Ultrasoundography of the normal and pathologic long head of biceps tendon

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Abstract

The purpose of this pictorial essay is to illustrate the ultrasonographic aspects of the long head of the biceps tendon. The normal anatomy and different pathologic processes affecting this structure are described. Recognizing abnormalities of the biceps tendon is important because the function of the tendon is to stabilize the anterosuperior portion of the rotator cuff and its pathology may be a cause of shoulder pain.

Rezumat

Scopul acestui eseul în imagini este de a ilustra aspectele ecografice ale tendonului capului lung al bicepsului brahial. Sunt descrise atât aspectele anatomic normale cât și diferitele procese patologice întâlnite la nivelul acestuia. Recunoașterea modificărilor tendonului biceps este importantă atât datorită funcției sale de stabilizator al porțiunii anterosuperioare ale cotului rotatoriilor cât și prin faptul că aceasta poate fi sursă de durere la nivelul umărului.

The biceps brachii muscle is located on the anterior part of the upper arm, being a long and fusiform muscle. The biceps has several functions, the most important being to rotate the forearm (supination) and to flex the elbow. The term biceps brachii is a Latin phrase meaning “two-headed [muscle] of the arm”, in reference to the fact that the muscle consists of two bundles of muscle, each with its own origin, sharing a common insertion point near the elbow joint [1,2,3].

Normal anatomy and sonographic appearance

At the proximal insertion, the biceps brachii muscle has two heads: the short and the long head.

The short head of the biceps originates from the coracoid process of the scapula, having a common tendon with the coracobrachialis muscle.

The tendon of the long head of biceps brachii (LBT) has an intracapsular portion (from its insertion into the superior labrum to the bicipital groove) and an extracapsular portion (at the level of the bicipital groove, until the musculotendinous junction). The tendon originates from an area just above the glenoid fossa of the scapula, from the supraglenoid tubercle, and, in part, from the glenoid labrum. The junction of the LBT and the superior labrum represents an area of potential normal variants [4]. The morphology of the tendon insertion is variable with either a narrow or broad base of attachment. The tendon glides over the humeral head, stabilizing it in the glenoid fossa by preventing the humerus from riding up in the fossa when the arm is raised.

The LBT enters the bicipital groove through the rotator cuff interval, the space between the subscapularis and supraspinatus tendons. This space is covered and stabilized by the coracohumeral ligament (CHL), with a 2-3 mm thickness, echogenic appearance (fig 1).
The transverse humeral ligament (THL) is the next LBT stabilizing structure in the bicipital groove. Situated in the distal continuty of the CHL, the THL is composed of the most superficial fibers of the subscapularis tendon, bridging the lesser and greater tuberosities (fig 2).

It appears as a thin echogenic layer that overlies the bicipital sulcus. The last stabilizing structure is the tendon of the pectoralis major, anterior to the myotendinous junction of the LBT (fig 3) [5,6,7].

At the bicipital groove level the BLT is covered by a tendon sheath. This tendon sheath is considered to be a direct extension of the joint capsule [8].

The LBT must be examined in its full course in two perpendicular scanning planes (fig 4).

The patient sits with the elbow flexed to 90° and the forearm pronated resting on the lap. The frequency of the linear probe used must be in the range of 7.5 to 10 MHz. In the transverse plane, the LBT is identified as a round-shaped echogenic structure situated in the bicipital groove. The origin of the tendon is not visible but, at the rotator cuff interval, the tendon is identified as an oval-shaped echogenic structure between the tendon of subscapularis anteromedially and the supraspinatus posterolaterally. In the tendon sheath a small amount of normal synovial fluid can be detected. During the dynamic examination (internal and external rotation of the shoulder) the tendon should remain
inside the groove. In the longitudinal plane the normal fine fibrillar pattern of the LBT should be revealed. It is usually necessary to angle the transducer superiorly, “head to toe”, in order to visualize the tendon in an orthogonal manner [7,9].

**Pathology**

**Tendinitis, tenosynovitis**

The most important ultrasonography findings of tendinitis and tenosynovitis are the presence of fluid in the tendon sheath and the alteration of the fibrillar pattern. Acute tenosynovitis is characterized by the anechoic enlargement of the sheath, first with a normal tendon echotexture (fig 5, fig 6).

![Fig 5](image1.png)

Fig 5. Acute tenosynovitis of the LBT, longitudinal (a) and transverse (b) scan. Note the aspect in transverse scan in the sectional plan marked on the longitudinal scan

![Fig 6](image2.png)

Fig 6. The same case from fig 5. The aspect in transverse plane is different due to the change of the sectional plane

As the inflammation persists, the tendon becomes thick and diffuse hypoechoic, and inside the tendon sheath a combination of fluid and synovial proliferation can be detected (fig 7-11).

![Fig 7](image3.png)

Fig 7. Important tenosynovitis of the LBT. There is an important volume of fluid with a small proliferation of synovial (arrow)

![Fig 8](image4.png)

Fig 8. Tenosynovitis of the LBT with the sheath almost filed with proliferated synovia (arrow). D- deltoid muscle

![Fig 9](image5.png)

Fig 9. Tendinitis and tenosynovitis of a LBT (arrows); longitudinal (a) and transverse (b) scan.
In chronic tendinitis the tendon may appear frayed, degenerated, and fibrous tissue may replace the fibers [9,10]. Occasionally the tendon or the sheath may calcify. The echoguided puncture of the biceps tendon sheath can be done easily, avoiding the tendon (fig 13).

Fluid within the sheath is a pathologic but nonspecific finding. Due to anatomic reasons the glenohumeral joint communicates with the LBT sheath. If the tendon has a normal ultrasonographic aspect, the origin of the fluid should be sought elsewhere in the glenohumeral joint [7,10]. The volume of fluid in the sheath tends to be large in full-thickness tears and small in adhesive capsulitis and partial – thickness tears of the articular surface [10].

The fluid from the sheath should be differentiated from the subacromial-subdeltoid bursa fluid. The bursa lies superficially, between the tendon sheath and deltoid muscle (fig 14, fig 15).
Fig 14. Subacromial-subdeltoid bursitis (B). There is no fluid the tendon sheath. BG- bicipital groove

Fig 15. Transverse scan of the LBT. Small amount of fluid in the tendon sheath (arrow) and fluid in the subacromial-subdeltoid bursa (B). D- deltoid muscle, BG- bicipital groove

Fig 16. Total-thickness tear of the LBT, longitudinal scan. Arrows- the two ends of the tendon.

Fig 17. Tear of the LBT at the musculotendinous jonction, longitudinal scan. BM- biceps muscle, arrow-hematoma

Fig 18. Transverse scan of the LBT. The tendon is subluxated over the lesser tuberosity (LT). The bicipital groove is empty (BG). The arrow shows the place of the transverse humeral ligament tear

Detection of the fluid collection concomitant within the sheath (glenohumeral joint) and within the bursa is a strong indicator for a full-thickness tear of the rotator cuff [7,11].

Tear

Partial-thickness tears appear as hypoechoic areas within the tendon, seen both in transverse and longitudinal scans. The tendon partial tears may extend for great distances along the tendon [7,9].

Total-thickness tears are identified by a sudden disruption of the fibrillar pattern and through visualization by the two tendon ends floating within a hematoma or within tendon sheath fluid (fig 16, fig 17) [7,9].

The aspect of “empty groove”, with the nonvisualization of the tendon within the bicipital groove and biceps muscle contraction with bulbous appearance, characterize an acute rupture. In chronic ruptures there is a partial non-visualization
of the upper portion of the tendon, whereas the lower portion adheres within the groove. It is important to examine the entire length of the bicipital groove. In time, the empty bicipital groove may fill with echogenic scar tissue that simulates a normal LBT. In this case, the absence of a fibrillar pattern is indicative for a non-tendinous structure [12].

Patients with partial or complete tears of the LBT are significantly more likely to have associated tears of the supraspinatus and subscapularis tendons [13].

**Displacement**

The displacement may be subluxation (at least part of the tendon is displaced over the lesser tuberosity) (fig 18) or dislocation (the entire tendon lies outside the groove) [7]. Dislocation of the LHB usually occurs medially (fig 19, fig 20).

If there is an association with a full-thickness tear of the subscapularis tendon, the dislocation will be under the subscapularis tendon. If the tendon is not torn, the dislocation will be anterior to the subscapularis tendon. Dynamic evaluation, during external rotation of the shoulder is particularly useful in the diagnosis [9,10]. Sometimes, the dislocated tendon may be difficult to identify because of its deep location [12].

**Osseous abnormalities of the bicipital groove**

A bony spur may be seen arising from the floor or from the walls, especially from the medial wall (fig 21). The irregular bony contours of the bicipital groove or the spurs are associated with the degeneration of the biceps tendon, tears or tenosynovitis (fig 22) [10].
Fig 21. Spur arising from the bicipital groove floor (open arrow). Arrow- LBT. Note the small amount of fluid within the tendon sheath (*) and subdeltoid bursa (arrowhead).

Fig 22. Longitudinal scan of the bicipital groove. Irregularities of the bony floor (arrow). Fluid in the tendon sheath (*). D- deltid muscle.

References