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WEBINAR

Pragmatic MSK Ultrasound: 8-Step Protocol for Assessing the Distal Biceps Tendon

October 2023

Your Host

Shelley Guenther, CRGS, CRCS

Sonographer | Clinical Marketing Manager

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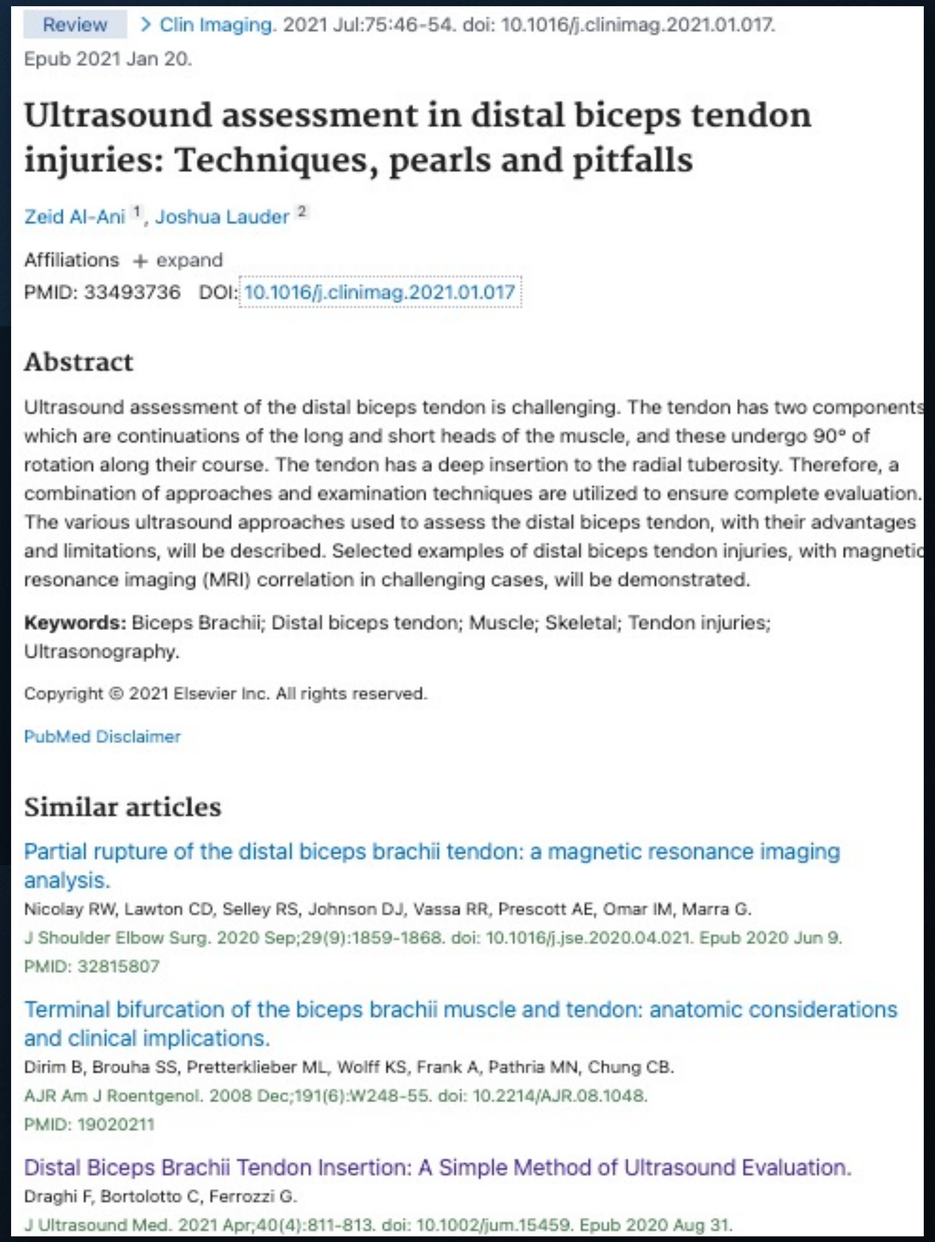
Ultrasound assessment in distal biceps tendon injuries: Techniques, pearls and pitfalls

> “Ultrasound of the distal BT is challenging…. a combination of approaches and examination techniques are utilized to ensure complete visualization.”

Al-Ani Z, Lauder J. Ultrasound assessment in distal biceps tendon injuries: Techniques, pearls and pitfalls. Clin Imaging. 2021 Jul;75:46-54. doi: 10.1016/j.clinimag.2021.01.017. Epub 2021 Jan 20. PMID: 33493736.



Review > Clin Imaging. 2021 Jul:75:46-54. doi: 10.1016/j.clinimag.2021.01.017. Epub 2021 Jan 20.

Ultrasound assessment in distal biceps tendon injuries: Techniques, pearls and pitfalls

Zeid Al-Ani [1], Joshua Lauder [2]

Affiliations + expand

PMID: 33493736 DOI: 10.1016/j.clinimag.2021.01.017

Abstract

Ultrasound assessment of the distal biceps tendon is challenging. The tendon has two components which are continuations of the long and short heads of the muscle, and these undergo 90° of rotation along their course. The tendon has a deep insertion to the radial tuberosity. Therefore, a combination of approaches and examination techniques are utilized to ensure complete evaluation. The various ultrasound approaches used to assess the distal biceps tendon, with their advantages and limitations, will be described. Selected examples of distal biceps tendon injuries, with magnetic resonance imaging (MRI) correlation in challenging cases, will be demonstrated.

Keywords: Biceps Brachii; Distal biceps tendon; Muscle; Skeletal; Tendon injuries; Ultrasonography.

Similar articles

Partial rupture of the distal biceps brachii tendon: a magnetic resonance imaging analysis.
Nicolay RW, Lawton CD, Selley RS, Johnson DJ, Vassa RR, Prescott AE, Omar IM, Marra G.
J Shoulder Elbow Surg. 2020 Sep;29(9):1859-1868. doi: 10.1016/j.jse.2020.04.021. Epub 2020 Jun 9.
PMID: 32815807

Terminal bifurcation of the biceps brachii muscle and tendon: anatomic considerations and clinical implications.
Dirim B, Brouha SS, Pretterklieber ML, Wolff KS, Frank A, Pathria MN, Chung CB.
AJR Am J Roentgenol. 2008 Dec;191(6):W248-55. doi: 10.2214/AJR.08.1048.
PMID: 19020211

Distal Biceps Brachii Tendon Insertion: A Simple Method of Ultrasound Evaluation.
Draghi F, Bortolotto C, Ferrozzi G.
J Ultrasound Med. 2021 Apr;40(4):811-813. doi: 10.1002/jum.15459. Epub 2020 Aug 31.

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Distal Biceps Brachii Tendon Insertion: A Simple Method of Ultrasound Evaluation

> The crab position… allows for optimal visualization of the distal biceps tendon in the axial plane ”

Draghi F, Bortolotto C, Ferrozzi G. Distal Biceps Brachii Tendon Insertion: A Simple Method of Ultrasound Evaluation. J Ultrasound Med. 2021 Apr;40(4):811-813. doi: 10.1002/jum.15459. Epub 2020 Aug 31. PMID: 32865288.

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Distal Biceps Brachii Tendon Insertion: A Simple Method of Ultrasound Evaluation

Ferdinando Draghi [1,2], Chandra Bortolotto [2], Guia Ferrozzi [3,4]

Affiliations + expand

PMID: 32865288 DOI: 10.1002/jum.15459

Abstract

Different ultrasound approaches have been proposed to evaluate the distal biceps brachii tendon, such as lateral, posterior, medial, and anterior, all allowing good visualization of the distal biceps tendon and its pathologic appearances. Here we describe a new method of ultrasound evaluation of the distal biceps tendon insertion with the patient in the so-called crab position. The crab position is used to evaluate the posterior compartment of the elbow but also the lateral and medial compartments. This position allows for coverage of 75% the elbow in a single position, with less discomfort for the patient and a fair amount of saved time. In this position, after the evaluation of the common extensor tendon in the long axis, turning the transducer 90° and moving it distally allows for optimal visualization of the distal biceps brachii tendon in the axial plane. It is a simple, quick approach that allows for excellent visualization of the insertion of the distal biceps brachii tendon while avoiding an anisotropic effect.

Keywords: distal biceps brachii tendon; tendon; ultrasound.

Similar articles

Disorders of the distal biceps brachii tendon.
Chew ML, Giuffrè BM.
Radiographics. 2005 Sep-Oct;25(5):1227-37. doi: 10.1148/rg.255045160.
PMID: 16160108 Review.

Ultrasound assessment in distal biceps tendon injuries: Techniques, pearls and pitfalls.
Al-Ani Z, Lauder J.
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Ultrasound classification of traumatic distal biceps brachii tendon injuries

> “Ultrasound can be used as a first-line imaging modality to evaluate distal biceps tendon injuries.”

de la Fuente J, Blasi M, Martínez S, Barceló P, Cachán C, Miguel M, Pedret C. Ultrasound classification of traumatic distal biceps brachii tendon injuries. Skeletal Radiol. 2018 Apr;47(4):519-532. doi: 10.1007/s00256-017-2816-1. Epub 2017 Nov 24. PMID: 29177701; PMCID: PMC5814508.

Skeletal Radiol. 2018 Apr;47(4):519-532. doi: 10.1007/s00256-017-2816-1. Epub 2017 Nov 24.

Ultrasound classification of traumatic distal biceps brachii tendon injuries

Javier de la Fuente [1], Marc Blasi [2 3], Sílvia Martínez [4], Pablo Barceló [5 6], Carlos Cachán [1], Maribel Miguel [7], Carles Pedret [8 9]

Affiliations + expand

PMID: 29177701 PMCID: PMC5814508 DOI: 10.1007/s00256-017-2816-1

Free PMC article

Abstract

Objective: The present work is aimed at analysing ultrasound findings in patients with distal biceps brachii tendon (DBBT) injuries to assess the sensitivity of ultrasound in detecting the different forms of injury, and to compare ultrasound results with magnetic resonance imaging (MRI) and surgical results.

Materials and methods: A total of 120 patients with traumatic DBBT injuries examined between 2011 and 2015 were analysed. We compared ultrasound results with MRI results when surgery was not indicated and with MRI and surgical results when surgery was indicated.

Results: For major DBBT injuries (complete tears and high-grade partial tears), the concordance study between exploration methods and surgical results found that ultrasound presented a slight statistically significant advantage over MRI (ultrasound: $\kappa = 0.95$-very good-95% CI 0.88 to 1.01, MRI: $\kappa = 0.63$-good-95% CI 0.42 to 0.84, kappa difference $p < 0.01$). Minor injuries, in which most tendon fibres remain intact (tendinopathies, elongations and low-grade partial tears), are the most difficult to interpret, as ultrasound and MRI reports disagreed in 12 out of 39 cases and no surgical confirmation could be obtained.

Conclusions: Based on present results and previous MRI classifications, we establish a traumatic DBBT injury ultrasound classification. The sensitivity and ultrasound-surgery correlation results in the diagnosis of major DBBT injuries obtained in the present study support the recommendation that ultrasound can be used as a first-line imaging modality to evaluate DBBT injuries.

Keywords: Distal biceps tendon; External bicipital aponeurosis; Imaging technique; Injury classification; Tendon retraction; Ultrasonography.

Conflict of interest statement

All the authors declare that they have neither conflicts of interest nor any disclosure to declare.

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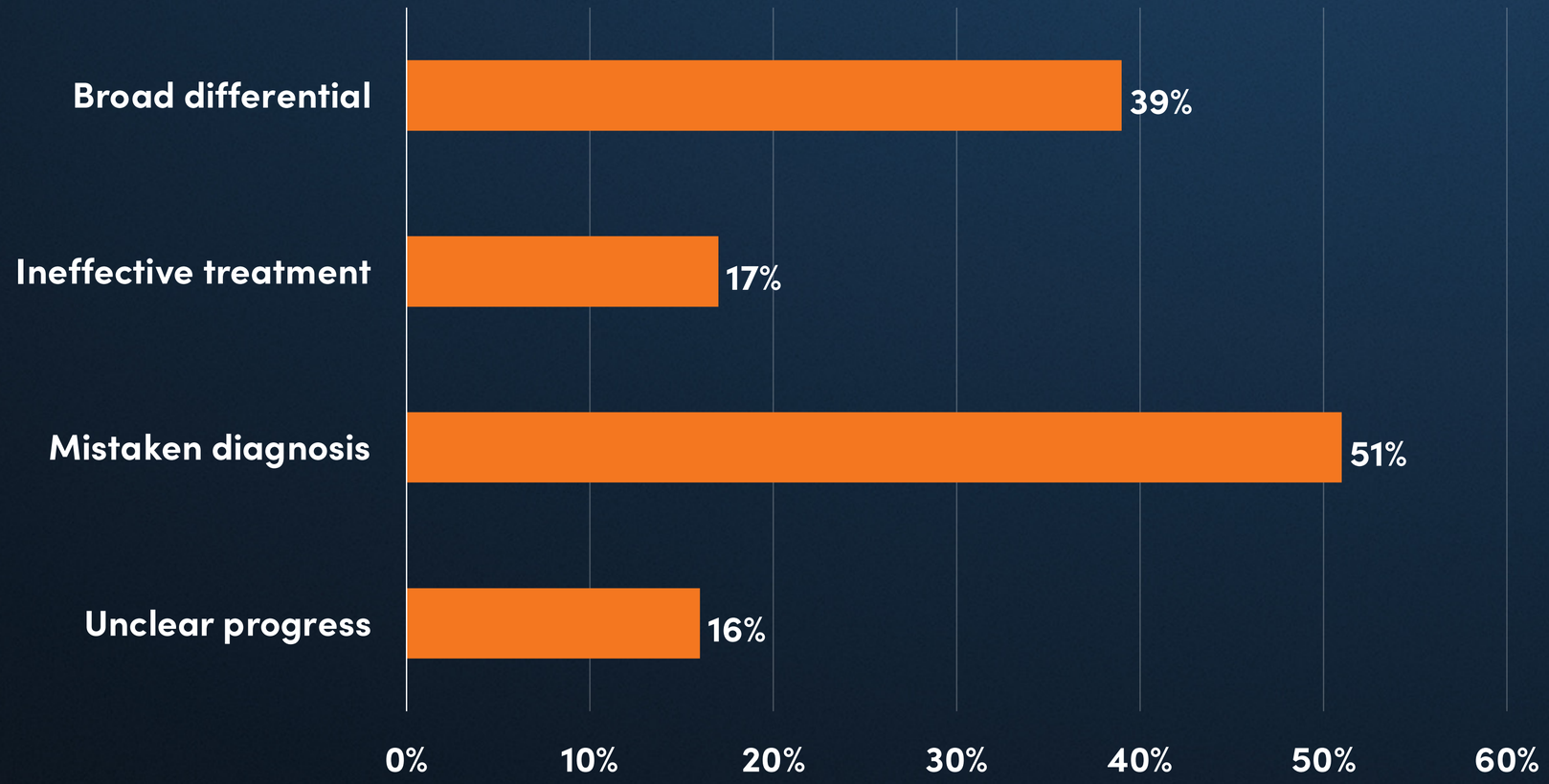
Interactive Poll

When you come across MSK injuries or abnormalities, Which of these challenges have you encountered in treating MSK concerns?



Your Expert Speaker

Marc Schmitz, MSc

Founder & CEO of Sonoskills

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The 8-step distal biceps tendon ultrasound protocol

Marc Schmitz, MSc.

Disclosure

I have NO financial relationship or conflicts of interest with the presented material in this activity

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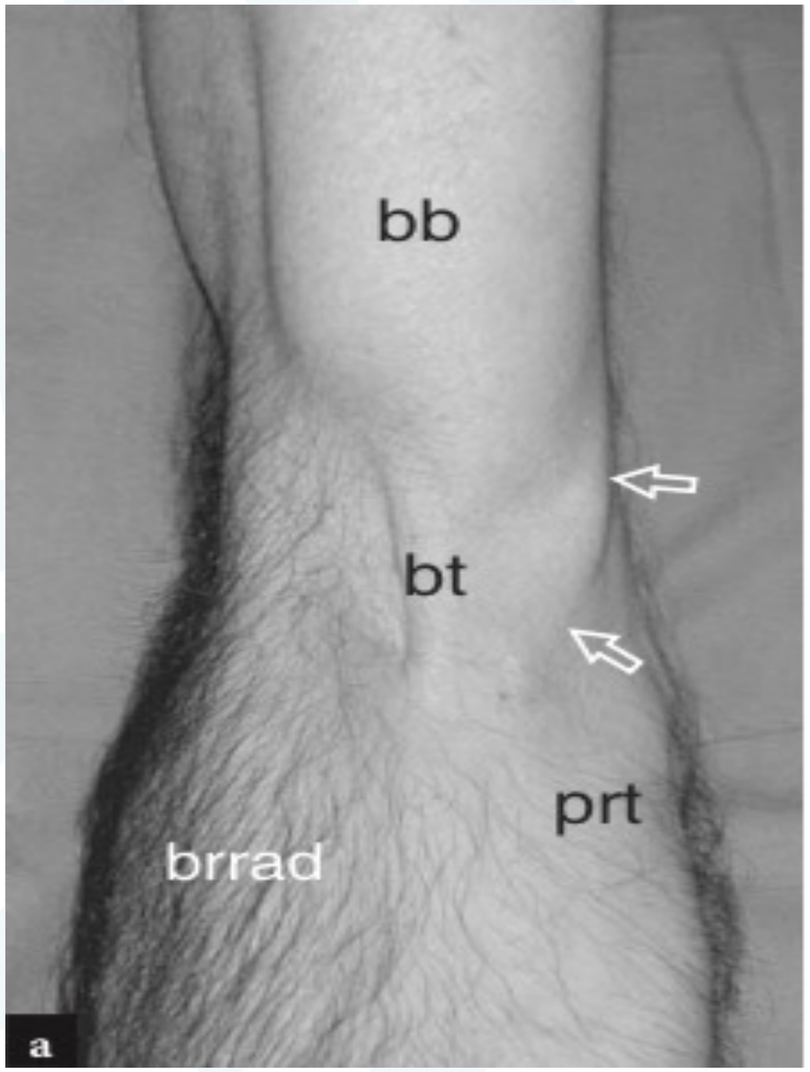
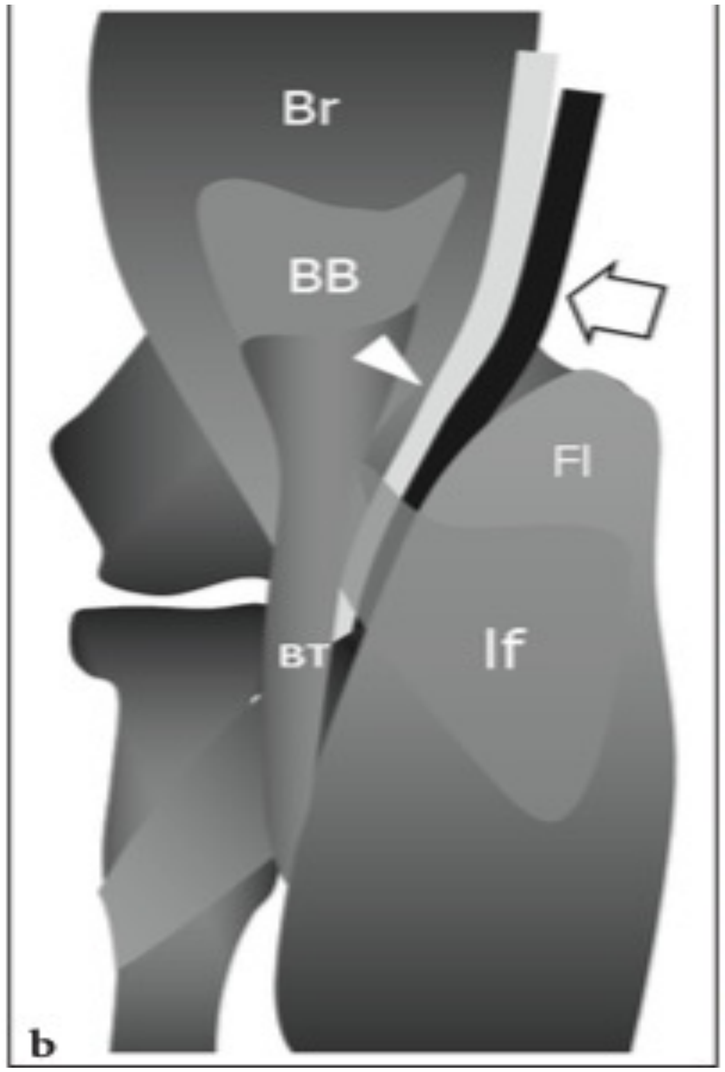
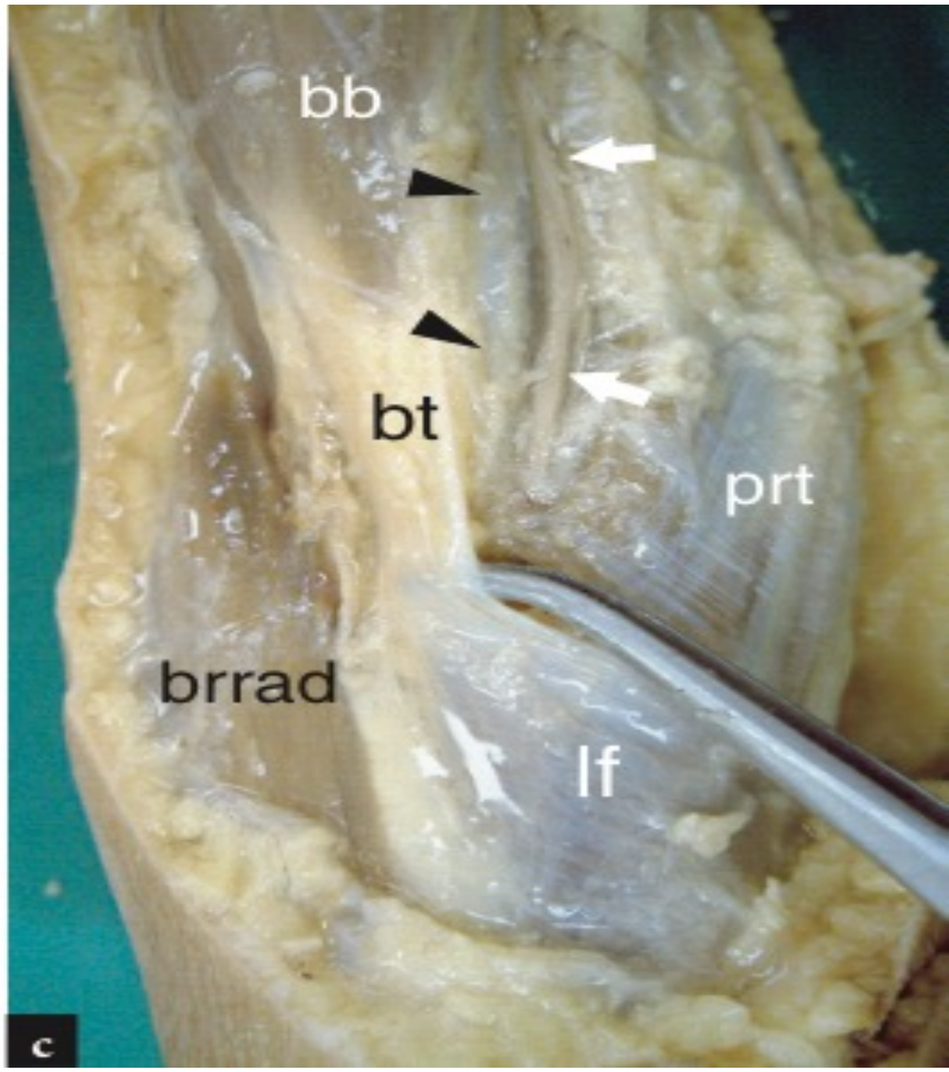
+7.000 ultrasound pathology cases
Regular contributor
free access!!

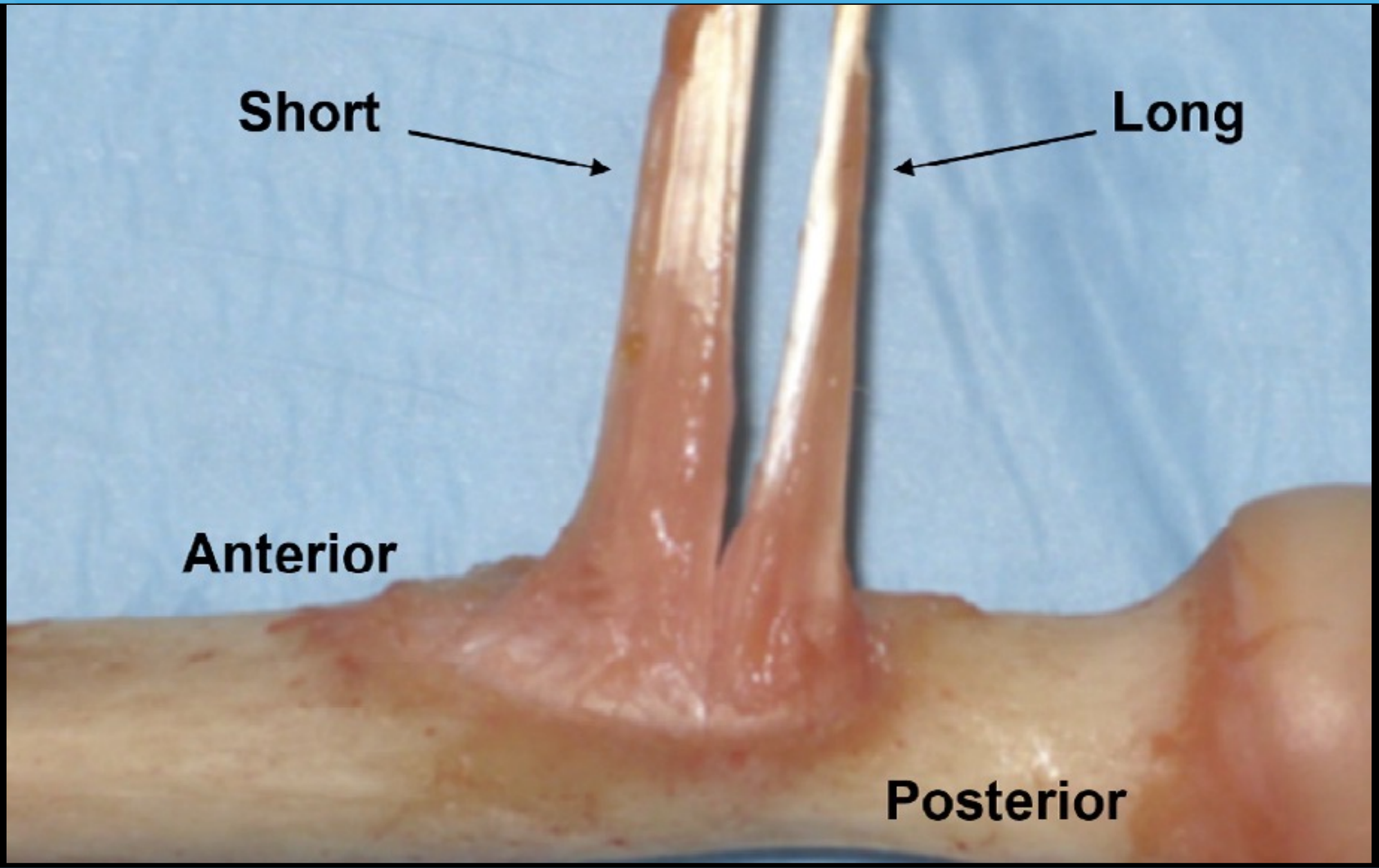




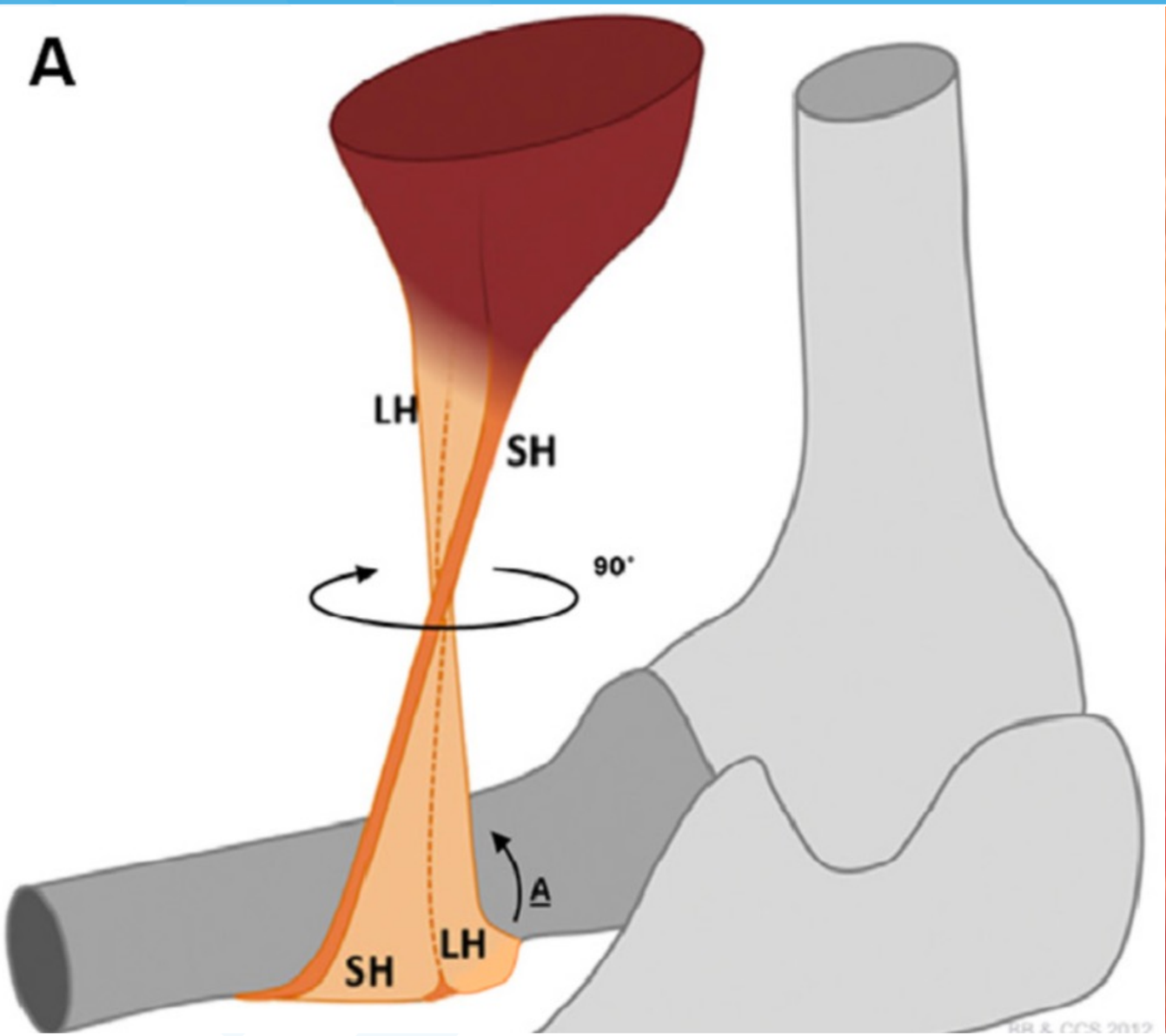


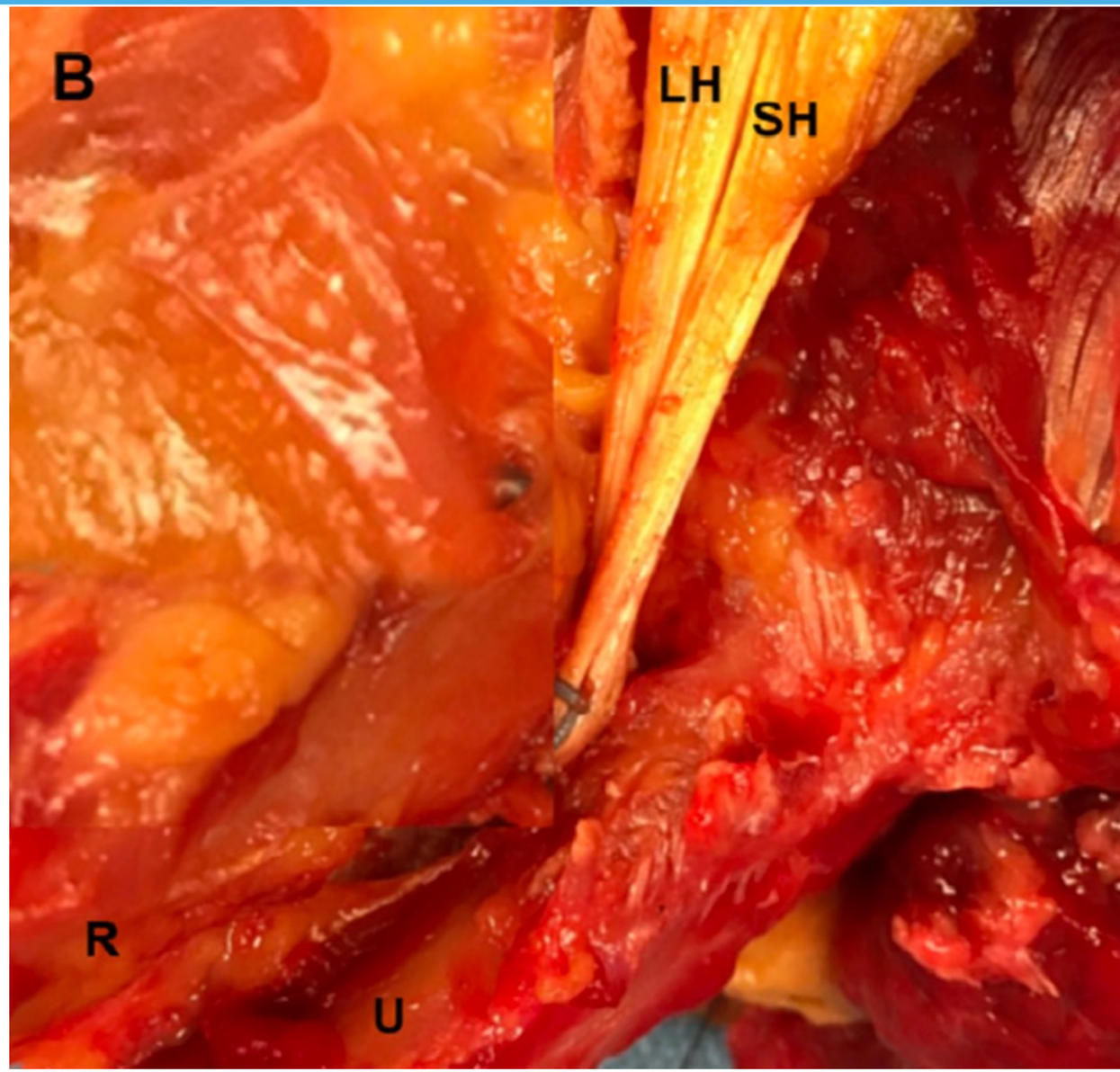
Bianchi et al. 2007

Cho et al. 2011

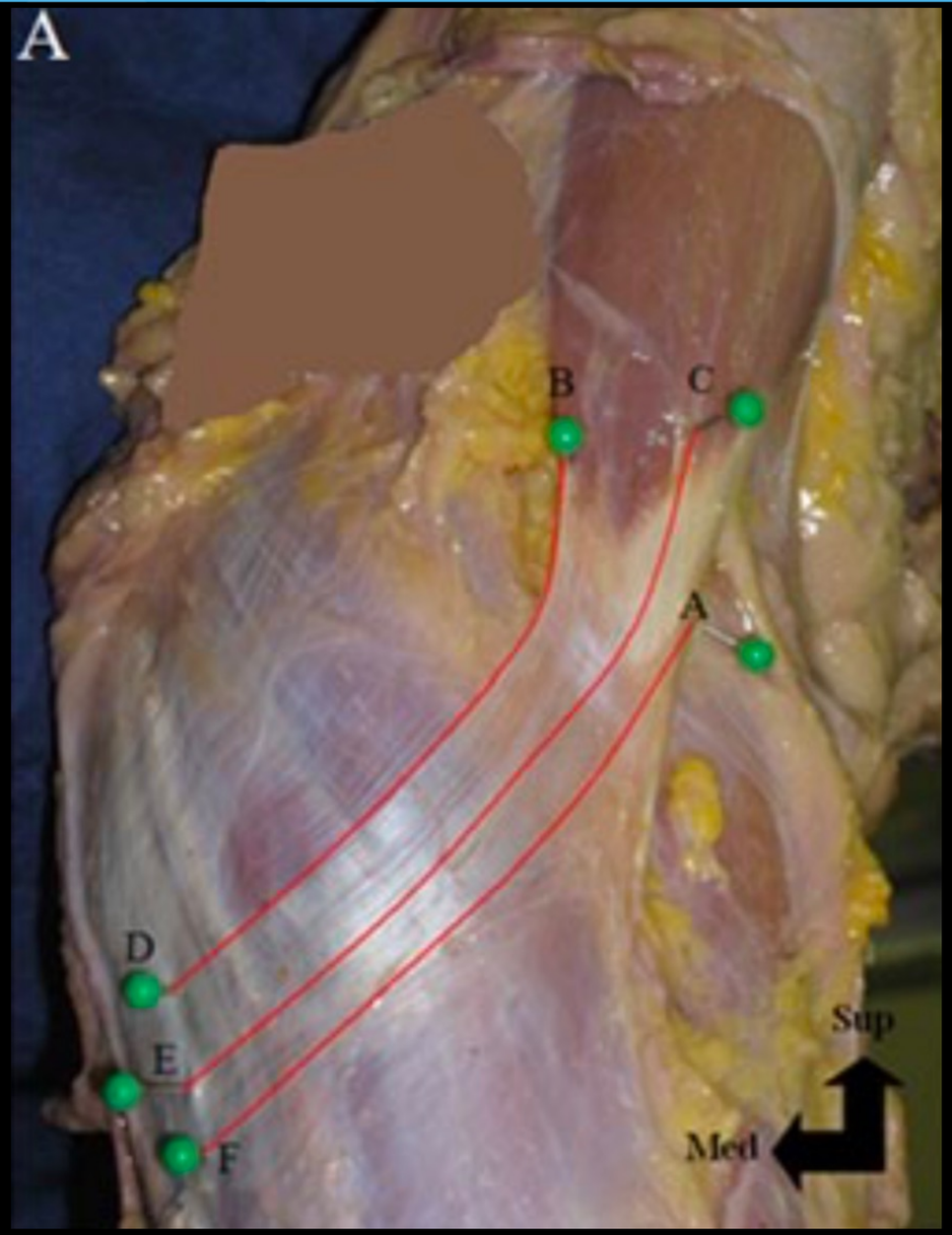


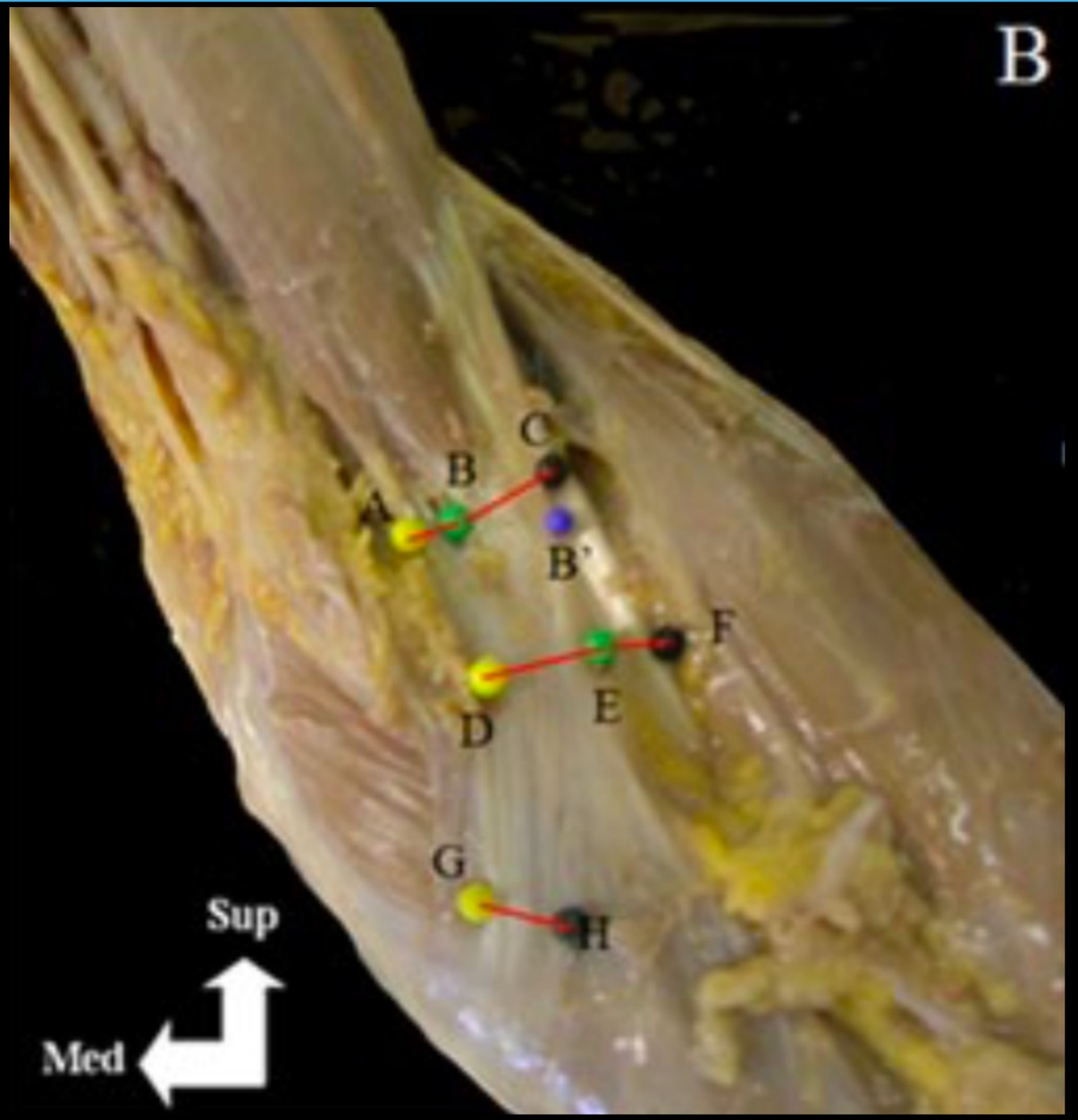
Schmidt et al. 2016





Schmidt et al. 2016; Srinivasan et al. 2020





Snoeck et al. 2014

Distal biceps: anatomy

- Flat tendon
- No tendon sheath (and thus no tenosynovitis)
- One or two (or more) separate tendons (short/long head):
  - Myotendinous junction: both positioned side by side; long head lateral
  - Distal: changing orientation, demonstrating 90◦ of tendon external rotation; short head more superficial.
- Insertion:
  - Long head: proximally, with an oval shaped footprint to most of radial tuberosity
  - Short head: fanshaped and more distally into the radial tuberosity

Distal biceps: anatomy

- Size whole footprint:
  - Length: ± 21 mm
  - Width: ± 7 mm
- CSA:
  - Long head: ± 7.2 mm^2
  - Short head: ± 5.2 mm^2
- Lacertus fibroses (bicipital aponeurosis):
  - Stabilizes distal tendon
  - Load distribution
- Bicipital bursa:
  - Surrounds the attachment of both tendons
  - Acts to reduce friction between the tendons and the radial tuberosity

Al-Ani et al. 2021

8-step distal biceps tendon protocol

1. Clinical examination
2. Ventral DBT + BA approach: SAX
3. Ventral DBT approach: LAX
4. Dorsal DBT approach: LAX + dynamical test
5. Dorsal DBT approach: SAX
6. Medial DBT approach: LAX
7. Lateral DBT approach: LAX + dynamical test
8. Pathology classification*SonoSkills pathology checklist

Step 1

Clinical Examination

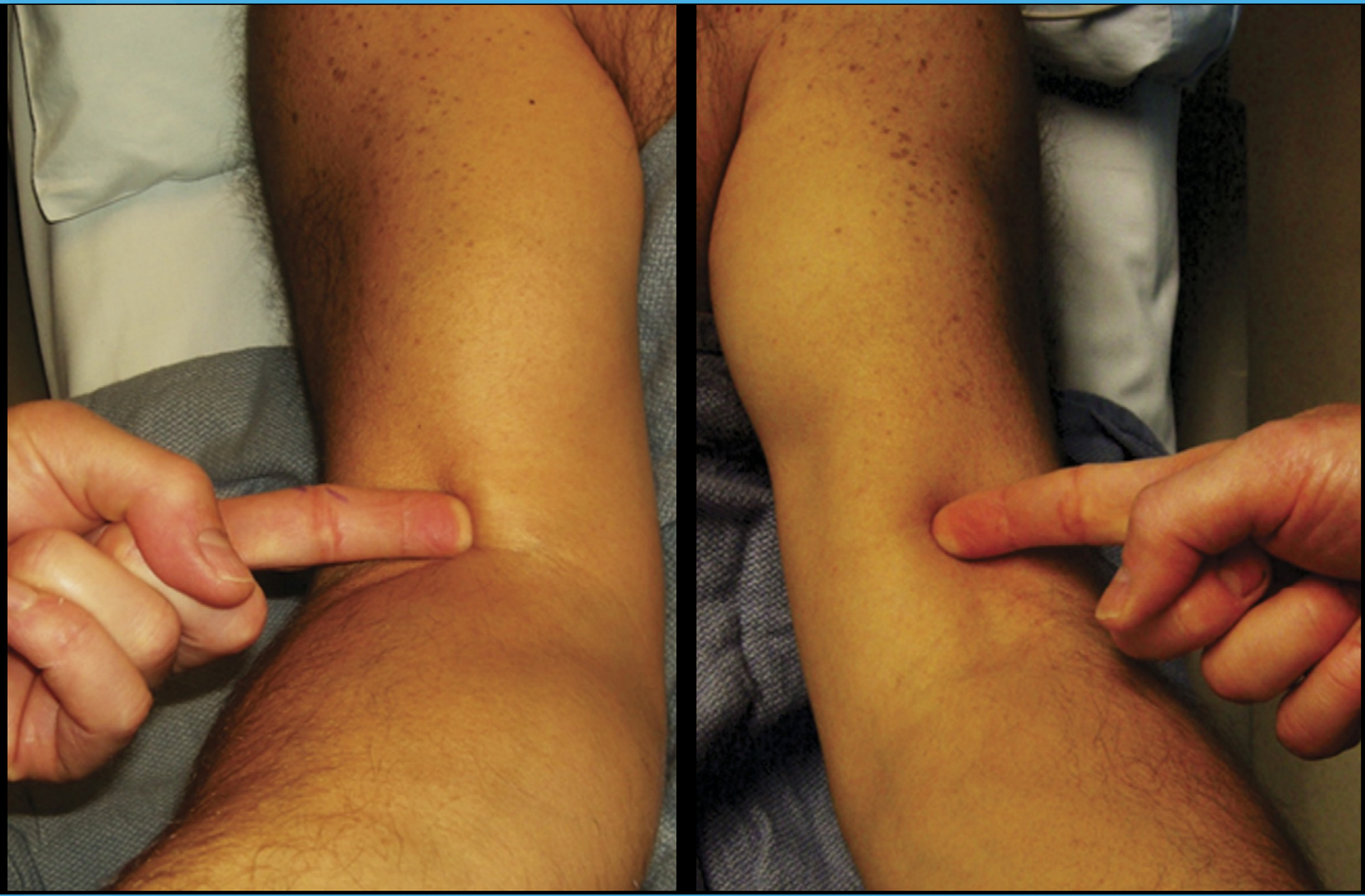
Reversed “Popeye” sign

Caekebke et al. 2021

Distal biceps provocation test

Caekebke et al. 2021

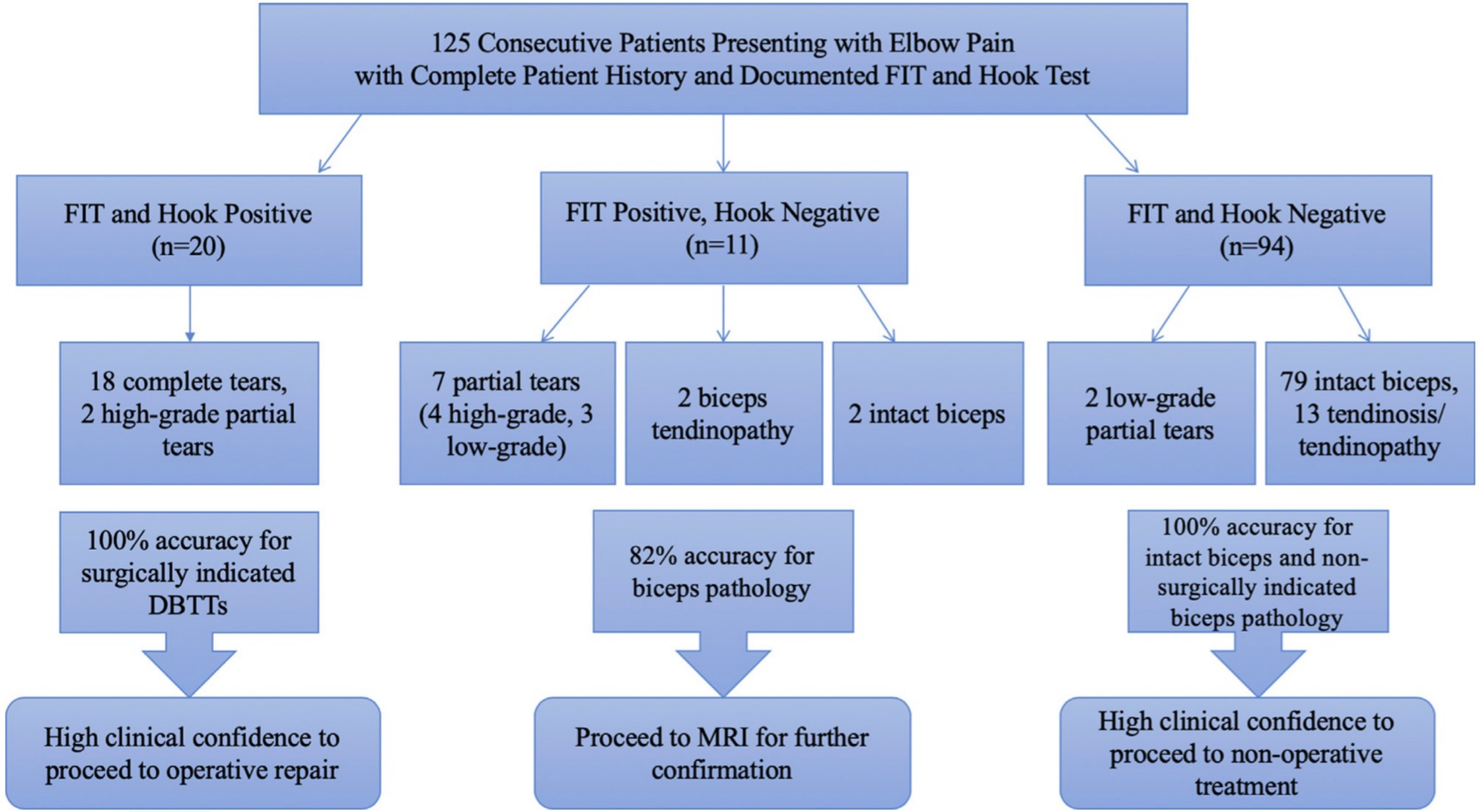
Hook test



Schmidt et al. 2013

Flexion initiation test

Bono et al. 2021



Bono et al. 2021

Diagnosis of complete DBT tears is **mainly clinical**, whereas in partial tears medical imaging is a valuable addition to the clinical diagnosis.

Step 2

Ventral approach of DBT and BA (SAX)

Step 3

Ventral approach of DBT (LAX)


L15HD3012112A0183
MSK
MI 0.53
TIS 0.06
TIB 0.12
4,8 cm
SC

Step 4

Dorsal approach of DBT + dynamical test (LAX)

Step 5

Dorsal approach of DBT (SAX)


L15HD3012112A0183
MSK
MI 0.53
TIS 0.06
TIB 0.12
3 cm
SC

Step 6

Medial approach of DBT (LAX)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Step 7

Lateral approach of DBT + dynamical test (LAX)


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COURSES

Distal biceps tendon

(Sono)pathology

Distal biceps: pathology

- Distal biceps tendon < proximal biceps tendon
- Ruptere incidence: 1.2 per 100.000 per year
- Mostly: men between ages of 40 – 60 years
- Risk factors:
  - Weightlifting
  - Anabolic steroids
  - Smoking
  - Poor physical condition
  - Increasing activity levels men in 5th and 6th decades
  - Systemic processes:
    - Several rheumatology diseases
    - Chronic uremia
    - Hemiodialysis
    - Hyperparathyroidism

Stevens et al. 2012

Distal biceps: pathology

- Complete tear as a result of single traumatic event:
  - Or > sudden eccentric load applied to a flexed elbow
  - Or > forceful hyperextension against resistance
- Sensation:
  - Pop / sharp pain in antecubital fossa
  - Weakness elbow flexion / supination
- Tears frequently result in functional weakness and disability
- Bruising
- 2 weeks: within this time prefered diagnosis and surgical repair
- Palpable defect, or tendon retraction, only if:
  - Distal biceps tendon is avulsed from radial tuberosity
  - AND torn lacertus fibrosis
- Site: mostly within 1 – 2 cm of its insertion
- ±2cm: location of hypovascular zone

Stevens et al. 2012

Distal biceps: pathology

- Partial tear
  - Uncommon: partial tear < complete tears
  - Underlying process maybe bone impingement or tendinosis
  - Single-bundle ruptures are presumably underreported
  - Difficult to diagnose:
    - Antecubital fossa pain
    - May or may not have a history of a traumatic event
    - A painful but intact tendon, verified by a hook test, is indicative of a partial tear
  - Some patients with bicipitoradial bursitis can present with an enlarging mass

Distal biceps: pathology

- Pitfall 1: intact lacertus fibrosis makes clinical diagnosis more difficult.
  - Retraction <8 cm typically correlates with an intact lacertus
  - Retraction >8 cm indicates a torn lacertus
- Pitfall 2: if the distal tendon is bifurcated an isolated rupture of a single tendon, with the other remaining intact, is possible

Stevens et al. 2012

Distal biceps: potential pathology in MSKUS

- Mechanical enthesopathy
- Inflammatory enthesitis
- Calcifications in the tendon or the enthesis
- Neovascularization, e.g. by means of B-flow examination
- Cubital bursitis (bizipitoradial bursitis)
- Interosseous bursitis
- Tendinosis (usually 1–2 cm proximal)
- Partial ruptures
- Complete ruptures
- Avulsions with osseous tearing
- Postoperative assessment with evaluation of tendon integrity, anchor position, suture position
- Determination of tendon elasticity using elastography
- Mechanical impingement during pronation-supination
- Secondary irritation caused by enthesophytes, osteophytes or by articular pathologies (synovitis, activated cubital arthrosis, synovial chondromatosis, etc.)

Tamborrini et al. 2020

MUSCULOSKELETAL

Clinical indications for musculoskeletal ultrasound updated in 2017 by European Society of Musculoskeletal Radiology (ESSR) consensus

Pathology	Consensus
Distal biceps insertion	2
Bicipitoradial bursitis	2

Sconfienza et al. 2018

Step 8

Pathology classification *SonoSkills pathology checklist

1. STRUCTURE OF PATHOLOGY

Shape – *did the morphology change?*

Echogenicity – *did the echogenicity of the anatomical structure change?*

Continuity – *are there any tears or fiber discontinuities?*

Doppler – *is there a presence of neovascularization?*

Functional – *how does the anatomy move?*

2. INTERPRET PATHOLOGY

LAX/SAX – *scan in two planes*

Left/right – *compare the affected with the non-affected side*

Measure – *quantify morphologic changes*

Relevance – *how clinical relevant are the changes?*

Pathology classification

MRI classification system	Ultrasound classification system	Ultrasound description	Number of cases	Relative (%)
No tear	Type 1	Thickened, hypoechogenic, loss of the fibrillary pattern, tendon continuity to the attachment retained, no evidence of torn fibres on the static and dynamic examinations	20	16.66
	Type 1a (Fig. 7)	It particularly affects one of the two DBBT components (short head or long head)	4	3.33
	Type 1b (Fig. 8)	It affects the full thickness of both DBBT components (short head and long head)	16	13.33
Partial tear	Type 2	DBBT thinning, irregular contour, anechoic appearance, partial tendon discontinuity, peritendinous effusion	35	29.16
Low grade (≤ 50 tear)	Type 2a (Fig. 9)	Tendon discontinuity at the attachment site, thinning ≤50% of the total thickness	18	15.00
High grade (>50 tear)	Type 2b (Fig. 5)	Tendon discontinuity at the attachment site, >50% of the total thickness	14	11.66
	Type 2c (Fig. 6)	Tendon discontinuity at the attachment site that affects the full thickness of a single DBBT component (short head or long head), which becomes retracted. A refraction artefact at the level of the tendinous stump is observed	3	2.50
Complete tear	Type 3	Proximal hypertrophic tendon stump with a refraction artefact, snake-like pattern on the long-axis view, absence of tendon fibres at the attachment site, peritendinous effusion	65	54.16
Non-retracted (≤ 8 cm)	Type 3a (Fig. 3)	EBA intact or hypertrophied, with minor tendon retraction	10	8.33
Retracted (>8 cm)	Type 3b (Fig. 4)	EBA tear with marked DBBT retraction, no evidence of EBA continuity	55	45.83

De La Fuente et al. 2018

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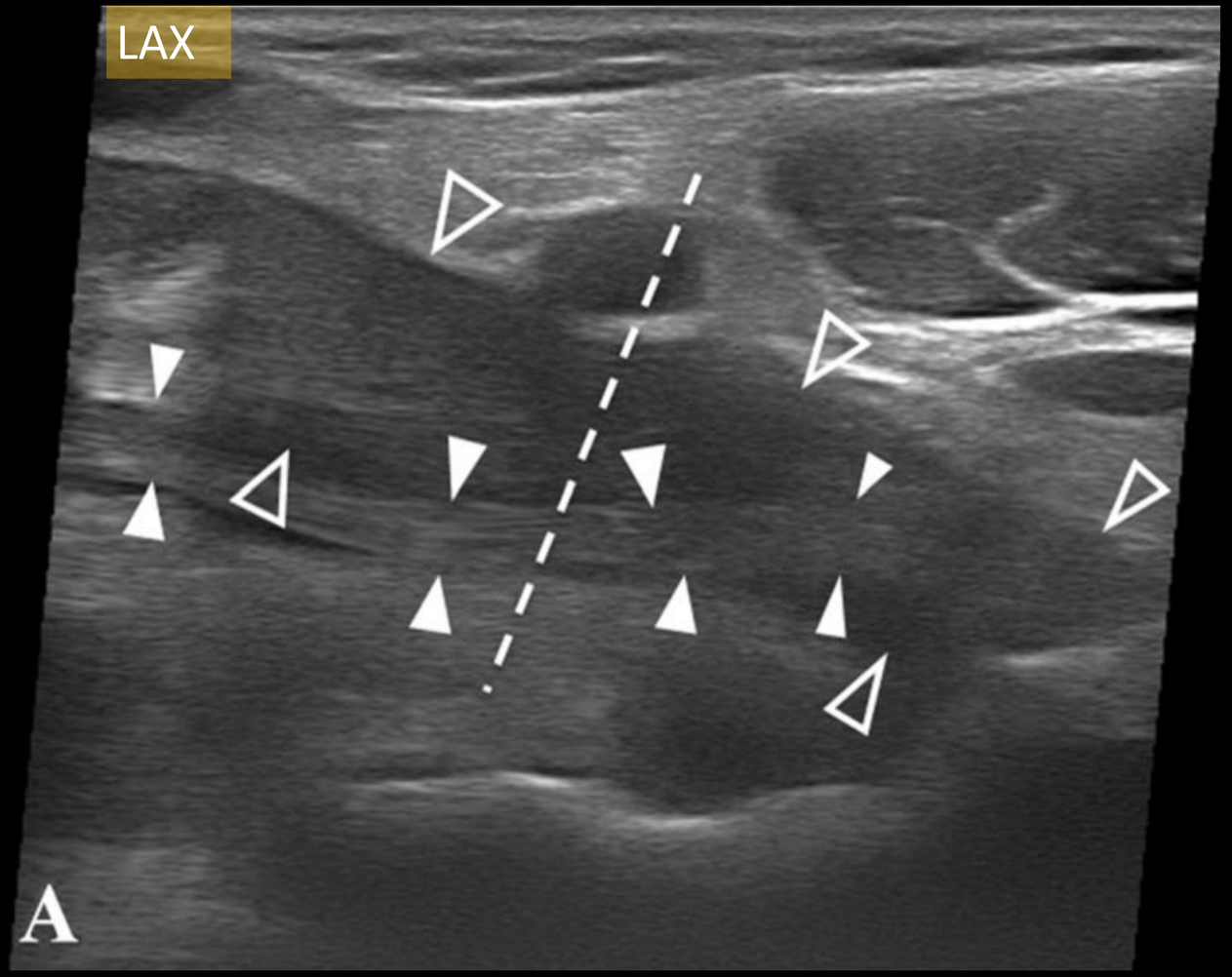
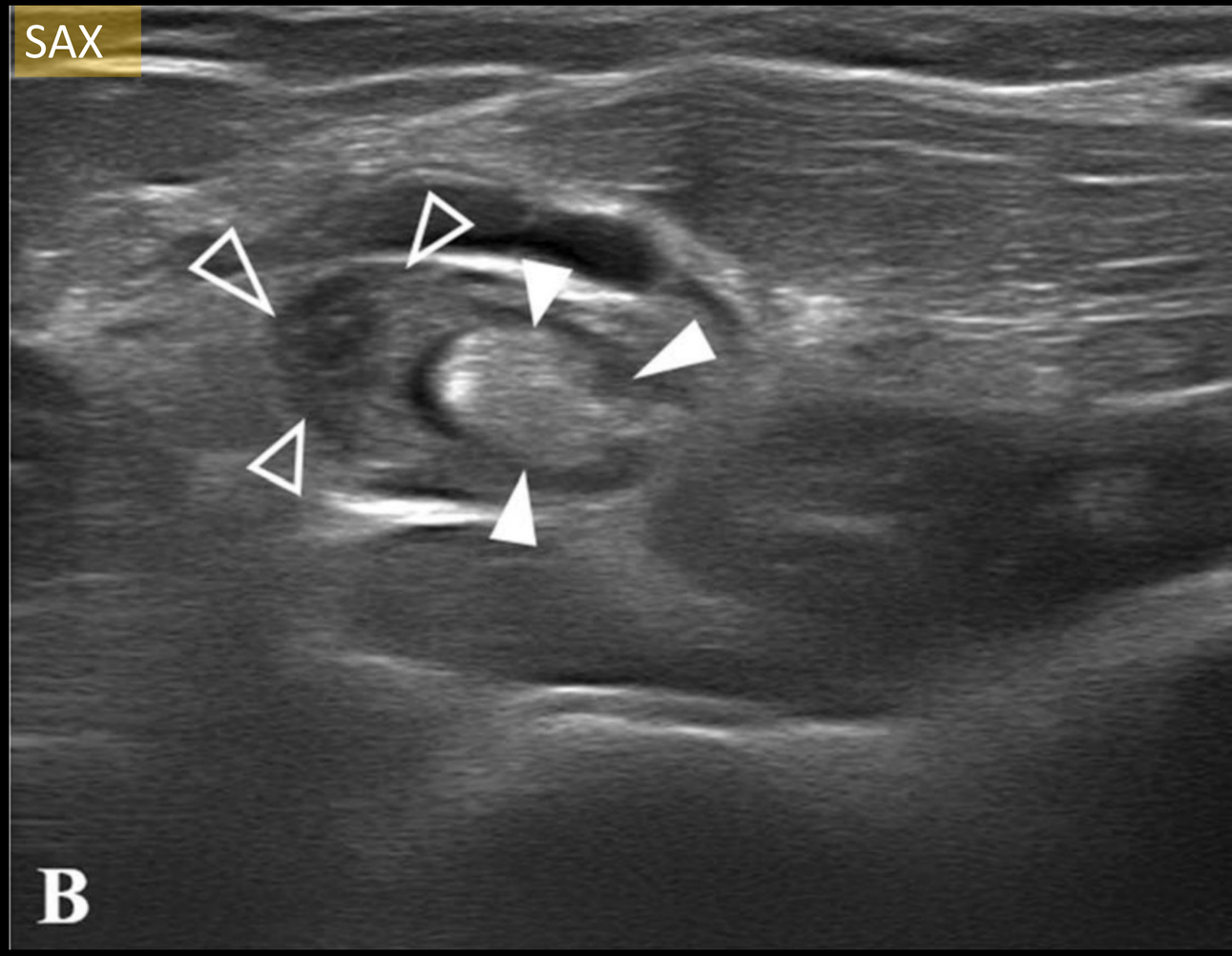
De La Fuente et al. 2018

Distal biceps: Type 1a pathology





De La Fuente et al. 2018

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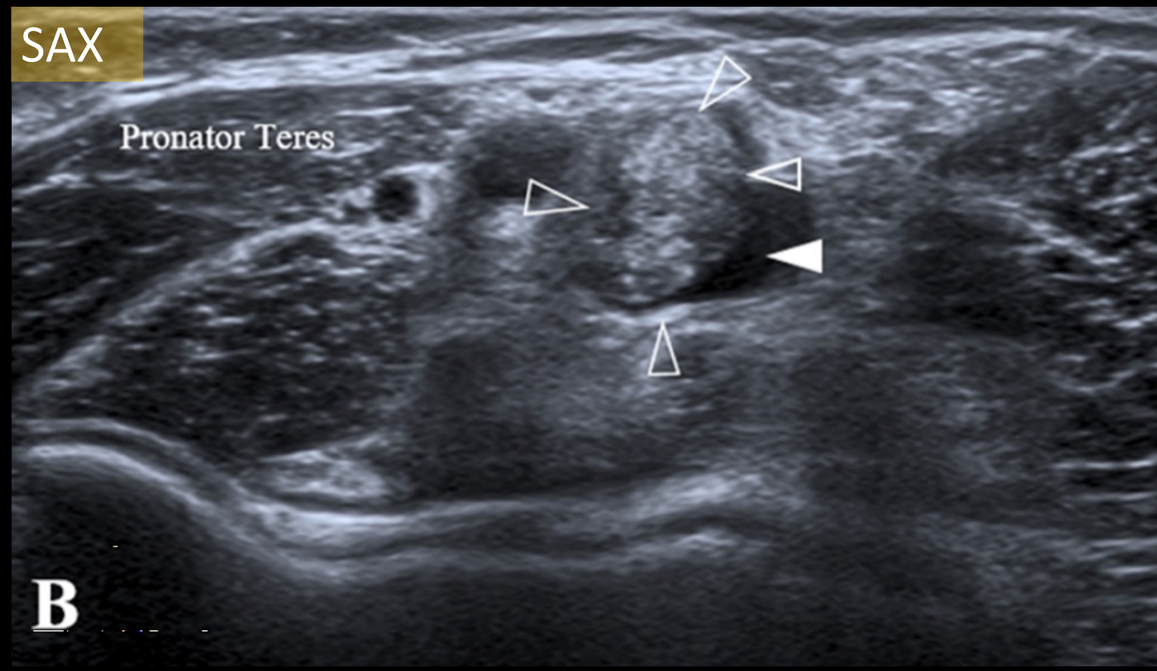
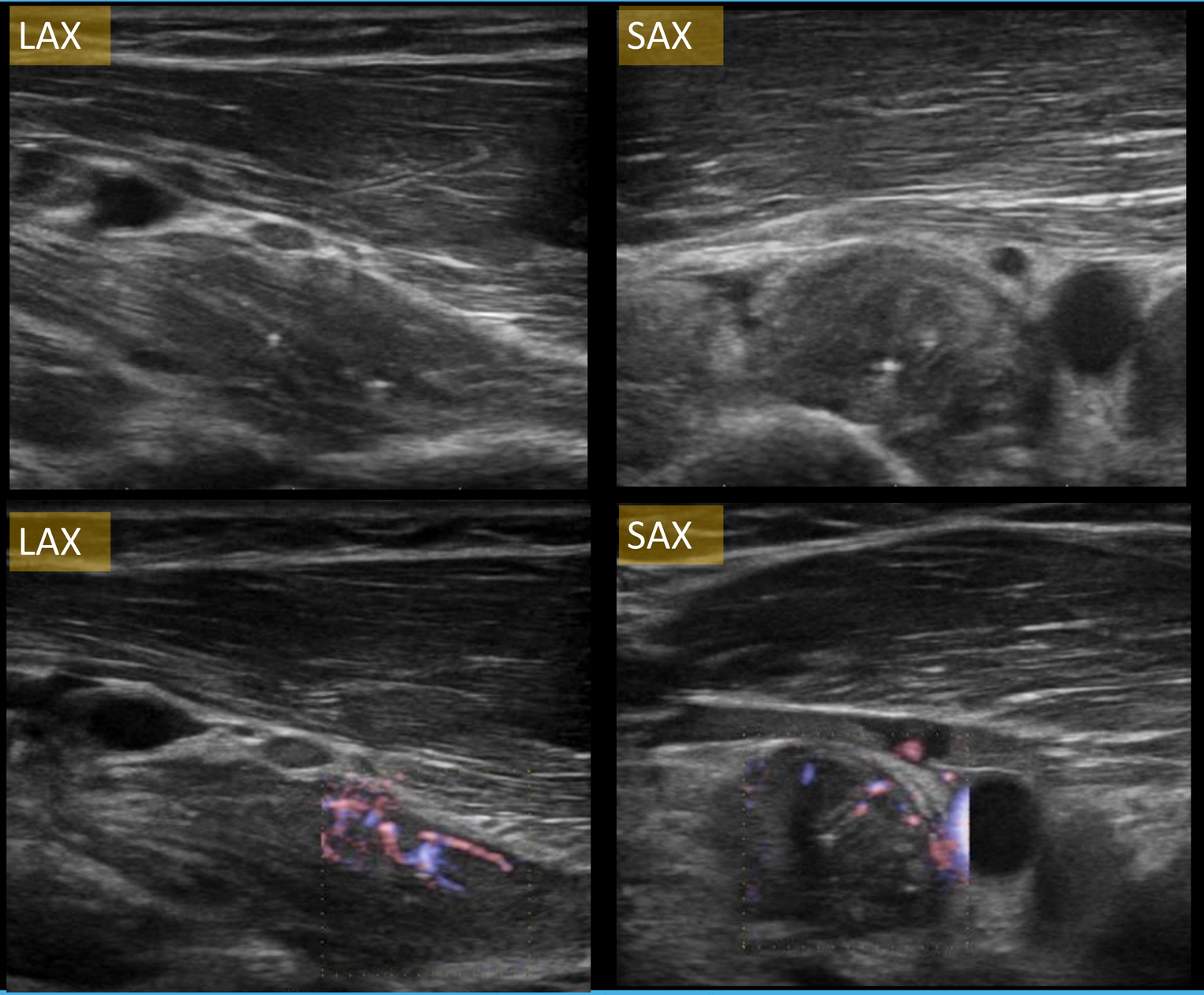
De La Fuente et al. 2018

Distal biceps: Type 1b pathology



De La Fuente et al. 2018

Distal biceps: Type 1b pathology



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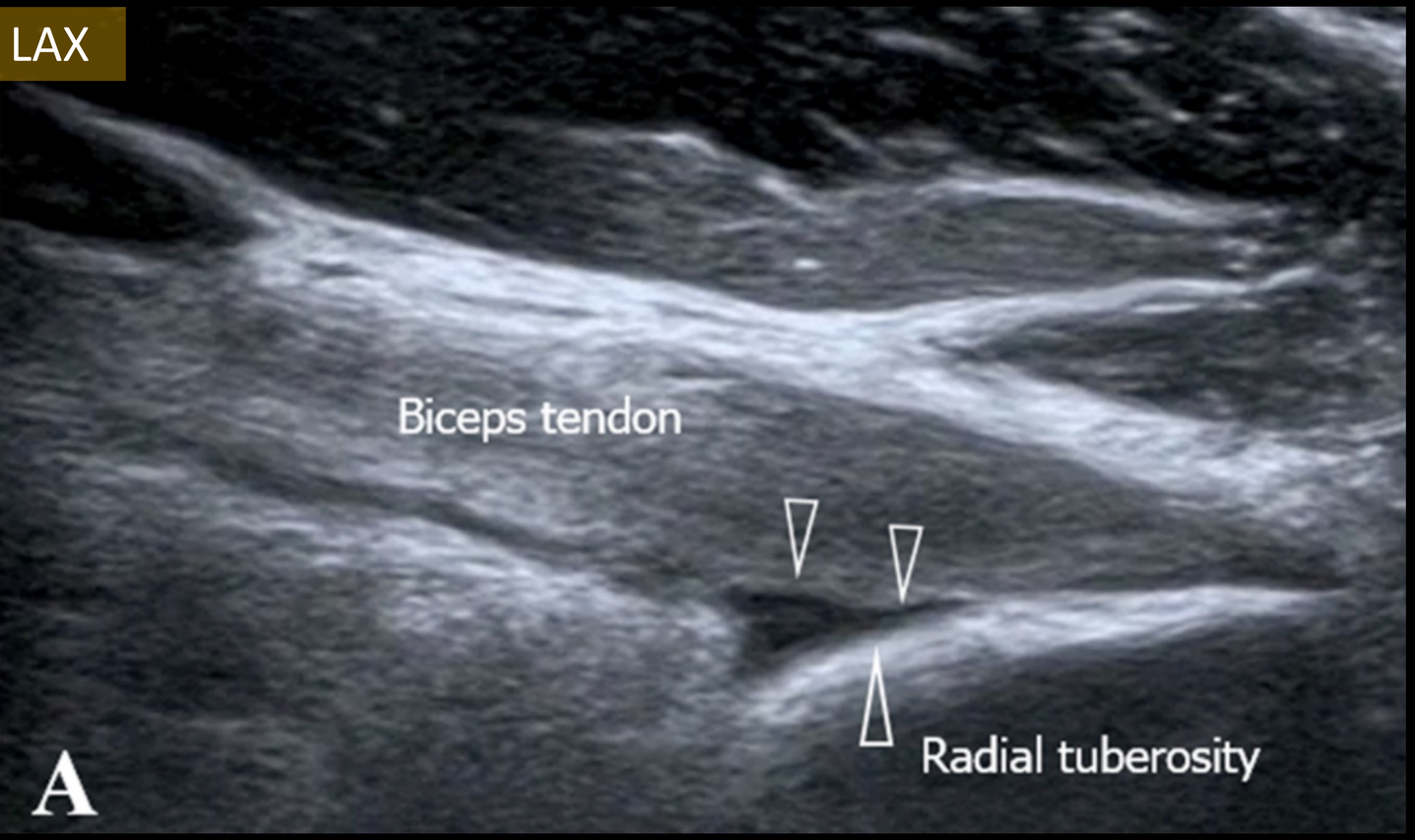
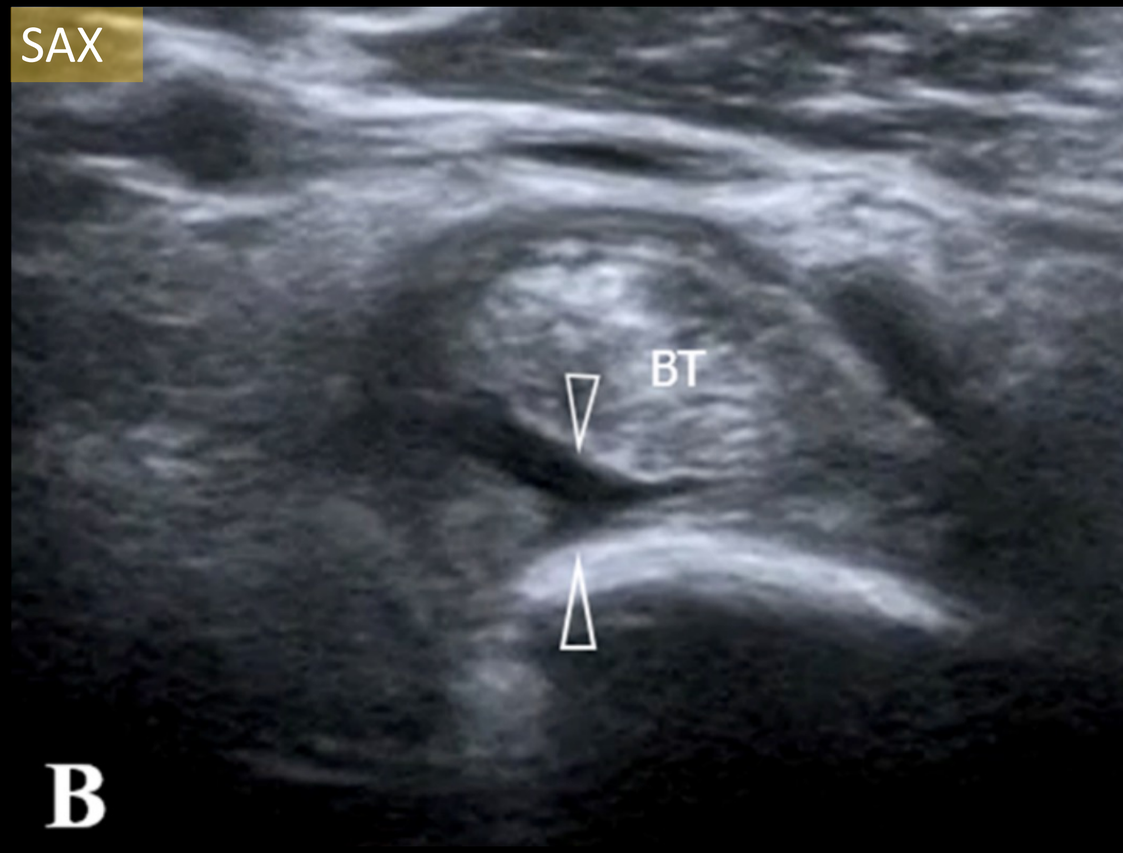
Non-retracted (≤ 8 cm)	Type 3a (Fig. 3)	EBA intact or hypertrophied, with minor tendon retraction	10	8.33
Retracted (>8 cm)	Type 3b (Fig. 4)	EBA tear with marked DBBT retraction, no evidence of EBA continuity	55	45.83

De La Fuente et al. 2018

Distal biceps: Type 2a pathology





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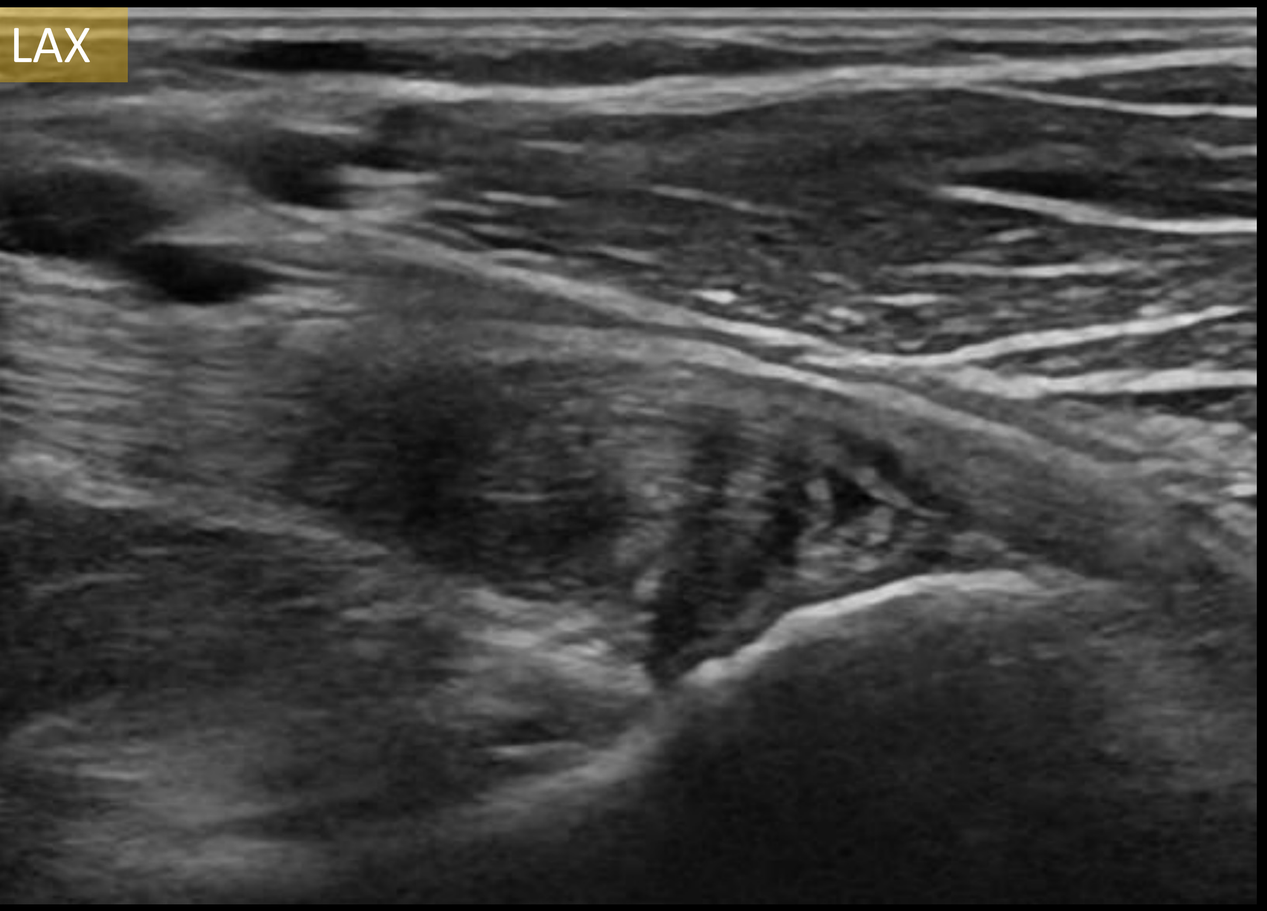
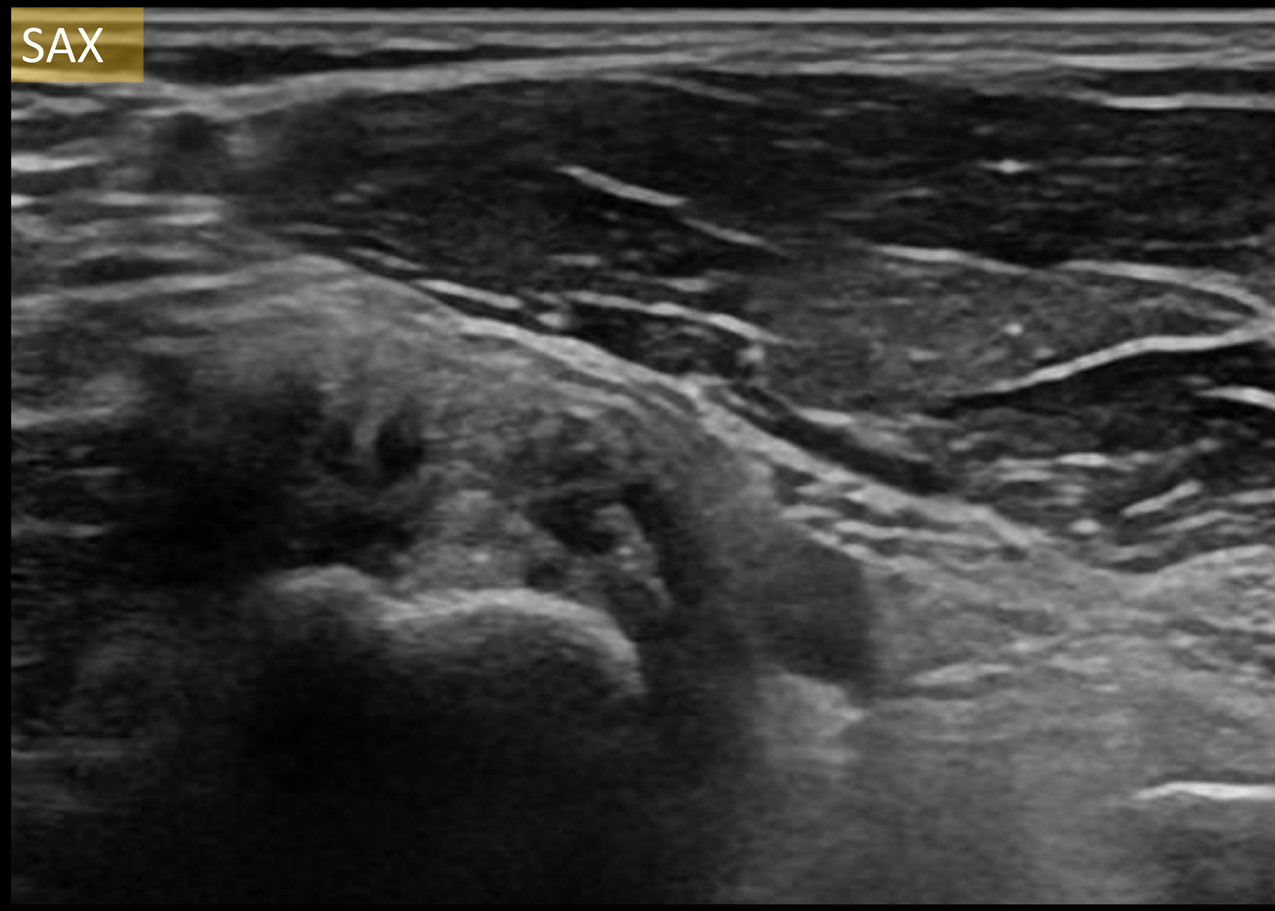
Distal biceps: Type 2a pathology





Pathology classification

MRI classification system	Ultrasound classification system	Ultrasound description	Number of cases	Relative (%)
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Partial tear	Type 2	DBBT thinning, irregular contour, anechoic appearance, partial tendon discontinuity, peritendinous effusion	35	29.16
Low grade (≤ 50 tear)	Type 2a (Fig. 9)	Tendon discontinuity at the attachment site, thinning ≤50% of the total thickness	18	15.00
High grade (>50 tear)	Type 2b (Fig. 5)	Tendon discontinuity at the attachment site, >50% of the total thickness	14	11.66
	Type 2c (Fig. 6)	Tendon discontinuity at the attachment site that affects the full thickness of a single DBBT component (short head or long head), which becomes retracted. A refraction artefact at the level of the tendinous stump is observed	3	2.50
Complete tear	Type 3	Proximal hypertrophic tendon stump with a refraction artefact, snake-like pattern on the long-axis view, absence of tendon fibres at the attachment site, peritendinous effusion	65	54.16
Non-retracted (≤ 8 cm)	Type 3a (Fig. 3)	EBA intact or hypertrophied, with minor tendon retraction	10	8.33
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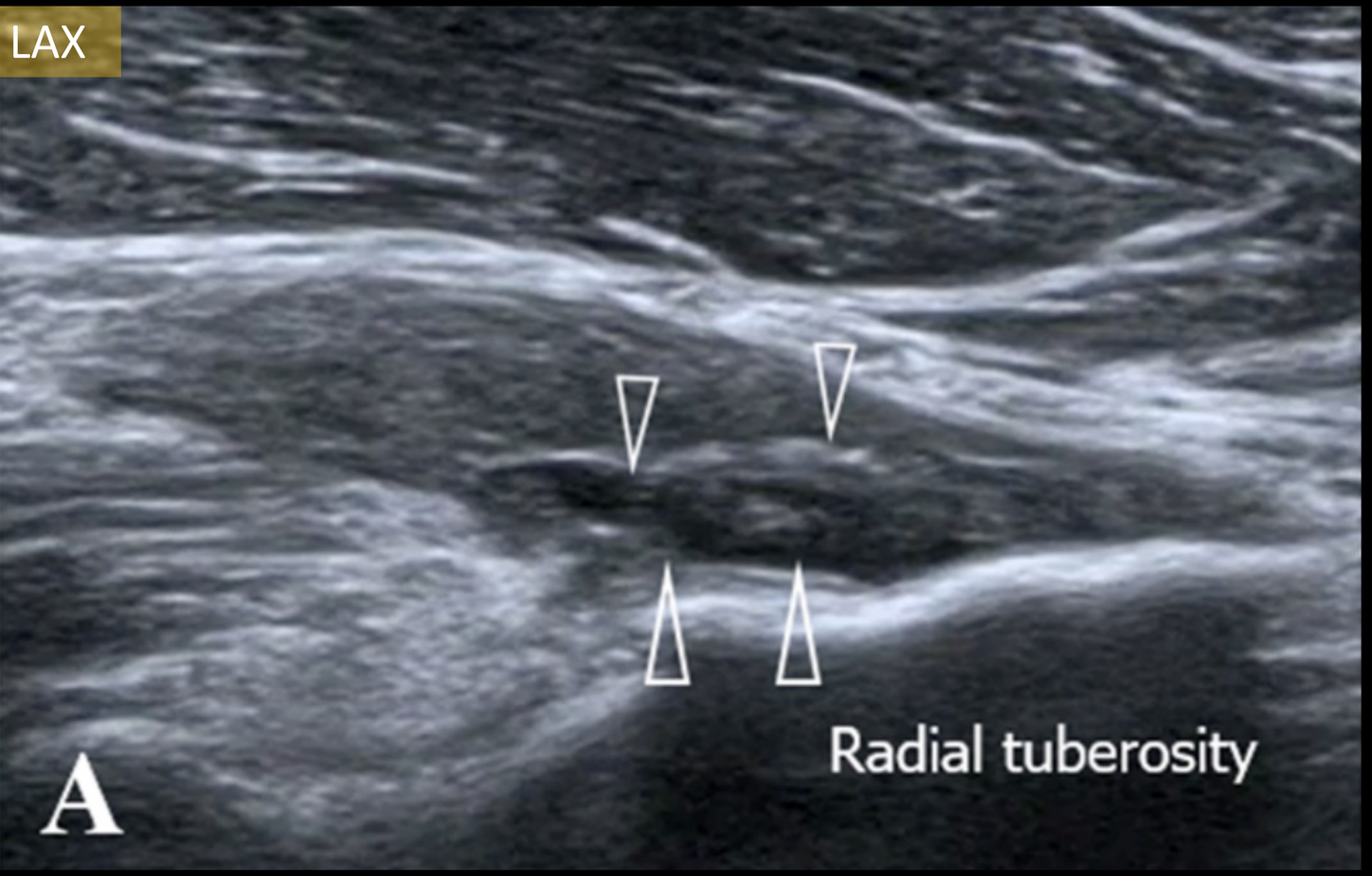
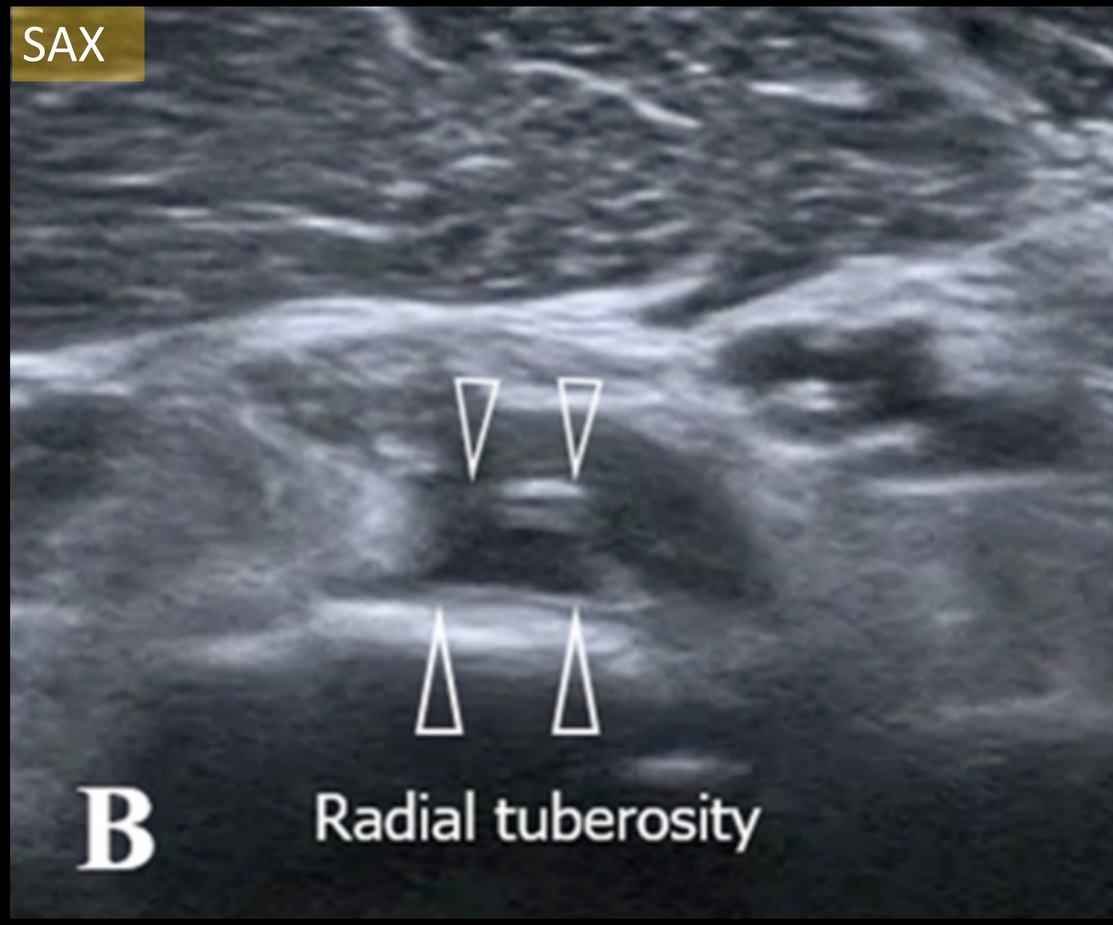
De La Fuente et al. 2018

Distal biceps: Type 2b pathology





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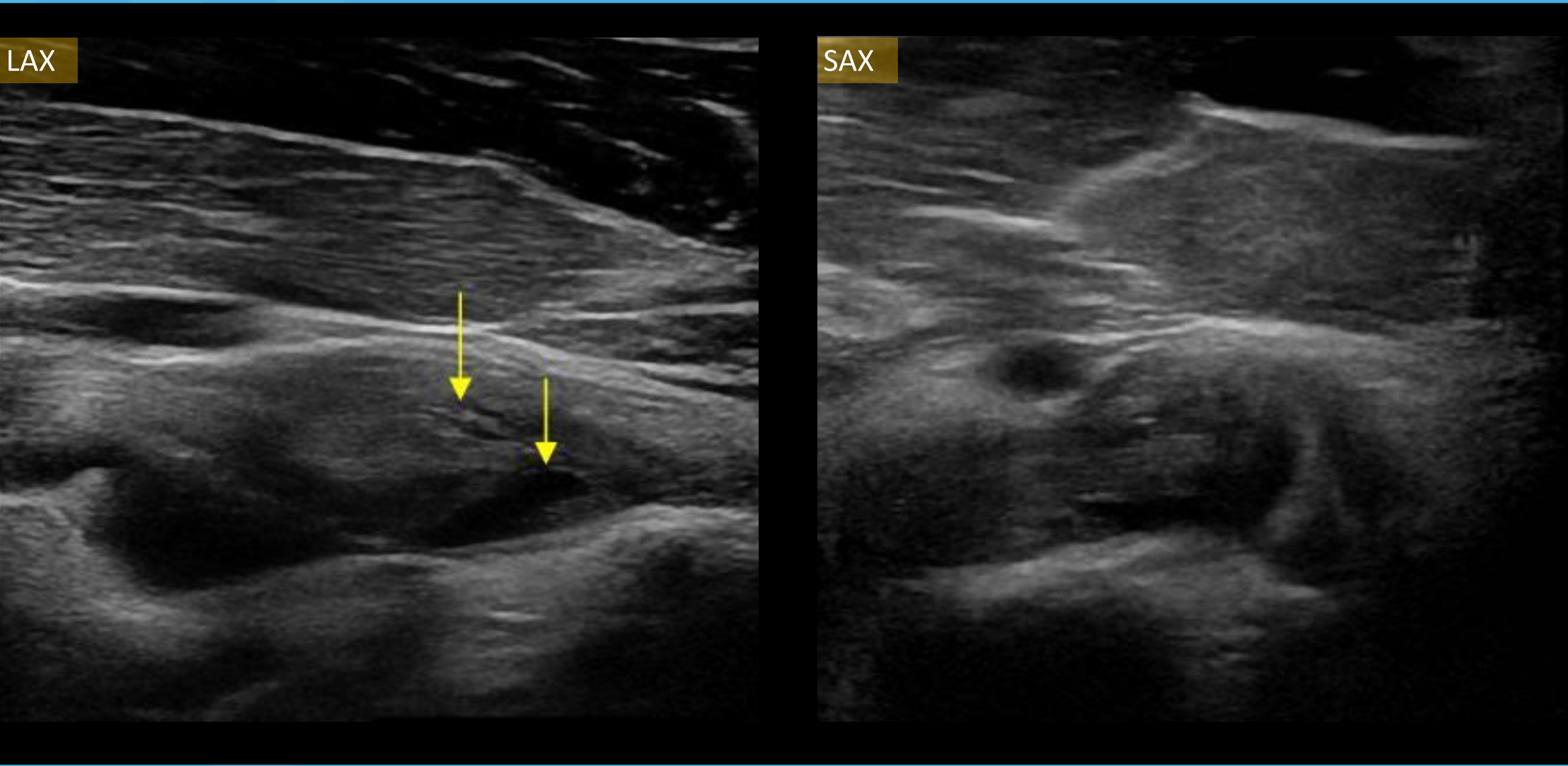
Distal biceps: Type 2b pathology



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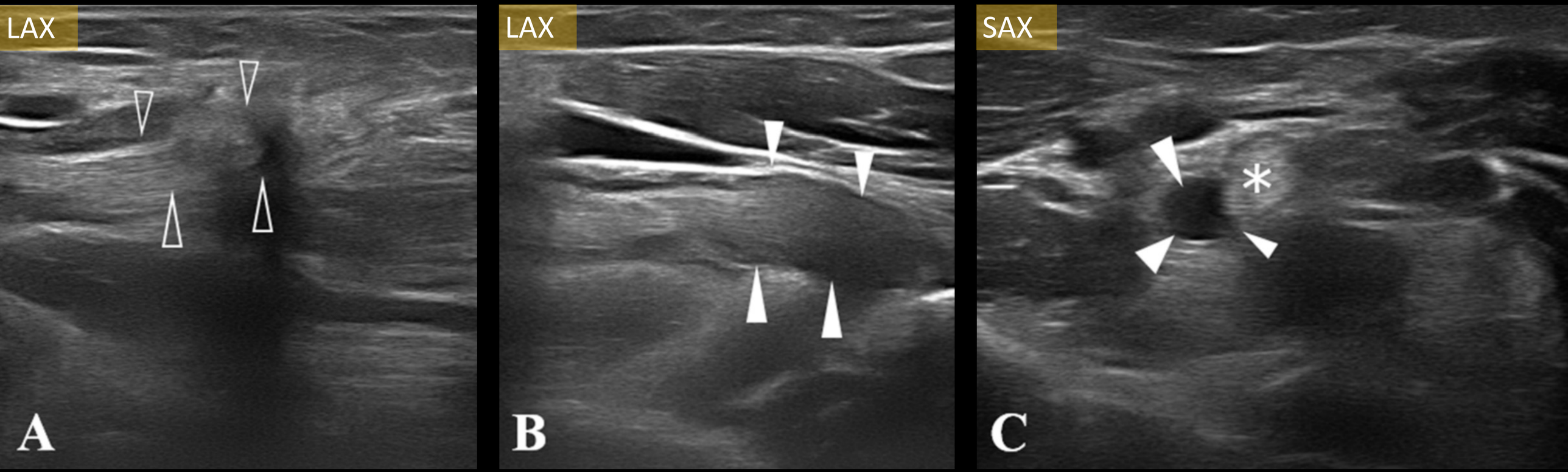
Distal biceps: Type 2c pathology



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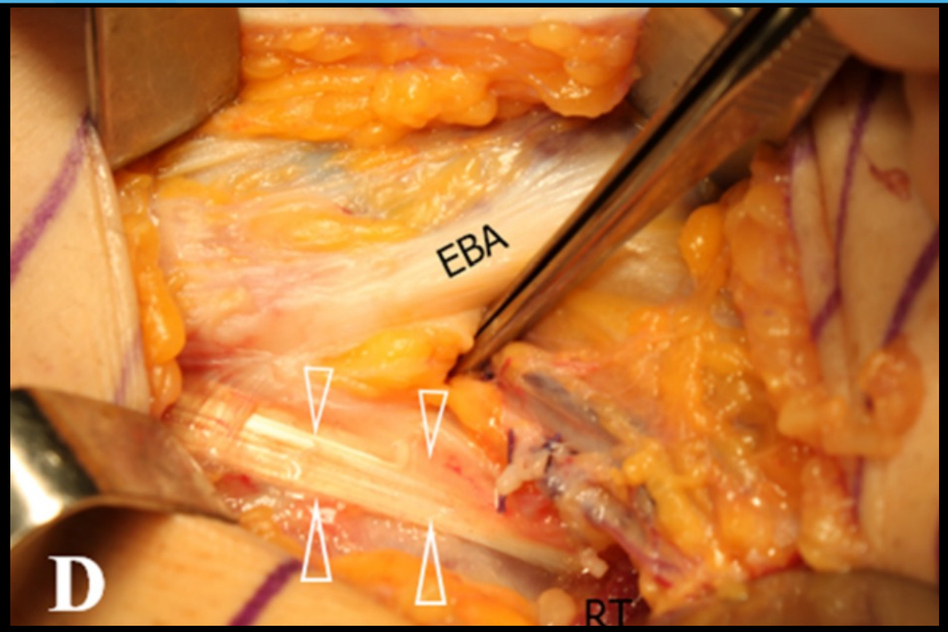
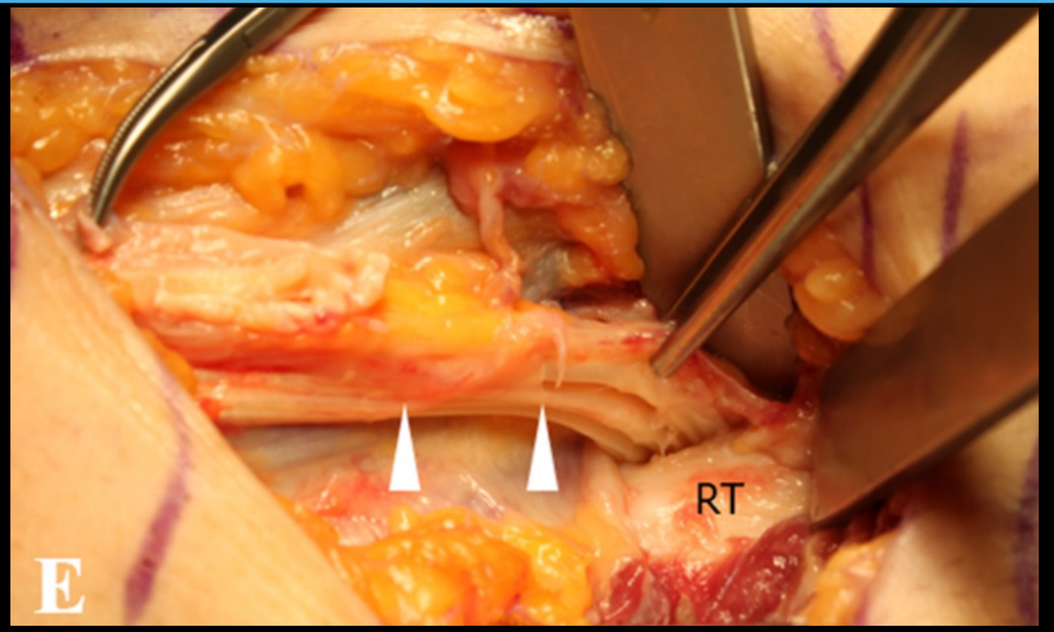
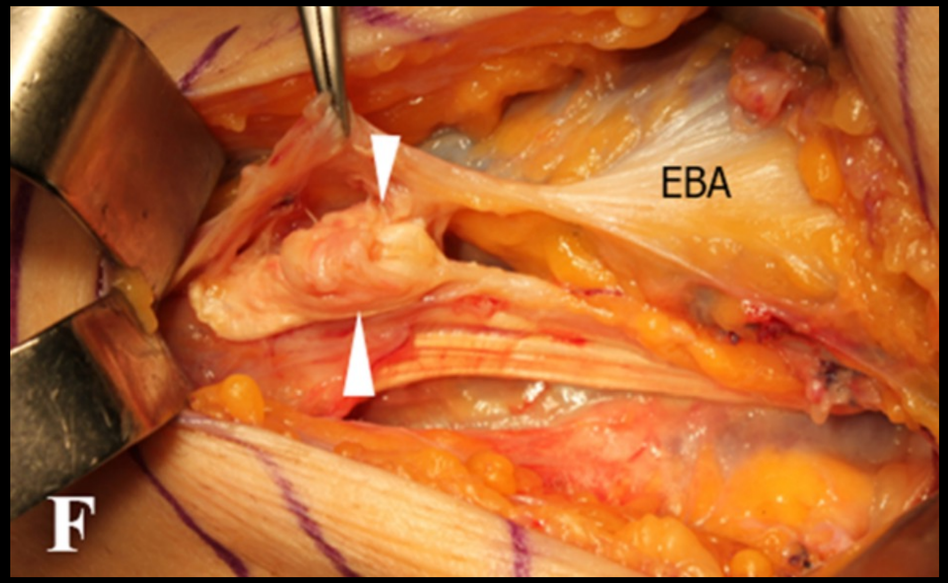
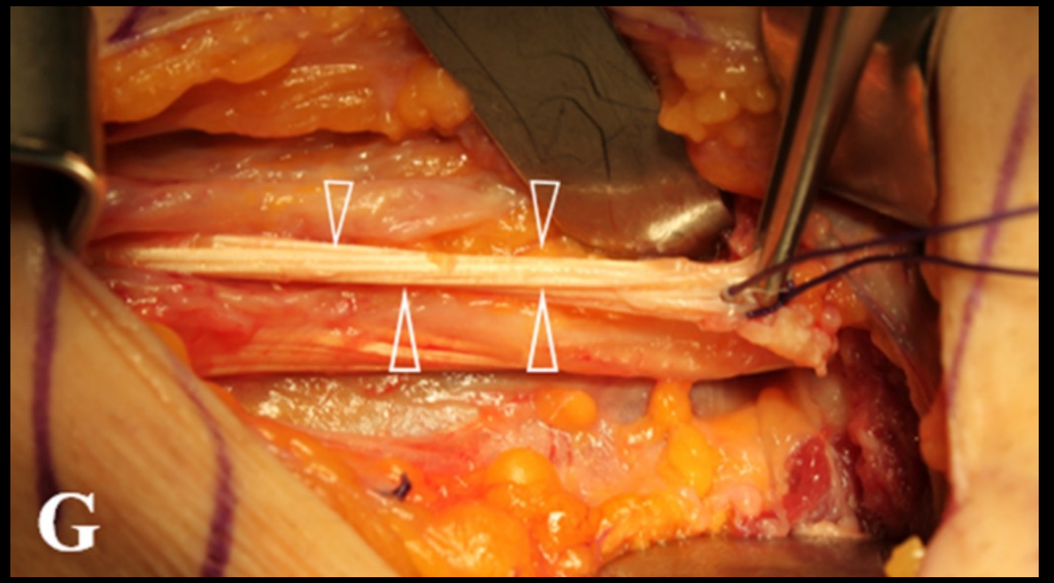
Distal biceps: Type 2c pathology









De La Fuente et al. 2018

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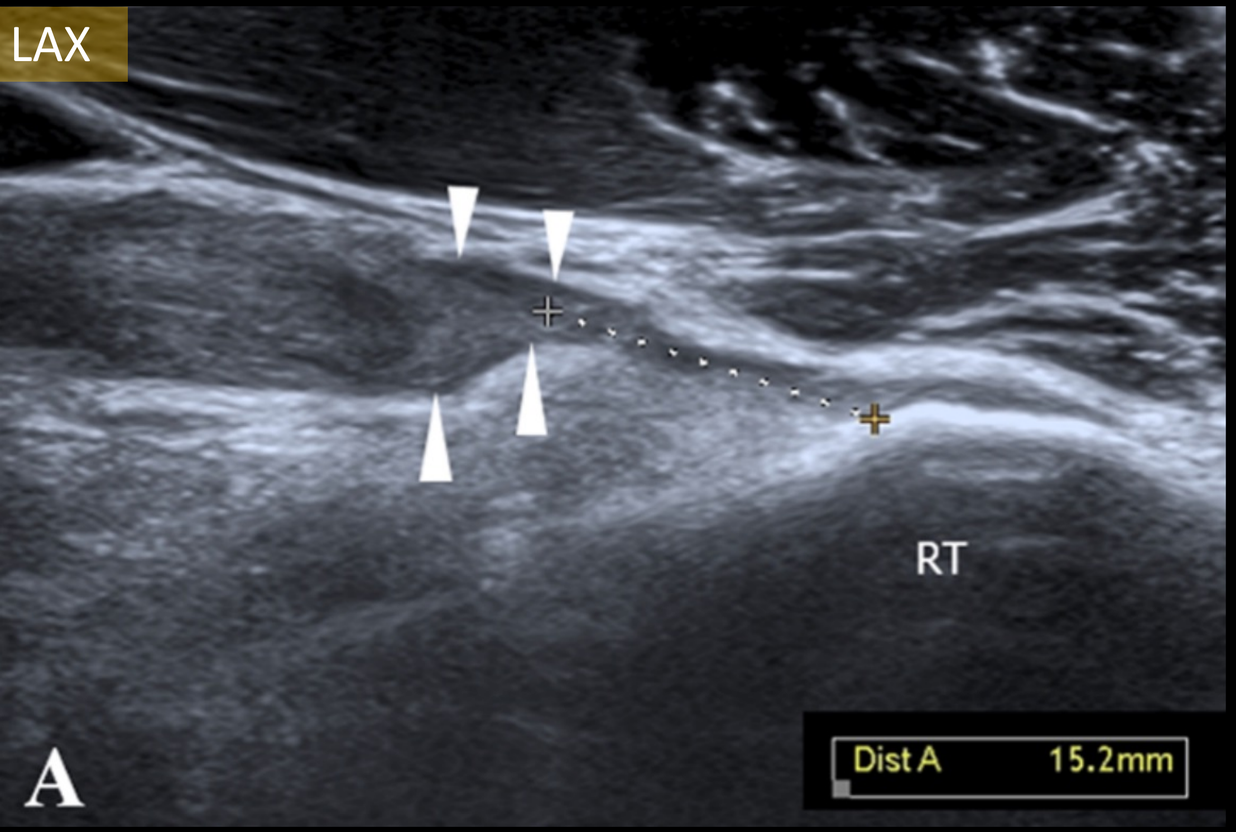
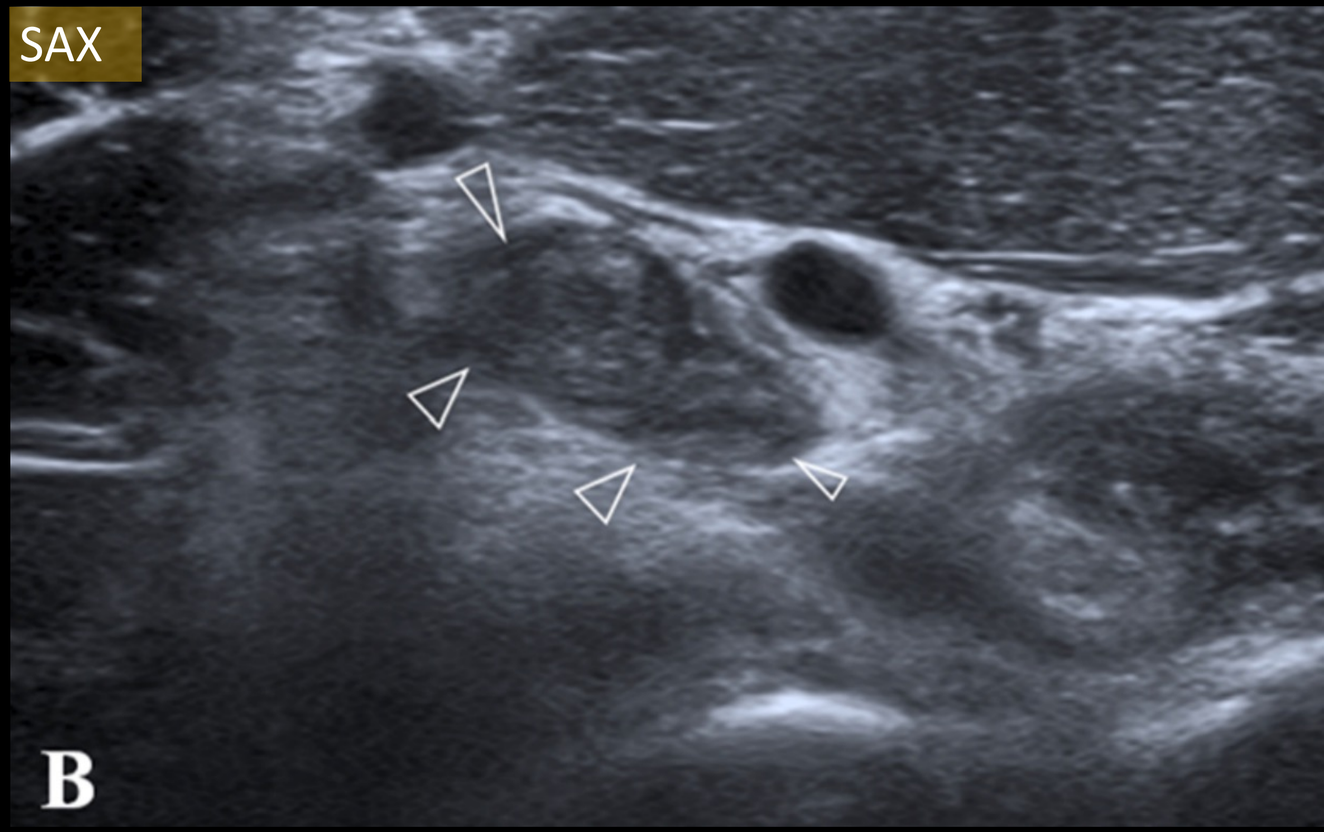
Distal biceps: Type 3a pathology





De La Fuente et al. 2018

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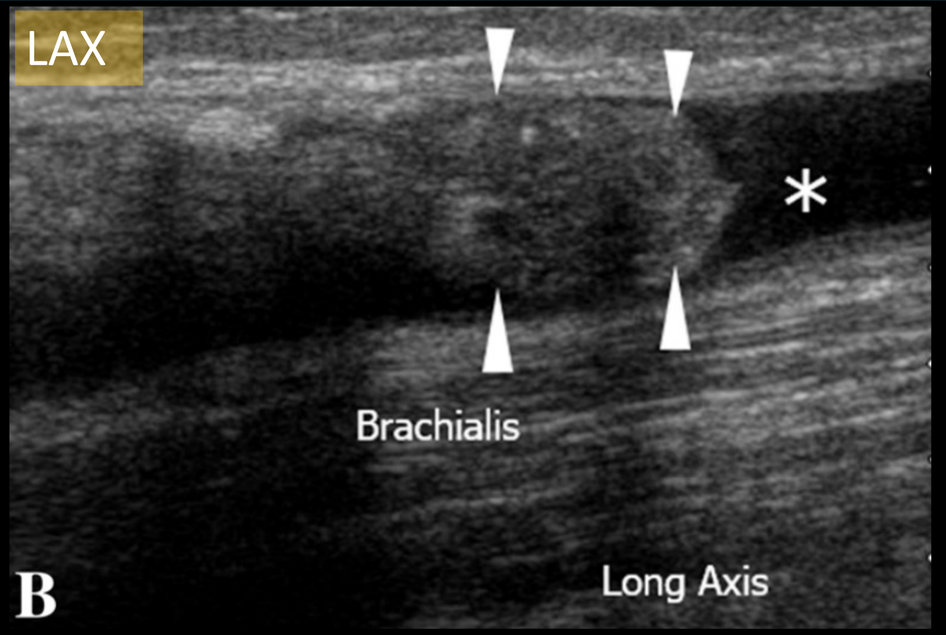
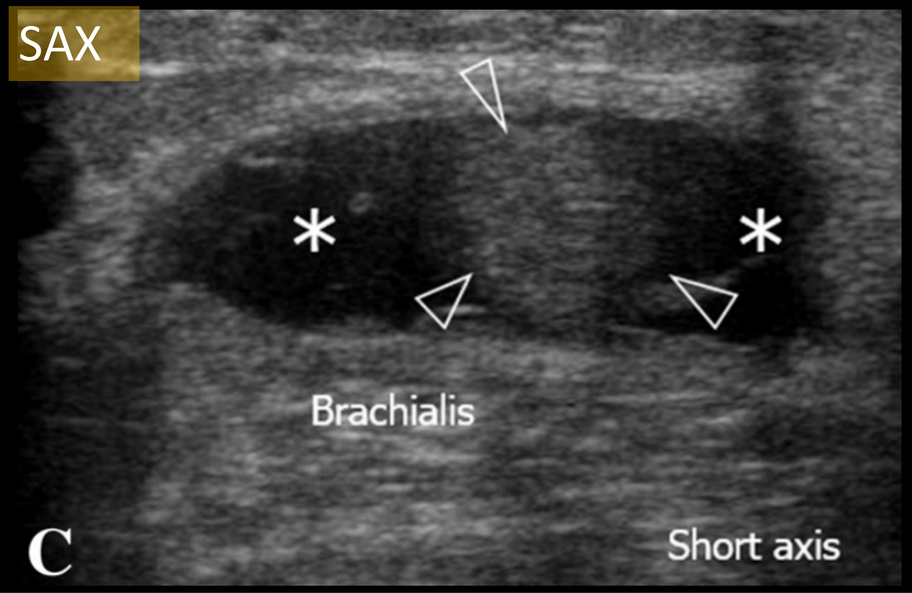
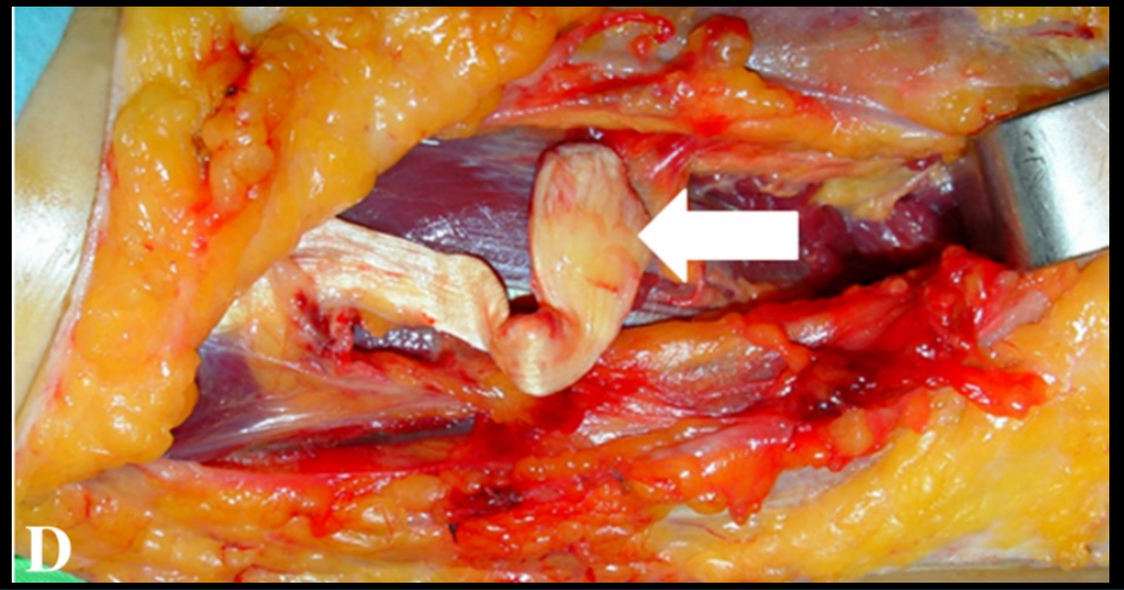
Distal biceps: Type 3b pathology

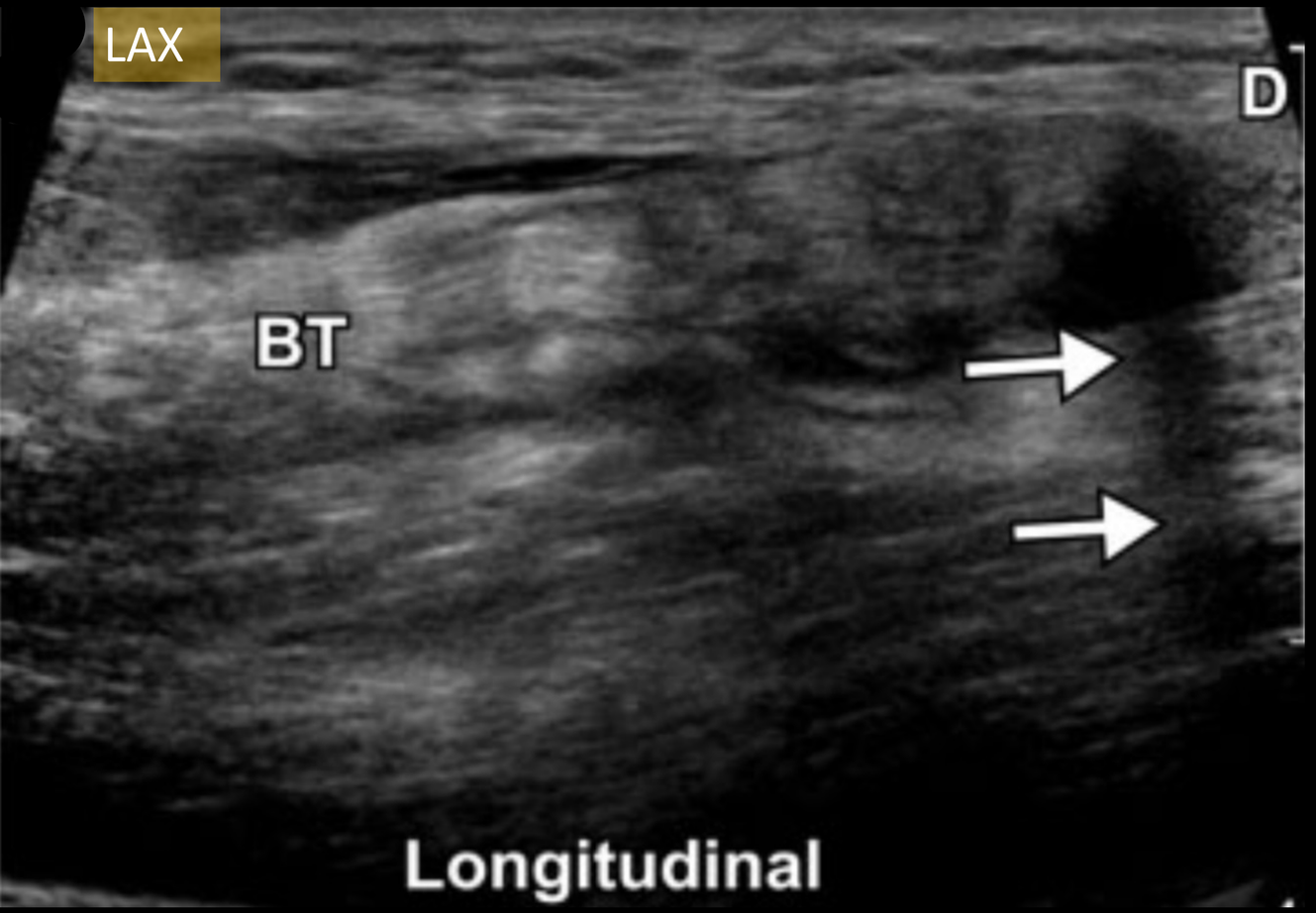


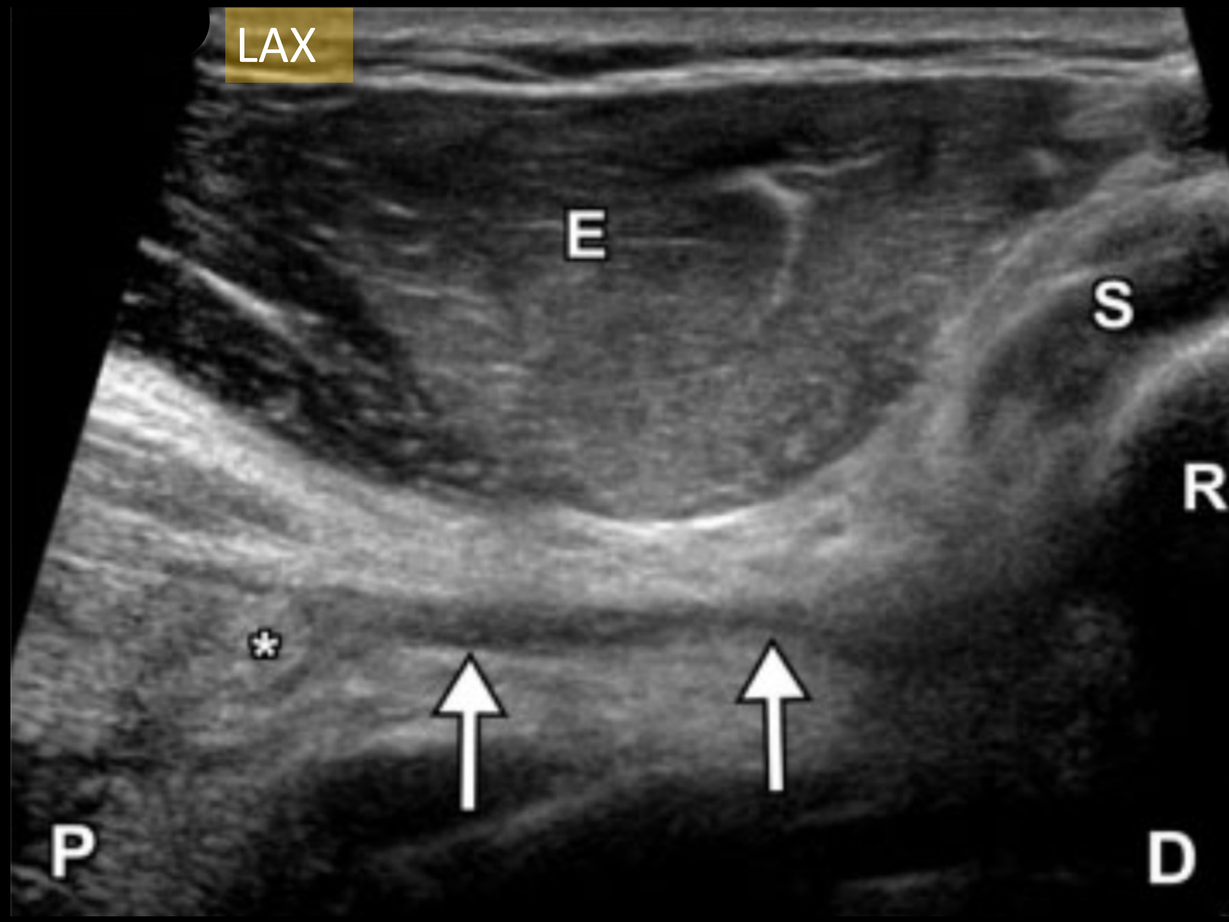




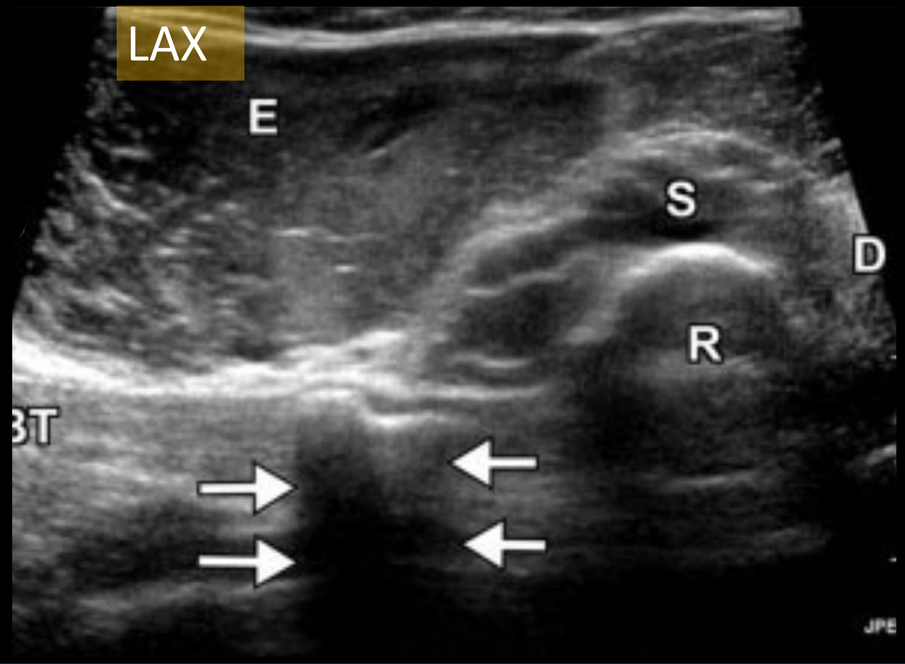
De La Fuente et al. 2018

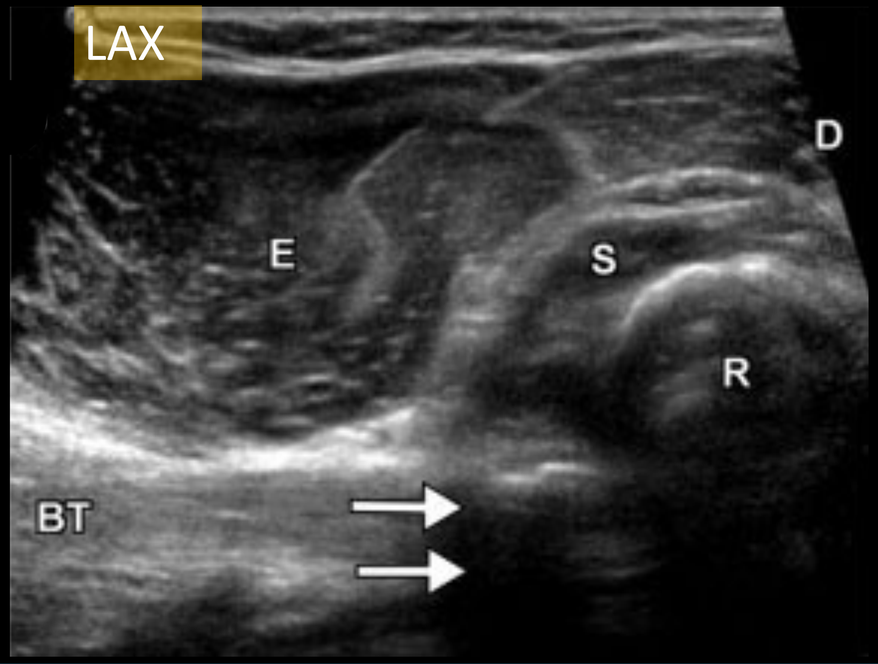
Distal biceps: Type 3b pathology





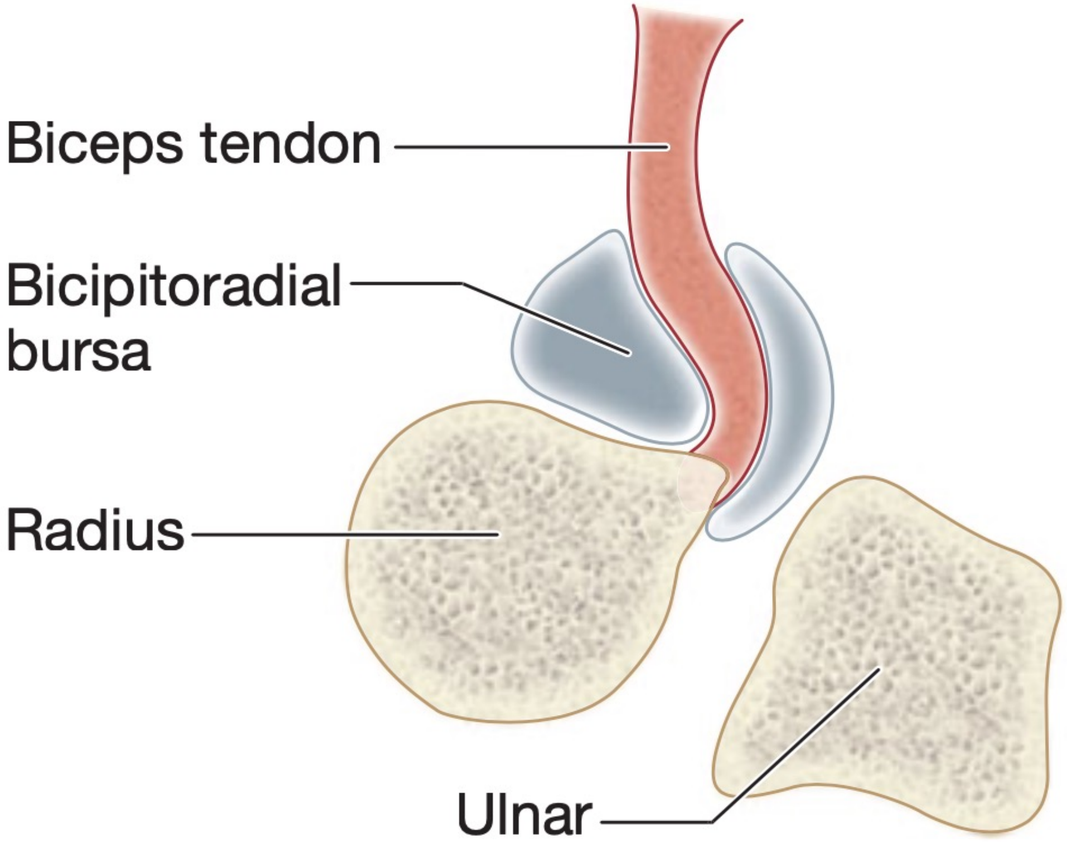
Kalume Brigido et al. 2013



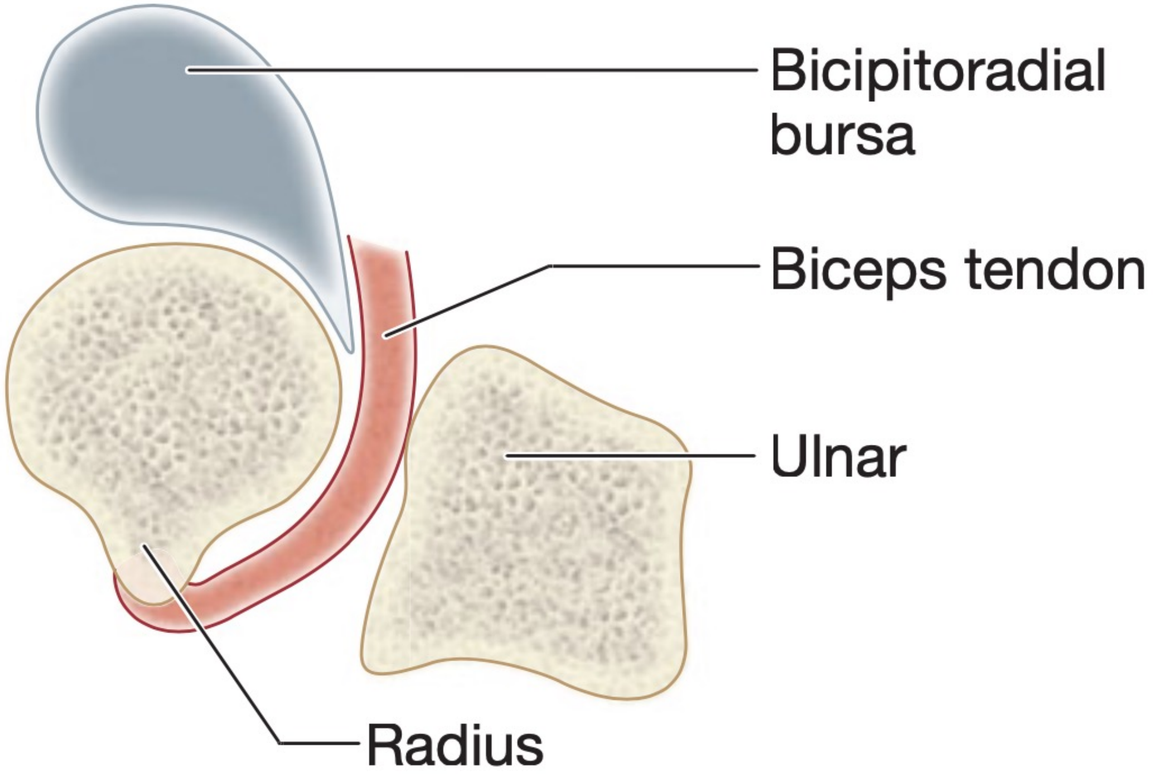


Kalume Brigido et al. 2013

Bicipitoradial bursitis



Supination



Pronation

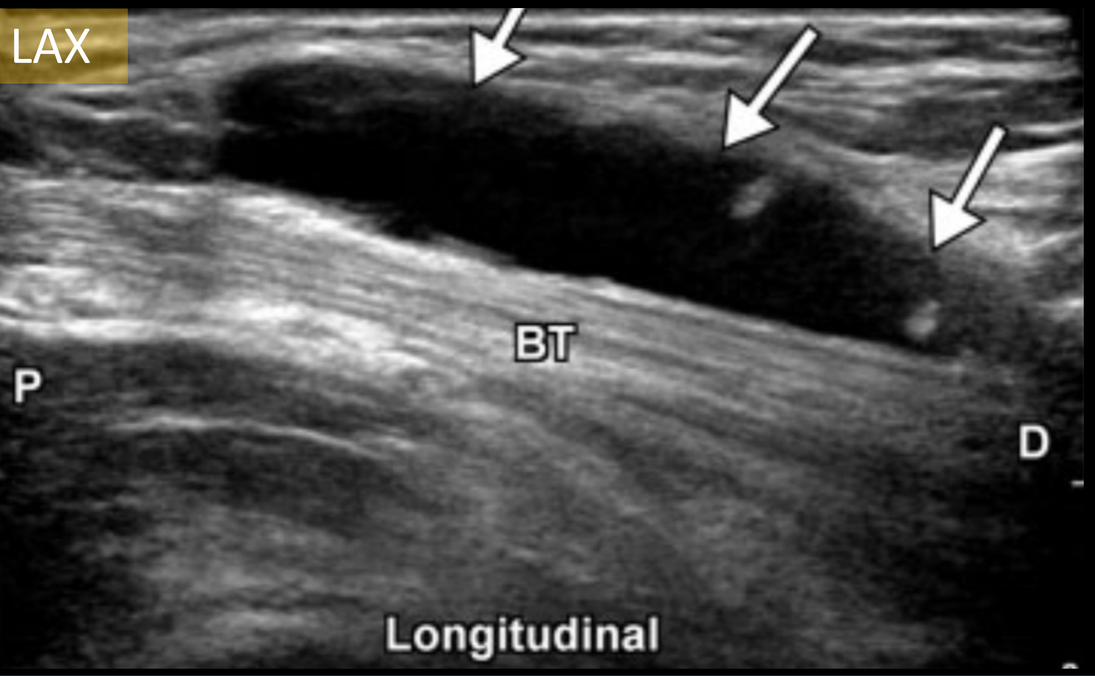
Malanga et al. 2014

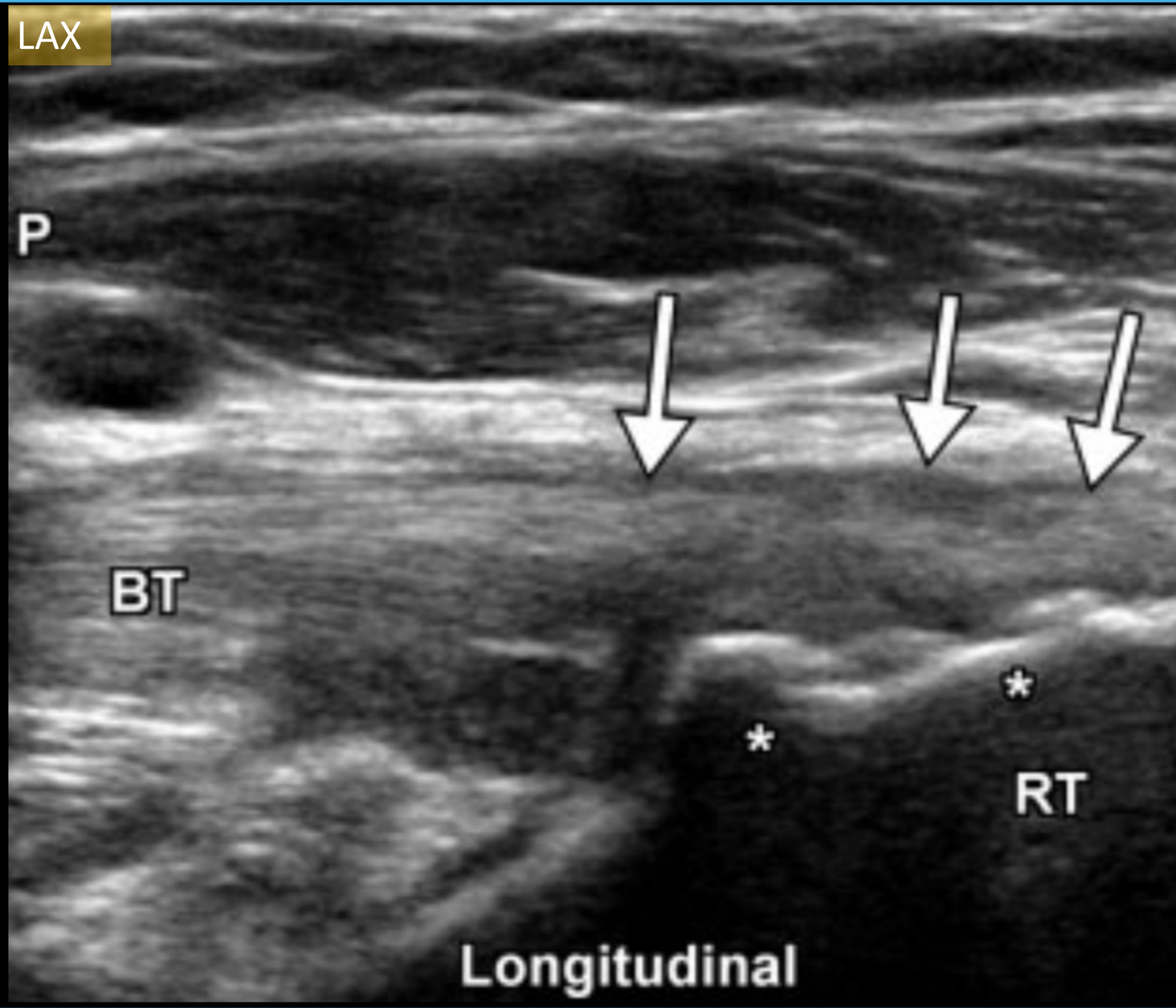
Bicipitoradial bursitis

- Surrounds the distal biceps tendon
- Situated between the tendon and the radial tuberosity
- During forearm pronation the bursa is compressed between the radial tuberosity, which becomes posterior, and the distal tendon of the biceps
- Does not communicate with the joint cavity
- May communicate with the interosseous bursa of the elbow

Draghi et al. 2012

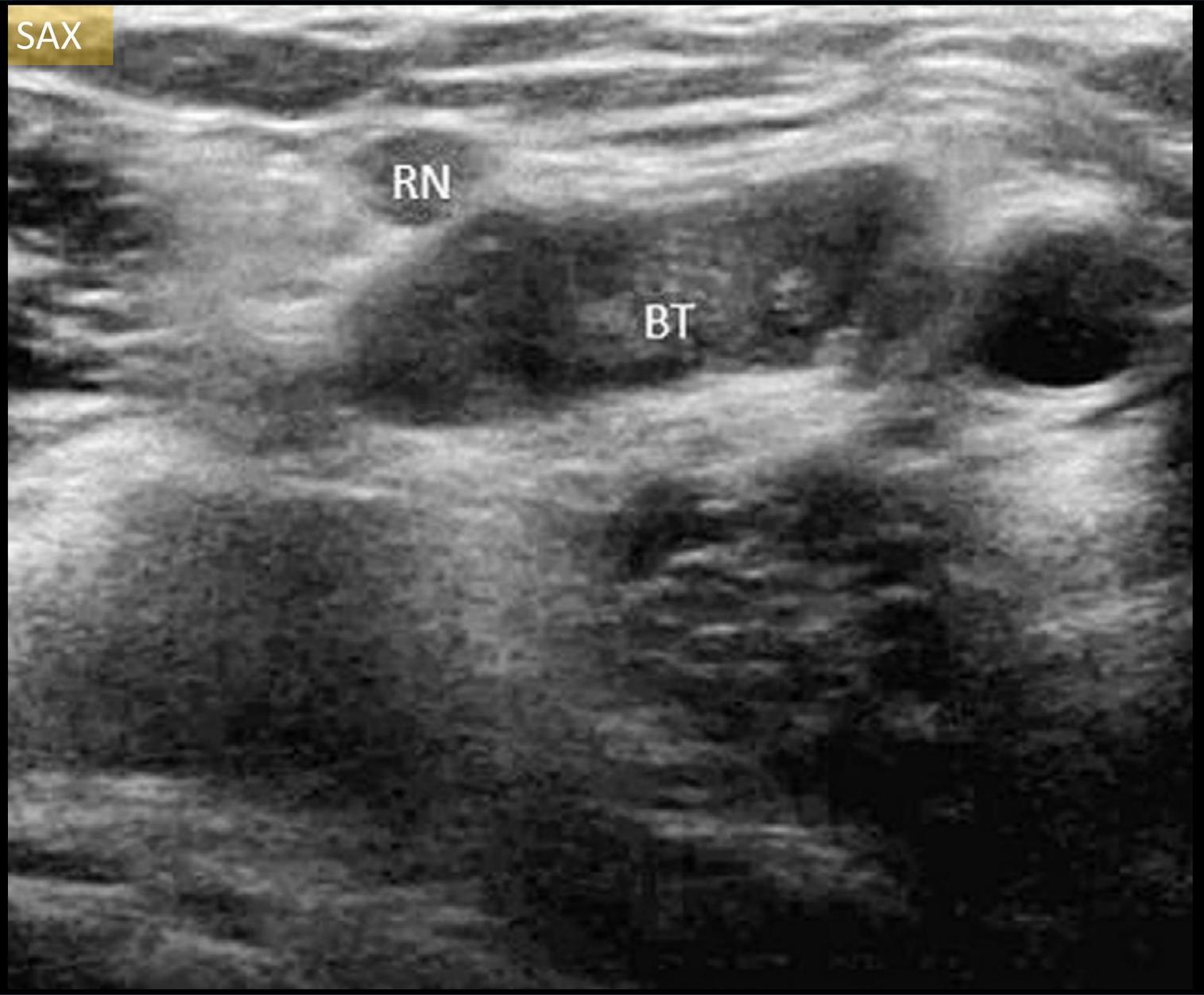
Bicipitoradial bursitis





Kalume Brigido et al. 2013

Bicipitoradial bursitis



Draghi et al. 2012

Bicipitoradial bursitis

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Live Demonstration

Shelley Guenther, CRGS, CRCS

Sonographer | Clinical Marketing Manager

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What additional information would you like?

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- Clarius Cloud Storage
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Questions

Marc Schmitz, MSc

Founder & CEO of Sonoskills

Shelley Guenther

Sonographer - @pocus_shelley

clarius

Thank you!