



Review

Ultrasound of the elbow with emphasis on detailed assessment of ligaments, tendons, and nerves



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ARTICLE INFO

Article history:

Received 4 September 2014

Received in revised form 5 December 2014

Accepted 9 December 2014

Keywords:

Elbow-ultrasound

Elbow-anatomy

Elbow-nerves

ABSTRACT

The high resolution and dynamic capability of ultrasound make it an excellent tool for assessment of superficial structures. The ligaments, tendons, and nerves about the elbow can be fully evaluated with ultrasound. The medial collateral ligament consists of an anterior and posterior band that can easily be identified. The lateral ligament complex consists of the radial collateral ligament, ulnar insertion of the annular ligament, and lateral ulnar collateral ligament, easily identified with specialized probe positioning. The lateral ulnar collateral ligament can best be seen in the cobra position. On ultrasound medial elbow tendons can be followed nearly up to their common insertion. The pronator teres, flexor carpi radialis, palmaris longus, and flexor digitorum superficialis can be identified. The laterally located brachioradialis and extensor carpi radialis longus insert on the supracondylar ridge. The other lateral tendons can be followed up to their common insertion on the lateral epicondyle. The extensor digitorum, extensor carpi radialis brevis, extensor digiti minimi, and extensor carpi ulnaris can be differentiated. The distal biceps tendon is commonly bifid. For a complete assessment of the distal biceps tendon specialized views are necessary. These include an anterior axial approach, medial and lateral approach, and cobra position. In the cubital tunnel the ulnar nerve is covered by the ligament of Osborne. Slightly more distally the ulnar nerve courses between the two heads of the flexor carpi ulnaris. An accessory muscle, the anconeus epitrochlearis can cover the ulnar nerve at the cubital tunnel, and is easily identified on ultrasound. The radial nerve divides in a superficial sensory branch and a deep motor branch. The motor branch, the posterior interosseous nerve, courses under the arcade of Frohse where it enters the supinator muscle. At the level of the dorsal wrist the posterior interosseous nerve is located at the deep aspect of the extensor tendons. The median nerve may be compressed at various sites, including the lacertus fibrosis, between the pronator teres heads, and the sublimis bridge. These compression sites can be identified with ultrasound.

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1. Introduction

Ultrasound is often used to assess soft tissue structures about joints [1]. Ultrasound offers some advantages over MR, owing to its higher resolution. This allows better depiction of fine nerve

branches and better appreciation of subtle alterations in the fibrillar echotexture of tendons and ligaments. Because ultrasound is dynamic, the integrity and continuity of tendons and ligaments can be assessed in real time in positions of stress. Comparison with the asymptomatic side is possible and may help diagnose subtle abnormalities. Finally power Doppler is valuable in diagnosing tendinopathies such as tennis or golfers elbow. A disadvantage of ultrasound is that it is operator dependent and may be technically difficult. This disadvantage can be overcome by proper training.

In this work we discuss the detailed ultrasound anatomy of tendons, ligaments and nerves about the elbow, using cadaveric correlation. We include tips and tricks for evaluating difficult anatomic structures.

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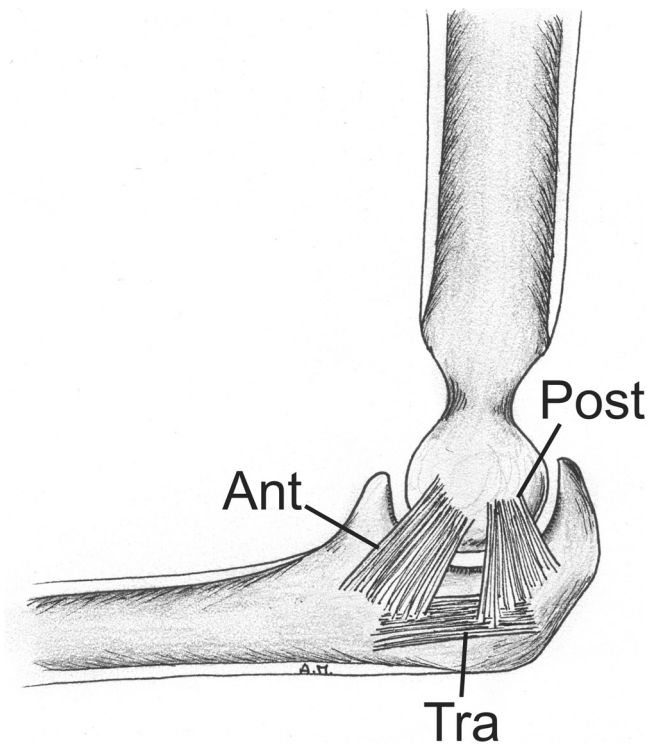


Fig. 1. Drawing of medial elbow ligaments. Note anterior (Ant), posterior (Post) and transverse (Tra) components of the ulnar collateral ligament.

2. Discussion

2.1. Medial ligaments

The ulnar collateral ligament (UCL) forms the major restraint to valgus stress [1,2]. It is commonly injured in the setting of throwing injuries and sports. The UCL consists of an anterior, posterior and transverse band (Fig. 1). The anterior band is mechanically the most important. To image the anterior band the elbow should be put in slight flexion as this allows optimal alignment of the ultrasound probe along the course of the ligament. An excellent trick is to hook the 2nd to 4th fingers of the operator behind the medial epicondyle from an anterior approach and let the probe slide onto the fingers from anteriorly. The probe is then positioned along the course of the ligament (Fig. 2).

On MR arthrography the distal attachment of the UCL to the ulna should be tightly attached to the sublime tubercle without contrast interposition between the ligament and ulna. On ultrasound, however, the ligament may appear to insert more distally.

In some patients, the proximal insertion of the anterior band may be somewhat broader or multifibrillar and this should not be taken for a sign of abnormality. It may often be difficult on one static image to separate the ligament fibers from the adjacent fatty tissue. Slightly tilting the probe back and forth uses anisotropy to better differentiate the ligament from adjacent fat (Fig. 2). Along the posteromedial aspect of the elbow the posterior band of the UCL can be seen. Probe positioning is similar to that for assessment of the ulnar nerve and the ligament of Osborne (Fig. 3). The posterior band of the UCL spans the humeroulnar joint like a hammock and forms the bottom of the cubital tunnel. The ulnar nerve is located adjacent to it.

The transverse component of the UCL courses between the ulnar insertions of the anterior and posterior bands, and is less important.

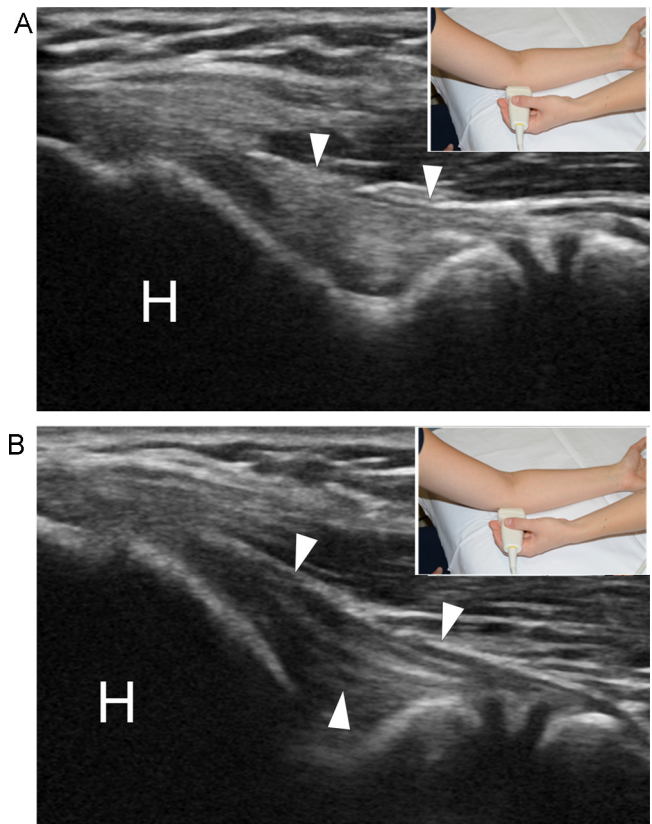


Fig. 2. (A, B) Longitudinal view of anterior component of the ulnar collateral ligament (arrowheads). Note that with tilting of the probe anisotropy can be used to better outline the ligament. In (A) ligament is difficult to differentiate from adjacent fat. Better differentiation is seen in (B). Also note multifibrillar aspect. H, humerus. Insert, probe position.

2.2. Lateral ligaments

The anatomy of the lateral ligaments is complex (Fig. 4) [2]. The ligaments include the radial collateral ligament (RCL), ulnar insertion of the annular ligament, and lateral ulnar collateral ligament (LUCL). Probe placement for the RCL is similar to that for assessment of the extensor tendons of the elbow in the longitudinal plane (Fig. 5). The concavity in the distal aspect of the humerus is identified for correct probe placement. Various tubercles may be identified on the lateral epicondyle. The radial collateral ligament

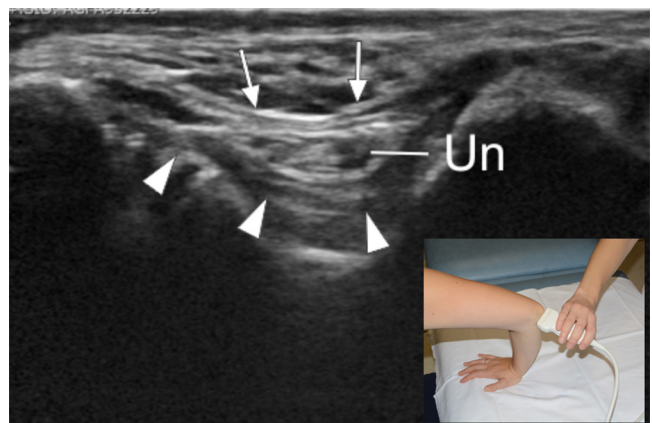


Fig. 3. Longitudinal view of posterior component of the ulnar collateral ligament. Note ligament (arrowheads) that forms a hammock for the ulnar nerve (Un). Ulnar nerve is covered by Osborne's ligament (arrows). Insert, probe positioning.

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