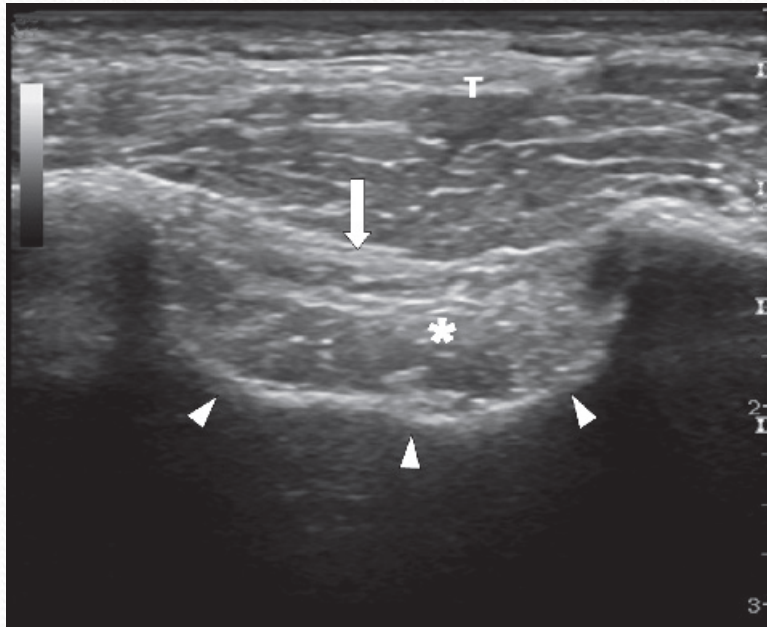


Posterior elbow-longitudinal image



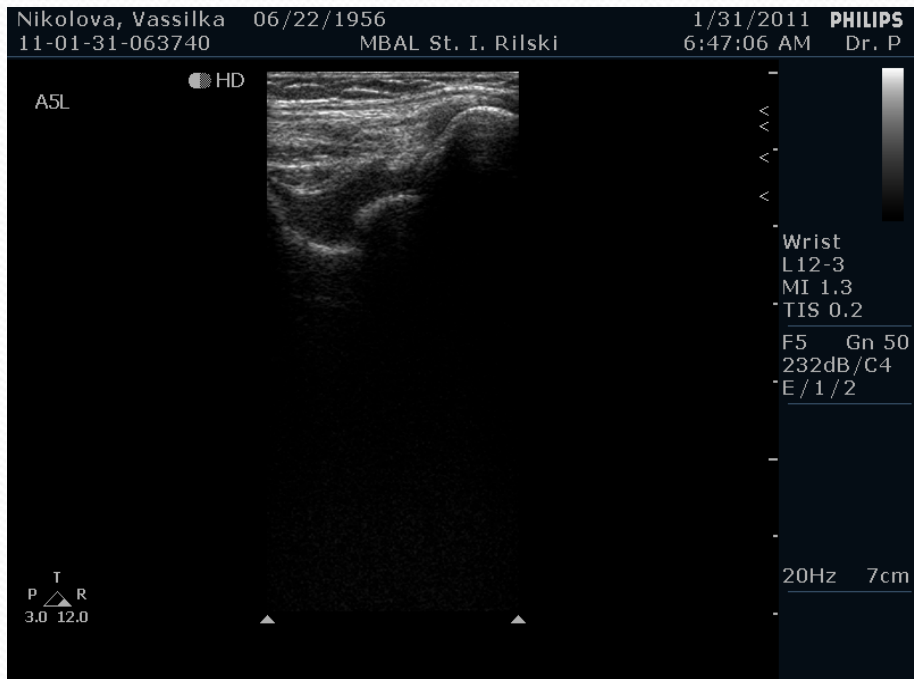
Imaging of the distal triceps muscle (T) and tendon (arrow) demonstrating insertion onto the olecranon process (O). The olecranon fossa (arrowheads) is identified as a deep groove on the posterior aspect of the humerus (H).

Posterior elbow-transverse image



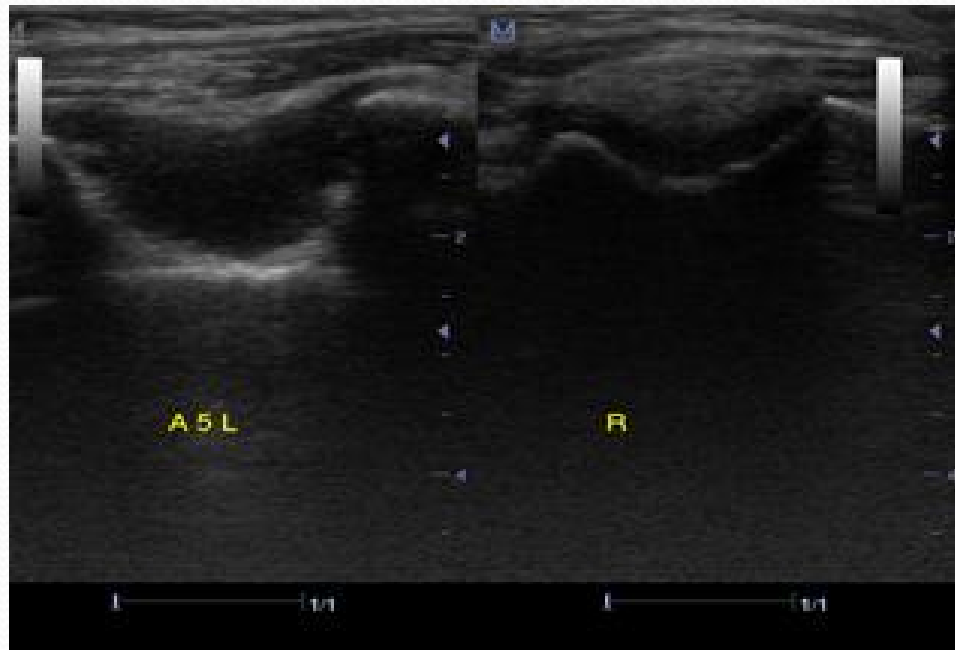
Transverse image at the level of the posterior humerus. The triceps muscle and tendon (T) are illustrated. Deep to this, the posterior joint capsule is visualized (arrow), with fat (asterisk) filling the olecranon fossa (arrowheads).

Posterior elbow

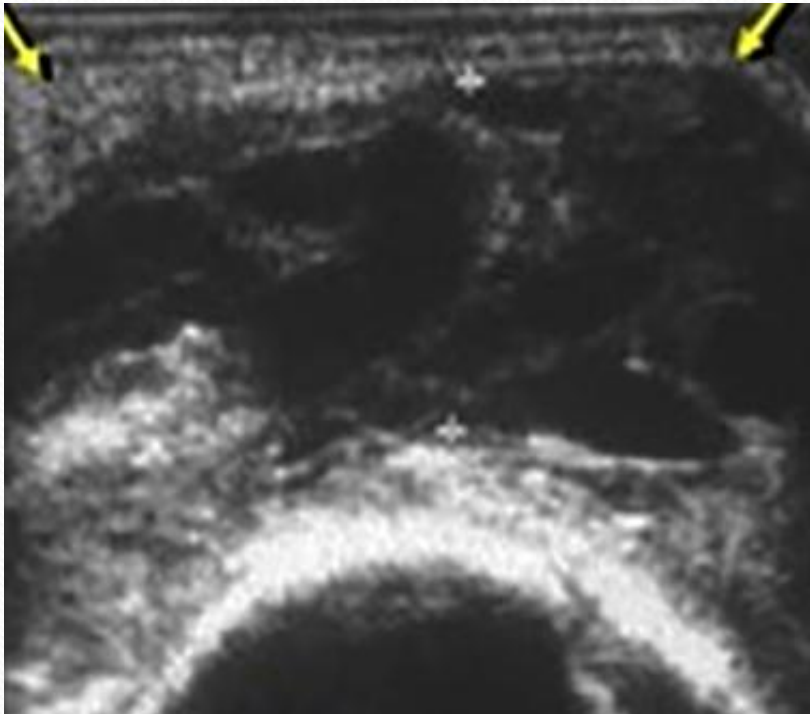


Posterior longitudinal scan
Exudative synovitis in patient
with psoriatic arthritis.
Anechoic synovial fluid in the
olecranon fossa .

Posterior elbow

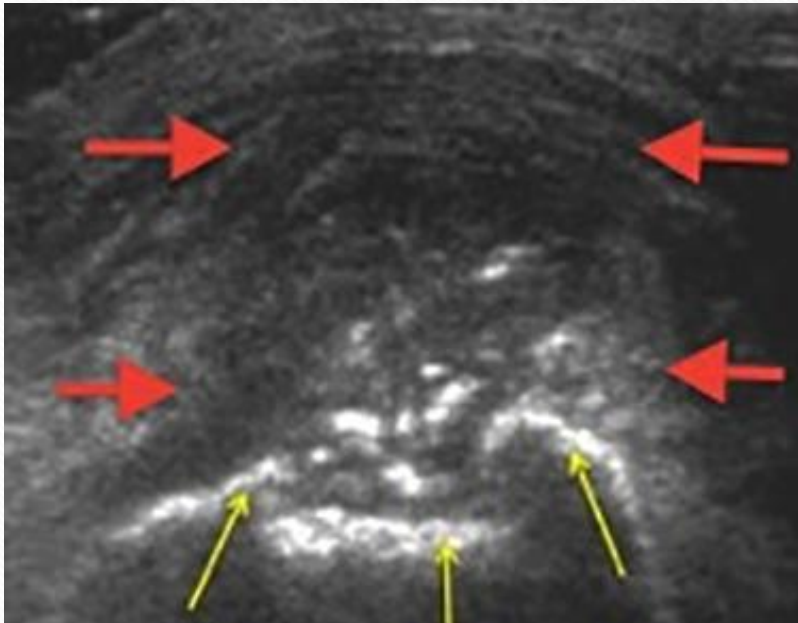


Posterior elbow



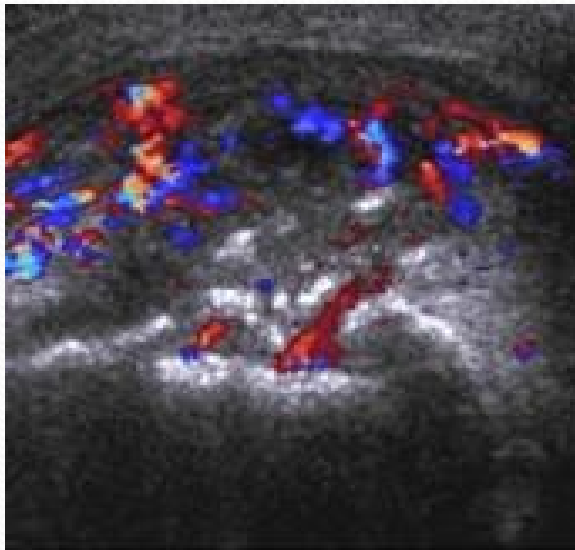
- Ultrasound reveals a well-defined anechoic or hypoechoic heterogeneous simple or complex fluid structure located at the peri-olecranon which is classic for olecranon bursitis.

Posterior elbow



- Ultrasound reveals a well-defined anechoic or hypoechoic heterogeneous simple or complex fluid structure located at the peri-olecranon which is classic for olecranon bursitis.

Posterior elbow

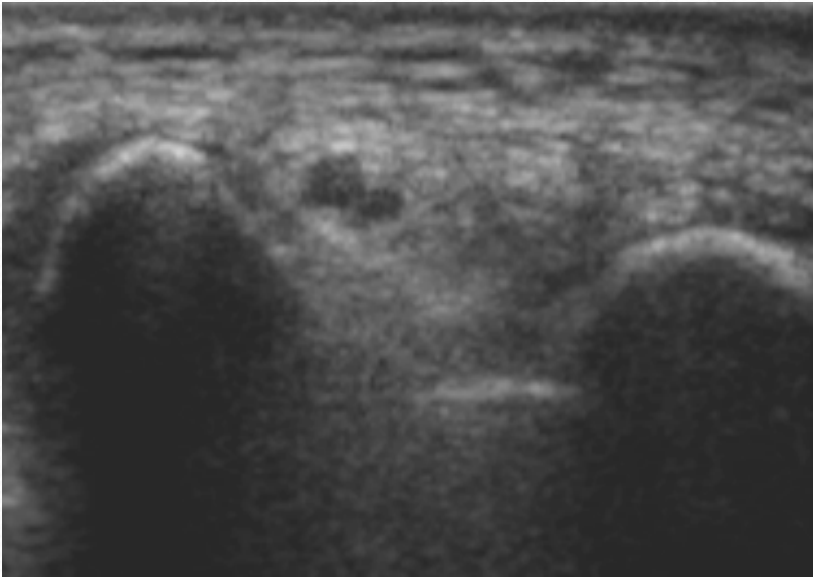


- Doppler activity demonstrating neovascularization and chronicity of inflammation.

Cubital tunnel and ulnar nerve

- The ulnar nerve lies posteromedial, in the condylar groove, formed between the olecranon process and the medial epicondyle bridged by a fascial sheet, the cubital tunnel retinaculum / Osborne retinaculum/.
- Approximately 1 cm distal to this tunnel, the ulnar nerve enters the proper cubital tunnel, a hiatus between the ulnar and humeral heads of the flexor carpi ulnaris muscle that are connected by an aponeurotic arch, the “arcuate ligament”.

Ulnar nerve-transverse view



The ulnar nerve is examined in its short-axis from the distal arm through the distal forearm (long-axis scans are less useful)

Conclusions

- Effusive Elbow
- Loose Bodies
- Tendon Diseases
- Ligaments
- Ulnar Neuropathy